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Role of Protected Block Curriculum in Surgical Education

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Additional information is available at the end of the chapter

<http://dx.doi.org/10.5772/intechopen.72120>

Abstract

A protected block curriculum for surgical resident training began at the Medical College of Wisconsin in 2005. The curriculum has evolved with time as educational emphasis has changed. However, the concept of having resident learners relieved of clinical duty to focus on learning has not changed. Separate protected block curriculums are held for PGY1 and PGY 2 during which residents have no clinical responsibilities. These periods are defined at the beginning of each academic year and are distributed to all faculties. The systematic design, implementation, and evaluation of the protected block curriculum (PBC) Model provides an educationally grounded model for training surgical residents consistent with accreditation council for graduate medical education (ACGME) competency mandates. Resident evaluations consistently support the use of our PBC as a method to attain and practice skill sets in a nonthreatening environment. Faculty benefits are able to evaluate residents' knowledge, skills, and attitudes in a nonclinical setting and engage residents as individuals. The format extended into the PGY3–5 years of training as it evolved. Over more than a decade of using PBC, we have performed a number of analyses on the program and even determined a cost for the program. The program continues to be adjusted to new technology and curriculum initiatives.

Keywords: surgical education, protected block curriculum

1. Introduction

The general surgery residency educational mission at the Medical College of Wisconsin (MCW) was under scrutiny in the beginning of the year 2002. Many key stakeholders voiced concerns that residents were not receiving the optimal educational experience preparing them for the continuum of residency and future clinical practice. A number of options to

address perceived educational shortcomings were presented to the department, but given interim leadership in the office of Chairman, no decision endorsing significant change was considered until 2004. In late 2004, department leadership stabilized and agreed that many of our PGY1 residents were struggling with the challenges in their first year of training, especially in the early months of their PGY1 year. Numerous reasons were offered and debated for this problem, but an obvious solution was the restructuring of the initial PGY 1 year of resident training. At the time, very little structured curriculum existed specifically for the PGY1 residents outside service or department wide major conferences such as weekly grand rounds and morbidity and mortality (M&M) conference. A weekly lecture series for residents existed, but topics were targeted to the upper-level residents. Each service had defined objectives that were specific for the service based on the patient populations served, but there was a lack of standardization of how those specific objectives were taught and assessed. The ACGME competencies had been recently introduced and numerous domains of the program were not specifically addressed by the current residency curriculum.

In response to this realization, the Program Director and the Chair of Surgery agreed to evaluate the current curriculum and plan a new curriculum for the next academic year. A scholarly approach to the change was taken by following Kotter’s eight-step process of change as a scaffolding for improving the educational program [1]. The process started with a planning committee composed of a small group of key faculty and residents who met and discussed the strengths and weaknesses of our current curriculum. These meetings were facilitated by a PhD educator from the Division of Educational Services in the Office of Academic Affairs at MCW. The matrix for these sessions used six domains of the ACGME Competency Program: medical knowledge, patient care, professionalism, interpersonal and communication skills, practice-based learning and improvement (PBL&I), and systems-based practice (SBP). A list of topics in each area was developed based on the current literature and our existing curricular objectives, since there was no available guidance on topics from surgical associations or organizations [2–5]. Additionally, a number of models were developed for the implementation of a new curriculum. The assumptions used to create these models are outlined in **Table 1**.

Two meetings were planned as retreats for the faculty including faculty from affiliate teaching sites and resident representatives. The first meeting highlighted the changes occurring

-
1. Compliant with the 80h work.
 2. Encourage an environment that is conducive to learning.
 3. Continue to expect residents to attend our major teaching conferences during this learning period (Grand rounds and M&M).
 4. Core services will have at least three residents.
 5. Proposed curriculum identified 240 h contact time for the first 3 years of residency. PGY1 time was 52 didactic hours, 48 case scenario discussions, 92 h of simulation, 24 h of the literature review, and 24 h of communication skills.
 6. The learning day could be 6 or 8 h long.
-

Table 1. Assumptions used to construct models.

in surgical education and the direction that the ACGME and Residency Review Committees (RRC) were taking. The urgency to respond to these changes was clearly delineated. The next step involved a presentation of the topics and the planning committee felt that it was necessary to cover in each of the ACGME competency domains. It was clear that the list was very long, and one of the tasks of this first retreat was to prioritize the topics for the PGY1 residents. This task was accomplished by splitting the faculty attendees into three groups and asking for their review. The final step of this first meeting was to present four models proposed by the planning committee. A small amount of discussion occurred to explain the rationale for the models. The action item for the participants was to review the material from the retreat and come prepared for the next meeting to make decisions about the curriculum model, we would implement.

Two weeks later, the second meeting was held. Two objectives were planned: (1) a review of curriculum topics and (2) decision on the model that we would use for the curriculum. A small number of changes were made in the topic list. Some specific additions included items for professionalism and communication especially with allied healthcare professionals. The major discussion was on the model that would be used as the chosen model since it would have the greatest impact on all stakeholders. A principle that was adopted, though with some hesitation, was that time for the curriculum must be free of clinical duties including overnight call responsibilities starting around noon on Saturday, the weekend prior to the curriculum. This item was the major change debated. A significant concern was the ability to support operative cases whether the PGY1 residents were not on clinical duty. Facilitators continued to keep the educational mission at the forefront and a final decision supporting the need to have protected time for educational activities won the discussion. The four models discussed are briefly outlined in **Table 2**.

A model E was brought forward from the participants. This model had a concentrated time period before the PGY1 residents actually started on clinical service followed by intermittent regular sessions. After considering the logistics of this model, it was also declined.

The final decision was to use model B. The PGY1 residents were informed of the curriculum the last week of June as their orientation sessions were held. This end-of-June session would extend a few days into July as an introduction to the overall curriculum. The actual “first semester” would be a week in August, September, and October. We would take a winter break in November and December. The “second semester” would be a week in January, February, March, and April. Graduation week in May would only be a couple of days.

Model A	2 days/week (with day off preceding to stay compliant with duty hours)	Declined
Model B	1 week–5.5 days/month	Accepted
Model C	2 weeks quarterly	Declined
Model D	Entire block of time 1 month	Declined

Table 2. The various types of curriculum models discussed during the faculty retreats.

The entire faculty agreed that our new protected block curriculum (PBC) would be free from service and on-call responsibilities, a week in duration, and continuous throughout the year. The schedule called for sessions Monday through Friday morning, with time used on Sunday for the completion of required materials including homework.

2. Maturation of the protected block curriculum

2.1. First year

Planning for the first year of our PBC began immediately. Faculty volunteers (champions) for the various aspects of the curriculum were recruited, and assignments were made for the entire year. Each session was planned to cover essentials for our PGY1 curriculum (**Table 3** attached). The faculty were divided into teams based on their topic assignments. An example of the competency domains and team leaders for our first week of the PBC are shown in **Table 4**.

Each month's curriculum was developed and teaching sessions were assigned to instructors. The majority of teaching was assigned to the surgical faculty, although we benefited from the expertise of several other departments when relevant. Sessions covering imaging were given by our colleagues from the Department of Radiology.

Cardiac complications were covered by cardiologists. Educators from our Department of Education helped with communication topics. Novel approaches to education such as videotaping resident presentations were used to help residents to review their communication skills. Medical knowledge was assessed at the conclusion of each block by using preexams and postexams covering material taught in each session. Skills assessments were performed for skill stations by using defined objectives for performance. Each session was evaluated by our residents and their comments were used to make changes in topics covered, presenters within or outside the Department, time spent on each topic, and decisions on future topics for upcoming months as well as future years [6].

A unique aspect of the PBC was the addition of the surgical learning and instructional portfolio (SLIP). [7]. This educational resource was developed based on recommendations from the ACGME toolbox. The residents were asked to identify a case that they encountered each month. They were required to describe a case history, review the diagnostic studies used, and present the differential diagnosis. A list of ICD9 codes and CPT codes was also required. Finally, a discussion of the case and lessons learned was required. These cases were reviewed by a faculty member and feedback provided. This activity was transitioned to all residents in 2010.

To administratively support the new PBC, a Division of Education within the Department of Surgery was established with a Chief, administrator, and administrative assistant that were important for the organizational success of the curriculum. This occurred in 2005. A Director of the PGY1 curriculum was designated.

The entire program was a resounding success. Feedback from our PGY1 residents was excellent. Feedback from our faculty was positive and surprising, as many faculty stated that they felt the

ACGME competencies	PGY 1	PGY 2	PGY 3	PGY 4	PGY 5
Medical Knowledge					
Assessment of basic diagnostic tests	How tests are ordered at each institution, normal values, usefulness, which are helpful in clinical situations.				
Imaging	Chest radiograph and others consistent with scope of practice for year of training				
Instruments <i>Match K&S to Scope of practice by year</i>	Needed instruments for operations within the training year's expectations				
Nutrition					
Fluid and electrolytes	Commonly seen in surgical patients, core chapters in any text	Abdominal CT	Special abdominal CT exams		
Acid/base balance	Commonly seen in surgical patients				
Shock resuscitation	All four types				
Surgical infections	Surgical ID content				
Transfusion medicine	Use of blood components, basic coagulation information				
Pharmacokinetics	What is this, how can it help, how are drugs handled by metabolic pathways, common problems, use of PharmD colleagues in practice				
Endocrine	Diabetes in surgical patients, metabolism in surgical patients, catabolism, anabolism, use basic chapter information				
Patient care					
General	ACS-Ultrasound 101, ATLS, ACLS if not already done this	US certification			

ACGME competencies	PGY 1 ¹	PGY 2	PGY 3	PGY 4	PGY 5
Order writing	How to write admission orders, post-op orders for scope of practice, different orders at different hospitals, different computer systems				
Pre-op Assessments	Knowledge of pre-op test needs for general and regional anesthesia Proper H and P for surgical procedure				
Use of consultants ²	How to contact consultants	When to contact and how to ask the right question			
Out vs in-patient procedures	Appropriateness of site of procedure for outpatient and inpatient surgery, different systems for procedures within the program.				
Perioperative Management	Pre-op bowel preparation Coagulation monitoring Pre-op risk assessment, cardiac, pulmonary, infection, DVT, comorbidities, Management of drugs pre-op including dosing and holding during perioperative period Know appropriate DVT protocols, Understand the risk analysis for DVT Principles of perioperative antimicrobial prophylaxis Stoma marking knowledge	Use of consultants Planning			

ACGME competencies	PGY 1 ¹	PGY 2	PGY 3	PGY 4	PGY 5
Operative skills, skill lab to achieve most of this as well as in the operating room	Reduction of surgical risk, maneuvers.				
	Draping, sterile field Basic tray and function OR Environment	Getting patient ready for appropriate procedure at skill level			
	25% effort				
	Climate control in OR, proper patient position for the scope of practice Problem solving when possible Proper use of Bovie	Knowledge of lights, backup systems, lasers, CUSA			
	Roles and responsibilities of surgeon and assistant Skin preps Time management in OR OR Costs Instruments needed for various procedures again within scope of practice				
	Knots 1+ 2 handed	Stapling techniques Sewing Bowel Intro Lap Intra-op US	Knots and sutures x # /time period (efficiency) Wet labs in trauma surgery, general surgery, vascular surgery, minimally invasive surgery	Thoracic procedures	
	Management of various types of drains and tubes	Drains and tubes			
	Instruments and handling within scope of practice				
	Sutures				
	Materials and dressings such as VAC pack for abdominal closure, retention sutures, other wound dressings				

ACGME competencies	PGY 1 ¹	PGY 2	PGY 3	PGY 4	PGY 5
	Amputation - Digit - Transmetatarsal - Above knee - Below knee - Digital Appendectomy Breast biopsy Bronchoscopy Circumcision Pilonidal Cyst drainage and removal Drain abscess -perirectal -Sub cutaneous Excision of: -Lymphoma -Skin lesion -Sub cutaneous lesions Hemorrhoidectomy Flexible sigmoidoscopy Gastrostomy Adult Hernia repair: - Ventral - Inguinal Hernia Pediatric Hernia Repair -Inguinal -Umbilical Hemorrhoidectomy Jejunostomy Major Wounds: -Suture -Debridement Remove: Skin moles -Small tumors -Subcutaneous cysts -Foreign bodies -Tumors	Cholecystectomy Small bowel resection Splenectomy Endoscopy upper and lower Central Venous: -Line placement -Percutaneous CV access -Implantation CV access devices Insertion: -Hickman catheters and other indwell catheters	Colectomy Advanced laparoscopic procedures Captain on trauma resuscitations	Thyroidectomy Vascular access	Parathyroidectomy Peripheral vascular Whipple
Post-op management	50% (all cases based if possible, allow the trainees to bring these cases to the group from their experience)	30%	30%	25%	20%

ACGME competencies	PGY 1 ¹	PGY 2	PGY 3	PGY 4	PGY 5
Fluid management	Routine fluid management				
Fever work-up	Work-up of fever at various times in the post-op period, use of imaging studies, use of lab tests, expected sources, appropriate treatment, appropriate communication	Direct the care of post-op patients	Anticipate post-operative needs	Direct post op management	Direct post-op management
Pain	End of Life curriculum				
Tubes, catheters	When to place and use, when to remove, how to monitor, how to place (skill), complications				
Mental status changes	Delirium, alcohol withdrawal, stroke, TIA, diabetic coma,				
Cardiopulmonary care	Hypertension, post-op pulmonary care, pneumonia, chest pain, management of tachycardia and bradycardia, CHF				
Wound management	Basic wound care, recognition of surgical site infections				
GI function	Ileus, constipation, stoma function and dysfunction, diarrhea, nausea and vomiting, PONV after anesthesia				
Complications	Oliguria, bowel obstruction, pulmonary embolus				
Practice-based learning and improvement					
EBM	Find articles relating to patient care problems	Question options in patient care	Define the options of care and begin to choose options	Know options of treatment and advantages and disadvantages	Establish own choices of patient management
Guidelines	Guideline and protocol development and use				

ACGME competencies	PGY 1 ¹	PGY 2	PGY 3	PGY 4	PGY 5
Time management in OR	Understand time management in OR. Be on time for OR start times. Help get patient ready for the start time in OR.				
Outcomes/Outcomes Research/Quality	Understand structure, process, and outcome from a PI perspective	Be able to identify PI opportunities			
Personal Log Surgical learning and instructional portfolio (SLIP)	Complete and review 12/year in a portfolio format				
Adult learning	Apply learning principles to self	Apply to MS	Direct junior residents in their learning		
Teaching skills	Lecture preparation and presentation to peers, maybe even a videotape session, how to use PowerPoint presentation effectively, How to use visual aids when speaking to patients	MS clinical teaching		Resident clinical teach	Resident clinical teach
E-learning	As a learner: evaluate own strengths and weaknesses		Optimal use		
Interpersonal and communication skills					
Patient communication	Explain how operation will proceed the effect that pre-op management has on post-op complications		Telling bad news	Offer alternative treatments as part of consent	
	Be able to explain to a patient a procedure within their scope of practice, have a patient come in and have individuals practice on the individual.				
	Delivering bad news from EOL curriculum				
Professional communication	Develop approach to "hand-offs to colleagues				
Case presentation	Synthesize data and produce plan for scope of practice, Begin to keep case log on ACGME web site, introduction to coding of cases within scope of practice.				

ACGME competencies	PGY 1 ¹	PGY 2	PGY 3	PGY 4	PGY 5
Informed Consent	What is Informed Consent, communicate to pt., document		Obtain consent routinely		
Medical writing	Dictations, discharge dictation content, letter writing, scientific writing		Direct junior residents in writing orders, write ICU orders	Manage an ICU plan	Direct overall patient care in any situation
Documentation	Importance of maintaining records in a timely fashion, coding and effect this has on billing for services.				
Medical error	How to share adverse events with patients and families, define medical error and its effects on healthcare				
Professionalism					
Principles (I-HEAARD) ³	Integrity, honesty, excellence, altruism, accountability, respect, and duty				
Unprofessional behavior	Accountability: dealing with unprofessional behavior, know policy for disruptive physician Duty to self - lifestyle - insurance - finance/ invest				
Medical License, Liability	Begin to work toward getting a Wisconsin medical license. Introduction to medical liability issues from MCWAH and malpractice carrier.			Coding exercise	JD exposure formal practice and practice management
Lifestyle	Understand the stresses of practice.	Helping colleagues		Leadership	Leadership
Mentoring	Role of a mentor			Become a mentor	
Systems-based practice⁴					
Societal issues and medicine	Case management. Be exposed to different healthcare systems. Discharge planning				

ACGME competencies	PGY 1 ¹	PGY 2	PGY 3	PGY 4	PGY 5
Teamwork	Roles and responsibilities of personnel in ward care and in the OR, understand team management of patients	Understand the delegation of work	Begin to delegate		
Advocacy, medical liability	Organized medicine, belong to the candidate group of ACS, expert witness activity				Choose specialty group membership
Coordinate	Be a member of a team of caregivers		Organize a team of care givers		
Technology	Understand technology will drive medical costs, technology assessment tools, ProForma, ROI,			Identify when technology may be helpful	
Organizational structure	Quality management in health care systems, hospital administration and committee structure. Committee presentation and belong to committees		Understand PI principles		
Cost-effectiveness	Coding of personal cases, understand medical economics, understand economic terms		Cost breakdown by scope of practice	Cost breakdown by scope of practice	Cost breakdown by scope of practice
Safety	Understand drivers of error in medicine				

¹Proficiency and Autonomy Expectation for exit PGY 1: The attending should be able to walk in the room and expect: a. Properly pre-op (e.g., position the patient). b. Reasonable level of understanding specific to scope of practice cases, which includes the steps (e.g., six ways to approach the umbilical/inguinal hernia repair – and associated EBM). c. Decide what step to do next. d. Perform with some guidance.

²When and how to use consultants preoperatively.

³ABIM –Acronym from Dept of Pediatrics at MCW: Integrity-Honesty, Excellence, Altruism, Accountability, Respect, Duty.

⁴SBP...requires that residents “demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value” www.acgme.org/outcome/comp/comphome.asp. It includes understanding how their own practices affect others, and knowing how to partner with others to improve health care. Micro and macro (David Leach “No resident is an island” in Nov 2004 ACGME Bulletin pg. 2–3).

Table 3. Surgery curriculum blueprint developed by MCW Department of Surgery Curriculum Committee.

current PGY1 residents were better at handling their roles on clinical services. We were encouraged with our results and a decision was made to continue the PBC and expand it into the PGY2. Based on the feedback from the residents and services, the PGY1 curriculum was shortened to end on Thursday evening so that the PGY 1 residents could return to their services on Thursday rather than on Friday afternoon. Thus, the structure that continues to this day is Monday through Thursday as full days, with Sunday used to support preparation time.

2.2. Subsequent rollout and evaluation

On the basis of evaluations and feedback, the second year of implementation of the PGY1 PBC was formatted similar to the first year in regard to time commitment over the course of the year. Some topics were changed based on the evaluation feedback from residents and faculty. Since inception, each year the curriculum is reassessed and changed based on internal and external requests and feedback.

After the first year of the PBC roll out, the PGY2 curriculum was designed, and a Director was designated. This design used a similar model although shortened to full-day sessions Monday through Wednesday, with Sunday used for preparation and homework. The topics addressed came from our Curriculum blueprint. Changes included making appropriate accommodations for a different set of surgical procedures and increased responsibilities and expectations for our PGY2 residents. Each of the blocks in the PGY 2 year had a primary focus: trauma, critical care, vascular surgery, breast diseases, colorectal cancer, and diverticular disease. The sessions were focused on these broad areas within each block, though some topics covered spanned many diseases, such as professionalism, communication skills, among others. Again, feedback from residents and faculty has been positive despite the removal of residents from clinical service.

A curriculum was also designed for rollout the following year for the senior residents (PGY 3–5 curriculum) following the principles of protected time away from clinical duties and exams, but using a different structure and capturing many elements already in place such as skills labs for upper-level residents. Monthly half-day sessions were designed to cover multiple topics guided by surgical content in textbooks, skills sessions including open and laparoscopic surgery on pigs, simulator exercises, ethics sessions, and various topics to prepare residents for practice after graduation.

A Resident Curriculum Committee was formed and served to oversee the implementation and management of the curriculums, allowing a forum for discussing of outcomes, faculty recruitment for teaching opportunities, ideas for content, and challenges to overcome since the curriculums evolved. Eventually, the committee was no longer needed when the curriculums matured.

Our robust evaluation process for the PBC identified multiple expected and somewhat unanticipated benefits of this format. The residents improved in their medical knowledge. Comparison of preexams and postexams provided evidence of learning that was reproducible. A representative example is provided in **Figure 1**. American Board of Surgery In-Training Exam (ABSITE) scores of our PBC residents improved compared to our historical controls in our program. We found a statistically significant correlation of post-test curriculum exam scores early in the academic year

Team	Area/competency	Topics
Team C	Patient care	Order writing, pre-op assessments, use of consultants, perioperative management
Team D	Patient care/operative skills	Skills lab, instrument recognition, surgical technique
Team E	Medical knowledge/post-op management	Fluid management, fever work up, Pain management, tubes and catheters, mental status change, cardiopulmonary care, wound management, GI function, complications
Team F	Practice-based learning and improvement	EBM, guidelines, time management, Personal Logs (SLIPS), adult learning, teaching skills, E-learning
Team G	Interpersonal and communication skills	patient communication, professionalism communication, informed consent, medical writing, documentation, medical error
Team H	Professionalism	I-HEAARD, professional and unprofessional behavior, medical license
Team I	Systems-based practice	Societal issues and medicine, teamwork, advocacy, medical liability, safety

Table 4. Each area/competency was assigned specific topics. A faculty facilitator led a team of faculty to cover the material during sessions within the curriculum.

and yearly ABSITE scores, allowing the identification of resident exam performance concerns early in the year and providing time for improved ABSITE preparation [8]. The communication sessions with videotaping improved resident presentations at grand rounds and in our morbidity and mortality conferences [9]. Surgical skills based on PGY1 OSATS scores for suturing and knot tying were also significantly improved [10]. All these benefits were felt to be attributable to

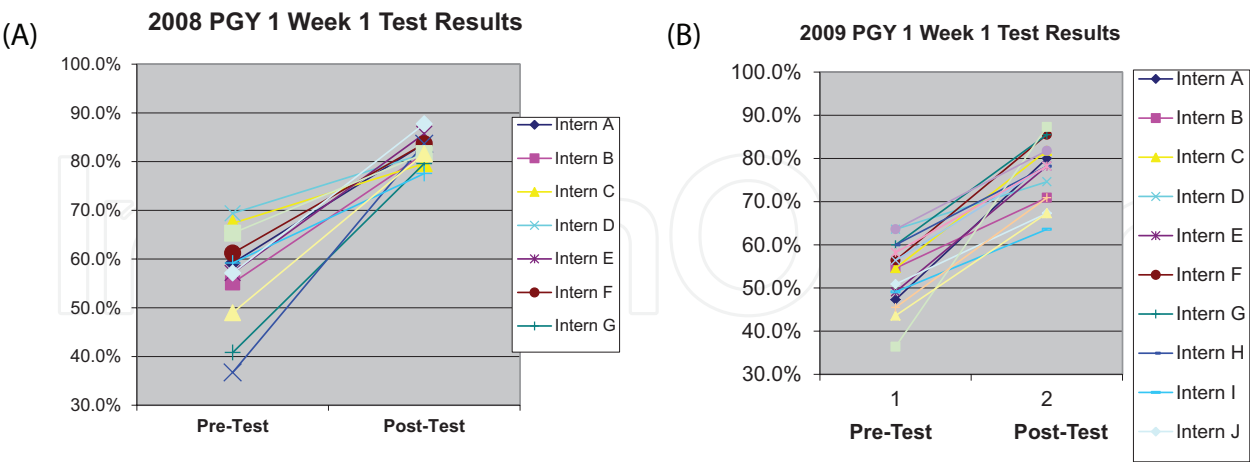


Figure 1. PGY 1 residents took the same written exam prior to the start of the curriculum session and again at the end of the session. Y-axis represents % correct. Depicted in (A) is a representative example of the highly variable knowledge set at the start of the curriculum week and the marked improvement at the end of the sessions. Depicted in (B) is the same results in the following year. Note that more residents from other surgical departments participated in the curriculum in the following year as depicted in B. The exams from year to year changed minimally and only to improve the clarity of questions based on analyses of the entire test and individual questions performed by MCW education services.

our curriculum presented in the PBC. Finally, importantly for physician wellness, the PBC format promoted a much closer collegiality among our PGY1 residents that, to this day, serves as a social support mechanism for each resident class throughout their training.

We also began to further analyze our results related to the infrastructure required to conduct the PBC [11]. Despite widespread support among department faculty, many faculty felt that the time and effort may not be worthwhile. This concern drove the Division of Education to complete a fiscal analysis of our PBC. We performed an assessment of the “costs” in hours and dollars for the protected block curriculum (PBC) for our PGY1 and PGY2 residents. Resources expended during the 2006–2007 academic year were evaluated in terms of the number, division, department, and rank of faculty involved in curriculum teaching. The hours of learner contact time and the monetary cost for consumable resources were calculated. The total number of faculty involved in the PGY1 curriculum was 49 compared to 29 for the PGY2 curriculum. Total faculty time spent teaching was 242.75 h (PGY1) and 156.5 h (PGY2) for 399.25 h. For both years of curriculum, total teaching hours by faculty rank within the Department of Surgery was 137.75 h for 12 assistant professors, 84.5 h for eight associate professors, 125.9 h for 15 professors, and 51.25 h for all others. Average time commitment for assistant professors was 11.5 h, for associate professors 10.7 h, and for professors 8.6 h ($p = 0.85$). Average time commitment for faculty in the Division of Education was 20.2 h, compared to 4.7 h for Departmental faculty in other divisions ($p = 0.0002$). The total monetary cost for consumable educational materials and space rental was \$76,186. A dedicated educational curriculum in a surgical residency has substantial and real associated costs; however, we also felt that the benefits are well worth this effort.

A question of sustainable was also asked. We assessed results from our PGY1 and PGY2 PBC from 2005 to 2014. A total of 126 PGY 1 and 2 residents completed the PBC. The average number of contact hours for PGY1 residents was 175 and for PGY2 was 120. The total faculty time consumed was 508 h/year. The pre/post improvement averaged 15%. Our resident ratings continued to be greater than 4.5 over the 9 years, while the average faculty ratings were 4.6 on the five-point scale. Our first time ABS pass rates for the qualifying exam (QE) improved after the entire resident cohort was enrolled in the PBC: 80% for pre-PBC-2005–2009 compared to 88% post-PBC-2010–2014. The most recent first time ABS QE pass rate from 2012 to 2016 has risen to 97%. These impressive pass rates support continued faculty and resident interest and commitment to sustain and evolve the curriculum.

2.3. Curriculum evolution

Over the past 12 years, our PBC for PGY1 and PGY2 residents has evolved. Since its initiation, resources on preparation for residency [12] recommended curriculum content [13], and basic and advanced surgery resident skills and procedures [14] have been made available. These resources, in addition to the new Surgical Council on Resident Education (SCORE) curriculum for General Surgery [15], serve to validate our own content and skills. Selected content from these resources has been incorporated into our curriculums, as appropriate. New graduation and American Board of Surgery requirements have led to the incorporation

of the fundamentals of laparoscopic (FLS) and fundamentals of endoscopic (FES) curriculums as longitudinal elements of our curriculum content. Examples of the evolution of our PGY1 curriculum is shown in **Figure 2** with a representative sample of a typical day from 2006 compared to a typical week in 2016.

Our PBC remains highly rated by junior residents and faculty. It continues to evolve in content and duration as the department has expanded and health care delivery has changed. The

Time	Topic	Goals/Objectives
7:30-9:00	Diversity Training	1. Incorporate a patient centered approach in the daily care of patients 2. Identify ethnic and socio-economic barriers and disparities in health care
9:00-9:15	Break	
9:15-10:15	Video Case Review-Respiratory	1. Describe properties of gas exchange in health and disease 2. Identify spirometric lung volumes in health and disease 3. Choose appropriate vasopressors and inotropes in health and disease 4. Describe metabolic function(s) of the lung
10:15-10:30	Break	
10:30-11:30	Lecture-Basic Cardiac Physiology	1. The heart as a dual function chamber during systole and diastole 2. Laboratory and clinical evaluation of left ventricular systolic function 3. Application and limitations of clinical measures of left ventricular systolic function 4. Laboratory and clinical measurement of afterload 5. Definition and measurement of diastolic function 6. Role of diastolic function in cardiac pathophysiology and heart failure 7. Role of the left atrium in cardiac performance
11:30-12:45	Lunch	Sponsored by Pfizer Pharmaceuticals
12:45-2:00	Interactive CD-Stress Gastritis	1. Describe the pathophysiologic mechanisms involved in the development of stress-related mucosal bleeding and peptic ulcer disease bleeding 2. Explain the pharmacology, preparation, and administration of available therapeutic options preventing stress-related mucosal bleeding and peptic ulcer disease rebleeding in the critically ill patient 3. Outline the current applications of intravenous and oral acid-suppressive therapy in the critical care setting
2:00-3:45	Case Based Learning-Critical Care	1. Describe properties of gas exchange in health and disease 2. Identify spirometric lung volumes in health and disease 3. Choose appropriate vasopressors and inotropes in health and disease 4. Describe metabolic function(s) of the lung
3:45-4:00	Break	
4:00-5:00	Lecture-Ethics Committee	1. Describe two functions of an ethics committee 2. List four different potential members of an ethics committee
5:00	Debrief	

(A)

PGY 1 April 2016	Monday 18-Apr	Tuesday 19-Apr	Wednesday 20-Apr	Thursday 21-Apr	Friday 22-Apr
7:30 a.m. - 8:00 a.m.	PBL: Instruction & Self Taught Portion of Training Ventilator Associated Pneumonia Carver	Ethics Committee & Its Function Morgenweck	Nutrition & the Surgical Patient Kryszewski	Evaluation & Surgical Management of Thyroid Disease Carr	
8:00 a.m. - 9:00 a.m.		Patient Safety & Quality Lemo		Lower GI Bleed Beckman	
9:00 a.m. - 10:00 a.m.	Case Presentations Groups #1,4,5 Redlich, Paul, Malinowski	Break	Patient Centered Care/Cultural Competency Webb	Basic Science Kugler	
10:00 a.m. - 11:00 a.m.		Small Bowel Physiology & Inflammatory Bowel Disease Otterson	Bugs & Drugs Graham	PBL Review Session: VAP Carver	
11:00 a.m. - 12:00 p.m.		Burns Soto			
12:00 p.m. - 1:00 p.m.	Ventilators 101 Paul			Loupe Fitting Design for Vision	
1:00 p.m. - 2:00 p.m.	ENDO TOWER Groups A & B President Ben 4	Ultrasound STAR Center Rm 2710 Group D Carver	CVL STAR Center Rm 2710 Group A Carver	Mock Oral Scenarios Malinowski	
2:00 p.m. - 3:00 p.m.	FEC Group A Kastnermeier	FLS Group B Higgins	FLS Group C Kastnermeier	FLS Group D Higgins	
3:00 p.m. - 4:00 p.m.	FLS Group A Higgins	FEC Group B Kastnermeier	FLS Group C Higgins	FLS Group D Kastnermeier	
4:00 p.m. - 5:00 p.m.				Fig Colon Training Lab Bullaji, Peterson	Return to Service

(B)

Figure 2. Depicted is a selected schedule of the PGY 1 curriculum from 2006 (A) (one of 4 days) and 2017 (B) (all 4 days). Note the types of didactic sessions in (A) compared to a mix of didactic and skills-based sessions (in dark gray) including those that address the new FLS and FEC requirements in (B).

program is now 4.5 days (Monday through Thursday, Sunday afternoon for final preparation) for PGY1 and 3.5 days (Monday through Wednesday, Sunday afternoon for final preparation) for PGY2 residents. Whether the reduction in time is related to an improvement in preparation of medical students for residency or our concern over clinical exposure is an unanswered question. We do believe that the presence of the PBC has had a positive impact on resident recruitment as it demonstrates our emphasis and dedication to surgical education. Anecdotally, some residents have expressed their interest in our PBC and opportunities for educational research as reasons for choosing our residency training programs.

The success of the program for the PGY1 residents has some local external validity of importance. We were asked by the Departments of Plastic and Urologic Surgery to include their residents in the program. These program directors recognized the potential positive impact on their junior residents as well. This inclusion helps bonding among residents who will be closely working together throughout their training program.

We have also continued to improve the separate educational sessions for our PGY3–5 curriculum. This curriculum was started in 2007 and replaced a straight didactic lecture series. It is held on one Wednesday morning, which is currently transitioning to Friday mornings, each month for 4 h providing 32 h of contact time. Again, the residents are relieved from clinical duty. A faculty facilitator leads discussion topics. These sessions are case based and the format is very similar to oral board questioning. These changes were requested by our residents as they became familiar with the PGY1 and PGY2 curriculums. The topics cycle every 3 years. Sessions on ethics are included.

Another addition added to our PGY1 and 2 PBC was surgical jeopardy. This has become a favorite for a few faculty facilitators as well as for our residents. This type of interactive game-based instruction has been utilized to teach and provide a casual, fun environment for residents to compete and socialize [16]. We participate in the American College of Surgeons (ACS) resident jeopardy session at the annual ACS Clinical Congress meeting. While we have never taken the top prize at the ACS Clinical Congress Jeopardy competition, we have been competitive many times.

Finally, the PBC has been a venue for scholarship for faculty interested in surgical education. A number of PBC-related manuscripts and presentations regarding our PBC curriculum have been published in peer-reviewed journals and in the AAMC MedEdPORTAL, respectively. Having a robust, sustainable, evolving, and faculty-supported curriculum has allowed many faculty, and selected residents, to pursue surgical education as a component of their careers interests. The current PGY1 curriculum director is enrolled in a Masters of Education in the Health Professions program and the PGY 2 curriculum director is enrolled in the Association for Surgical Education (ASE) Surgical Education Research Fellowship.

3. Conclusions

Surgical education requires constant attention and new methods of teaching and assessment must be considered. The PBC was initially met with a significant amount of skepticism from some faculty and senior residents resistant to change. However, as residents experienced the

new model, it was uniformly accepted and ultimately highly valued by the department. We believe that maintaining a positive focus on the educational mission allowed us to accomplish such a change to the traditional delivery of resident education. As the skills needed by health care providers continue to change, so must our educational objectives and how we deliver them. Our PBC has allowed us to focus on these new skills and competencies and provided a venue for continued evolution as we look to the future. Faculty interested in careers in surgical education makes the curriculum sustainable and ensures future scholarly products studying educational outcomes of our curriculums and surgical training programs.

3.1. Future of the PBC

We will continue to look for ways to improve our PBC. We are convinced that the learning environment we have established for our trainees is more conducive to the educational needs of our residents. Being away from clinical service allows their focus to be on learning and more receptive to learning without the distractions of clinical care. How we balance educational time and clinical service will need continuous evaluation and adjustment to meet the needs of our trainees.

Potential areas of future change that need ongoing evaluation relate to educational objectives and the needs of our trainees. Educational objectives will need to address the multitude of changes in medicine that continue to occur. These include the application of advanced medical devices, use of alternative interventions to surgery, medical care organizational changes, and quality and safety initiatives. While newer topics must be addressed, we also must not let them displace critical basic medical knowledge, patient care principles and basic skills common to surgical practice.

As our trainees transition from millennials to generation Zs, our educational techniques will need to change. A generation of learners raised with Internet access, social media, and mobile access will force us to consider how we deliver our material. Classroom time may decrease as mobile active learning opportunities increase. Manipulating the PBC into this type of learning should not be difficult, but it will require thoughtful planning.

Regardless of the changes required, we believe the infrastructure that we have designed will be flexible and sturdy enough to meet these challenges.

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