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Surgical Residency workload, perceptions and educational value: implications for competency- based medical education

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A thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Surgery

Abstract

Introduction: Surgical training has transitioned to competency-based medical education. There is incomplete understanding of current resident workload and how workload is perceived by trainees and faculty.

Methods: A prospective time-motion study was conducted in a Canadian general surgery training program. A web-based survey was used to compare observational data with faculty and learner perceptions of actual and ideal resident workloads and the educational value of workload components.

Results: 54 clinical periods were assessed (662.8 hours, 6375 individual events). 39.7% of time was spent on direct patient care, 33.2% on indirect patient care and 7.5% on education, including <0.1% on assessment. Faculty significantly overestimated time allocation to educational tasks. Both groups significantly overestimated time allocated to assessment. Both groups felt direct patient care and formal education tasks had high educational value.

Conclusion: Curriculum changes should aim to increase participation in educational activities, with a focus on assessment, and protect direct patient care activities.

Keywords

Surgical education, time- motion analysis, competency- based medical education, competency by design, educational value

Summary for Lay Audience

Surgical training has historically been based on a time-based apprenticeship model. As part of an overall transition in medical training towards competence-based training, surgical residency requires redesign with an emphasis on frequent assessment. The current surgical resident workload has not been extensively studied prior to implementing these changes to training.

Trained observers recorded the activities of general surgery residents throughout their work periods (daytime activities or overnight call). 54 periods were recorded, comprising 663 hours of data and 6375 data points. Residents spent 40% of their time engaged in bedside care tasks such as operating or seeing patients outside of the operating room. One third of time was spent on tasks required for care but not at the bedside including using the electronic medical record or discussions with other health care providers. 7.5% of time was spent on education tasks such as lectures, informal teaching or studying; with only 0.1% of time spent on assessment of residents.

Faculty surgeons and residents from the same training program completed a web-based survey regarding their perception of resident workload. Participants were asked to define what they felt the ideal resident workload comprised of and what was the value of components of the work done by surgical residents. There was good participation from both groups. Faculty overestimated the amount of time residents spent on education tasks. Both groups greatly overestimated the amount of time spent on assessment and informal teaching. Both groups felt that in an ideal workload there would be more direct than indirect (away from the bedside) patient care activities, but residents desired a greater ratio than faculty. There was agreement that direct patient care and education tasks had high educational value and that downtime and transit had low educational value; faculty felt that these indirect care tasks had higher value than residents.

This study allows for a greater understanding of current resident workload and provides goals when planning the next generation of surgical residency programs. Curriculum changes should aim to increase participation in educational activities, especially assessment, and protect direct patient care activities.

Co-Authorship Statement (where applicable)

Each of the individuals listed provided important contributions to this work.

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> As the primary author, Eric is responsible for the background, methodology, participated in data collection and completed the analysis of results. He is the primary author of this thesis.

Michael Ott, MD, MSc. Departments of Surgery and Oncology, Schulich School of Medicine and Dentistry

> As the supervisor and senior author for this work, Dr Ott helped develop the initial research idea and has been instrumental in project design, implementation, analysis and preparation of the thesis.

Chris J Zhang BSc, Schulich School of Medicine and Dentistry

> Chris assisted in protocol development, was tireless in data collection and was involved in data analysis and manuscript preparation.

Anna Mierza, MD, Schulich School of Medicine and Dentistry

Anna assisted with protocol development, pilot testing and the first stages of data collection.

Sayra Cristancho PhD, Scientist, Centre for Education Research & Innovation; Associate Professor, Department of Surgery and Faculty of Education

> Dr Cristancho provided guidance with project design, implementation, analysis and manuscript preparation.

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> Dr Lingard provided guidance with project design, implementation, analysis and manuscript preparation.

Manuscript Submission Proposals

Preparation for peer- review is in progress. Two manuscripts are under development.

Paper 1: Located in Chapter 2, planned submission to surgical journal.

Paper 2: Located in Chapter 3/ 4, planned submission to surgical education journal.

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Appendix 3. REB Approval Notice

Western Research

Date: 1 August 2018

To: Dr. Michael Ott

Project ID: 111541

Study Title: General surgery resident work patterns, educational value and economic value added: a prospective cohort study and economic analysis.

Application Type: HSREB Initial Application

Review Type: Delegated

Meeting Date / Full Board Reporting Date: 21/Aug/2018

Date Approval Issued: 01/Aug/2018

REB Approval Expiry Date: 01/Aug/2019

Dear Dr. Michael Ott

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above mentioned study as described in the WREM application form, as of the HSREB Initial Approval Date noted above. This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Faculty Participant Study Email Version 1 July 19 2018	Email Script	19/Jul/2018	1
Faculty Participants LOI and Consent Version 3 July 25 2018	Written Consent/Assent	25/Jul/2018	3
Observer Guide Version 3 July 19 2018	Non-Participant Observation Guide	19/Jul/2018	3
Online Survey Version 3 July 19 2018	Online Survey	19/Jul/2018	3
Protocol Version 4 July 19 2018	Protocol	19/Jul/2018	4
Resident Participant Study Email Version 4 July 19 2018	Email Script	19/Jul/2018	4
Resident Participants LOI and Consent Version 5 July 25 2018	Written Consent/Assent	25/Jul/2018	5

Documents Acknowledged:

Document Name	Document Type	Document Date	Document Version
References	References	20/May/2018	2

No deviations from, or changes to, the protocol or WREM application should be initiated without prior written approval of an appropriate amendment from Western HSREB , except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the TriCouncil Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Please do not hesitate to contact us if you have any questions.

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Chapter 1

1 Challenges in Planning the Future of Surgical Residency

Surgical training in its current iteration began in the late 19th century and its format has undergone little change since that time, despite ongoing challenges in the historical current format. In the near future medical and surgical training will undergo one of the largest transformations in the modern period with the introduction of competency- based medical education (CBME). CBME aims to drastically alter how residents are trained, with a focus on generating physicians capable of performing the tasks inherent to their profession as opposed to those who have spent a prespecified length of time in training. A tenet of CBME is the promotion of high- educational value activities and de- emphasizing service time as a requirement of training. The proposed changes to post-graduate medical education are an opportunity to reconsider the structure of surgical resident workload, designing a system optimized for the education of the learner as well as the needs of the system. Thought must be given to the effects of residency structure changes on workflow within academic health sciences centers (AHSCs), where a large portion of inpatient care is provided by resident physicians. This transition requires concrete data regarding the current residency experience in order to understand the effects of CBME implementation, plan for changes in residency structure to meet the goals of CBME and the effects on surgical practice in AHSCs.

1.1 Historical Perspectives on Modern Problems

1.1.1 Origins of Surgical Training

Surgical training at the beginning of the 19th century was built as an apprenticeship model in which trainees assisted in the care of patients under the direct supervision of surgeons. With the innovations of the 19th century bringing surgeons into hospitals, the location of this training changed but there was no formal standardization of training programs. The first formal training program that could be recognized as modern was developed at Johns Hopkins by William Halstead in the late 19th century. This system was adapted from preceptor- centric models Halstead had encountered during his travelling fellowships in German university hospitals. The key revision of Halstead was the emphasis on learner-centric model, where the surgical resident leads patient care under graded supervision over the course of eight- plus years.[1] Dr William Gallie introduced a similar system in Toronto in the 1930s, bringing modern surgical training to Canada for the first time.[2] While there have been changes to the structure of surgical training and new factors affecting the workload of surgical residents- detailed below- the overall structure of those early systems is unchanged; a system of graded responsibility based primarily on the length of service completed.

1.1.2 Work hour reductions and debates

Historically, service and work hours provided by residents were unlimited and unregulated. Surgical training has always been a delicate balance between clinical service provided by resident learners and education received in return [3]. In the early years, surgical trainees physically resided in their hospitals of training, providing near- continuous care. At the beginning of the 21st century this was no longer the case, but residents would be on call every second or third night with no restrictions on work hours, typically working in excess of 100 hours each week. In 2003 the American College of Graduate Medical Education (ACGME) in the United States first began limiting resident duty hours in an attempt to protect patients from provider fatigue, protect trainees from themselves and balance education and service [4]. The Royal College of Physicians and Surgeons of Canada (RCPSC)- unlike the ACGME- does not mandate maximum duty hours. Instead, the RCPSC has focused on recognizing and minimizing fatigue; duty hours have been left to individual provincial resident unions with national guidelines published to guide

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[1] Cameron, "William Stewart Halstead: Our Surgical Heritage."

[2] Harris, "As I Remember Him: William Edward Gallie, Surgeon, Seeker, Teacher, Friend."

[3] Sanfey, Cofer, and Hiatt, "Service or Education: In the Eye of the Beholder."

[4] Philibert, Friedmann, and Williams, "New Requirements for Resident Duty Hours."

negotiations [5]. In general, this has led to the restriction of overall hours per week (range 60-90 hours), limiting work periods to 18- 28 hours, and limiting in- house call ratios to 1 in 4 and 'home call' ratios to 1 in 3 [6].

Many authors have attempted to characterize the effect of work hour changes on resident experience. Studies that assessed resident training after the change to an 80- hour work week in the United States were extremely heterogenous but the overall trend showed that residents spent less time in clinic and in didactic sessions but that operative case volumes did not decrease [7]. There is concern that work hour restrictions will lead to decreased exposure, which will particularly affect surgical and other procedural specialties [8]. This led to the development of the FIRST (Flexibility in Requirement for Surgical Trainees) trial, a national cluster- randomized trial demonstrating that a flexible model of duty hour restrictions (with average work hours per week still limited) is not associated with adverse patient outcomes. In this trial residents reported no differences in overall satisfaction with education but felt that there were less negative effects of duty hour restrictions on multiple aspects of patient care [9]. There is still no consensus regarding the actual effects of work hour restriction on the efficacy of training, but the consensus is that residents are exposed to less cases than several decades prior.

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[5] National Steering Committee on Resident Duty Hours, "Fatigue, Risk & Excellence: Towards a Pan-Canadian Consensus on Resident Duty Hours."

[6] Pattani, Wu, and Dhalla, "Resident Duty Hours in Canada: Past, Present and Future"; PARO and CAHO, "2016-2020 PARO-CAHO AGREEMENT."

[7] Dimitris, Taylor, and Fankhauser, "Resident Work-Week Regulations: Historical Review and Modern Perspectives."

[8] Imrie et al., "A New Era for Resident Duty Hours in Surgery Calls for Greater Emphasis on Resident Wellness."

[9] Bilimoria et al., "National Cluster-Randomized Trial of Duty-Hour Flexibility in Surgical Training."

1.1.3 The Threat of Electronic Health Records

Another key change in healthcare in recent decades is the central place of technology in hospital systems. Computer physician order entry, computer-based imaging programs, electronic health records (EHRs) and patient tracking systems have been implemented under the premise of increased efficiency, cost savings and patient safety. The impact of these changes in clinical work environments on the education to service balance of resident learners was not investigated prior to implementation. As technology has advanced, the workload of residents has changed. Ironically, several authors have demonstrated that while technology may improve service delivery and patient safety, it also deceases educational opportunities and increases service needs on residents, particularly with increased time spent on computer related tasks [10]. As electronic records have become more ubiquitous and medical- legal concerns rise, documentation requirements have increased. In a survey of all residents in the United States, 92% of respondents reported excessive documentation obligations and 73% felt that documentation requirements negatively affected patient care, their own education and their ability to participate in the education of others [11]. In a survey of internal medicine residents, the 68% self- reported spending more than 4 hours per day on documentation [12]. Similarly, a study of the electronic health records use by surgery residents demonstrated that residents spent 2.4 hours per day on electronic documentation, and residents spent a significant portion of their off- shift time logged into the EHR [13]. The burden of documentation and the time required to interact with the electronic health record is a major factor affecting the education of current trainees at all levels.

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[10] Fletcher et al., "The Composition of Intern Work While on Call"; Block et al., "In the Wake of the 2003 and 2011 Duty Hours Regulations, How Do Internal Medicine Interns Spend Their Time?"

[11] Christino et al., "Paperwork Versus Patient Care: A Nationwide Survey of Residents' Perceptions of Clinical Documentation Requirements and Patient Care."

[12] Oxentenko, "Time Spent on Clinical Documentation."

[13] Cox et al., "Documenting or Operating: Where Is Time Spent in General Surgery Residency?"

1.1.4 Decreasing Numbers of Surgical Residents

Further compounding the effects of transitions in training is the reduction in surgical resident training positions. Over the past ten years the number of surgical resident positions has declined in North America, with 60 positions eliminated in Canada over that period [14]. As trainee levels are decoupled from AHSC service requirements and instead projected for on population needs, there will likely be further reduction in the number of specialist trainee positions in several instances.

The effects of these changes to the learning environment has not been well- characterized but several small studies have shown that optimal clinical volume is a difficult question to answer. Haney et al found that increased perceived educational value among internal medicine residents was associated with greater patient acuity and variability and in many cases, there was a parabolic relationship where both very low and very high patient censuses were detrimental. Reducing resident workload has been found to increase the quality of documentation, an imperfect marker of resident performance [15]. Adding additional providers and reducing resident workload improved self- perceived resident educational value of an internal medicine consultation service [16]. Unfortunately, there are no similar studies in surgical residents regarding the effect of increased inpatient care requirements. It has been shown that median operative volume of US graduating general surgery residents increased from 1023 to 1238 between 2005 and 2011. In surgical training, increased operative volume is frequently cited as a marker of strong education and operative volume is associated with increased resident confidence in performing

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[14] National Resident Matching Program, "NRMP Main Residency Match Data: Report Archive"; Canadian Resident Matching Service, "CaRMS R1 Match Interactive Data."

[15] Coit, Katz, and McMahon, "The Effect of Workload Reduction on the Quality of Residents' Discharge Summaries."

[16] Fang et al., "Impact of Adding Additional Providers to Resident Workload and the Resident Experience on a Medical Consultation Rotation."

procedures independently, but to our knowledge there is no evidence of improved patient outcomes [17].

1.2 Evaluating the Current Learning Environment

Despite focus on rebalancing service and education within post graduate medical education (PGME), in practice there still exists a substantial service component to the daily function of surgical services. A review by Boex and Leahy found that residents across all specialties allocated up to 35% of their time to non- or marginally educational patient care tasks. Furthermore, only 15% of time was allocated to teaching and learning time, although there was significant heterogeneity in this regard [18]. In a 2007 survey of surgical residents, Reines et al found that 40% of surgical residents felt that at least half of their time was taken up with service tasks, 69% of residents feeling that service tasks took up at least a quarter of their time. Conversely, the majority of attendings felt that service tasks took up less than 25% of a resident's time [19]. A 2011 nationwide survey of general surgery residents and program directors (PDs) showed there was general agreement the tasks that residents and educators feel are high value, but that PDs felt there was more value in almost all tasks than residents. A qualitative analysis of responses explored this further, and the majority of PDs commented that service is educational as it is part of the job of a practicing surgeon [20].

Contemporary residents are expected to care for more acute and a greater number of sicker patients in a system that requires a greater amount of documentation using inefficient electronic systems. While the shift towards restricted work hours is likely beneficial in several aspects, it places additional pressures on the ability of residents to learn in addition

[17] Fonseca et al., "Graduating General Surgery Resident Operative Confidence: Perspective from a National Survey."

[18] Boex and Leahy, "Understanding Residents' Work: Moving beyond Counting Hours to Assessing Educational Value," 2003.

[19] Reines et al., "Defining Service and Education: The First Step to Developing the Correct Balance."

[20] Sanfey, Cofer, and Hiatt, "Service or Education: In the Eye of the Beholder."

to provide the service inherent to their role. These factors are not an exhaustive list but form the basis of the argument for a radical shift in the training of future surgeons.

1.3 Competency- Based Medical Education within Surgery

A systematic review to develop a common definition of CBME defines it as: '…*an approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It de-emphasizes time-based training and promises greater accountability, flexibility, and learner-centredness*.' [21] CBME began with a new focus on defining and fulfilling set standards and was first popularized in the 1970s [22]. Initially it was incorporated into medical education with some success, but outcomes- based education was the leading model during the late 20th century. Over the past two decades CBME has become increasingly popular and has formed the framework for the vast majority of medical education curriculum developments in Canada and worldwide, with the development of CanMeds competencies for medical students and family medicine residents, and similar programs in other jurisdictions [23]. Canadian surgery programs have taken a leadership role with respect to CBME. The Orthopedic Surgery residency program at the University of Toronto began its CBME program in 2008 as one of the earliest adopters of a residency program based on CBME [24] and demonstrated that residents can be effectively trained in a compressed program that is optimized for education. The program was drastically changed with several rotations removed or altered and significant additional resources allocated to faculty development. The vast

[21] Frank et al., "Toward a Definition of Competency-Based Education in Medicine: A Systematic Review of Published Definitions."

[22] Carraccio and Englander, "From Flexner to Competencies: Reflections on a Decade and the Journey Ahead."

[23] Royal College of Physicians and Surgeons of Canada, "Competence by Design: Reshaping Canadian Medical Education."

[24] Nousiainen et al., "Eight-Year Outcomes of a Competency-Based Residency Training Program in Orthopedic Surgery."

majority of residents now complete training in four instead of five years and it is incredibly well received by both faculty and trainees.

As the Royal College transitions to a Competency by Design (CBD) model for all specialty training programs over the next several years, there will be a growing focus on creating high value learning experiences and assessments that can demonstrate a resident's capability with regards to skills and competency deemed essential to the practice of that specialty [25]. The implementation of CBD will continue to focus residents on engaging in less service oriented or indirect patient care tasks and in more direct patient care tasks that allow for them to gain and demonstrate competence in entrustable activities. [26]. With the implementation of this new training paradigm, it can be anticipated that the health care system will not be able to rely on residents who currently perform a large volume of indirect patient care within teaching hospitals. Academic health sciences centers (AHSC) are the largest and most complex care environments within the current Canadian healthcare system and medical trainees form an important part of their workforce. A similar change in AHSC workforce occurred when resident hours were restricted and led to many programs adopting models utilizing advanced care providers (ACPs) such as nurse practitioners and physician assistants to offload patient care responsibility from residents [27]. In general, these initiatives have been well received but not every program has the resources or funding models to add similar team members, especially in the Canadian single- payer system where ACPs are not as fully integrated into AHSC teams.

Surprisingly in their statements regarding CBME, neither the ACGME nor the RCPSC discuss this anticipated shift in the labour workforce which will occur as a result of focus on competency- based education. One of the core tenets espoused by CBME thought

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[25] Holmboe et al., "The Role of Assessment in Competency-Based Medical Education."

[26] Frank et al., "Competency-Based Medical Education: Theory to Practice."

[27] Knickman et al., "The Potential for Using Non-Physicians to Compensate for the Reduced Availability of Residents."; Buch et al., "Non-Physician Practitioners' Overall Enhancement to a Surgical Resident's Experience."

leaders is a shift towards a leaner- centric environment from the current system [28]. For clinical care to not suffer, the system must change so that it is not as reliant on leaners to function. The RCPSC emphasizes that service and education are not in opposition but blended in all residency activities and the introduction CBME should not affect AHSC workflow [29]. This is a noble aspiration but does not address the reality that without careful planning and likely provision of additional resources, there will be a significant gap in the ability of AHSC teams to provide the care expected of them. Accurate data regarding the current functioning of teams is essential to help plan for this transition in the coming years.

1.4 Time Motion Studies

This section examines time motion studies (TMS) methodology as a tool to evaluate the current surgical residency learning environment. TMSs are generally defined as continuous observation and recording of subjects by external observers for the purposes of analysis. TMS has several advantages when quantifying surgical resident workload and has been used successfully in areas of PGME.

1.4.1 Principles of TMS

Time motion study methodology was developed in the early 20th century with an aim towards increasing industrial efficiency and was first applied to the medical field by Frank and Lilian Gilbreth in the 1910's [30]. Over the next century, TMS has been applied to healthcare workflow, patient safety and the implementation of health information technologies. TMS in healthcare- as in other fields- is applied in a disparate variety of iterations based on the study examined. In a 2014 review of TMS studies in healthcare, Lopetegui et al. identified that 52% of studies used direct observation, the majority of which were based on continuous, direct evaluation of participants. They also identified

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[28] Frank et al., "Competency-Based Medical Education: Theory to Practice."

[29] Royal College of Physicians and Surgeons of Canada, "Competence by Design: Reshaping Canadian Medical Education."

[30] Lopetegui et al., "Time Motion Studies in Healthcare: What Are We Talking About?"

other methods of observation, including indirect observation via self- reporting, individual recall and video monitoring. In addition to continuous monitoring, sampling at defined time intervals has also been used but does not fit the classical definition of TMS [31].

While TMS represents a powerful tool to evaluate clinical work processes that are central to high- quality healthcare but relatively under- studied, there are several barriers to its use. Multiple attempts to aggregate TMS have demonstrated that there is prohibitive methodology heterogeneity [32]. The use of TMS checklists and standardized methodology has been advocated for but there is no single accepted protocol, and each study must adapt accepted methodology to their own local factors and unique research question. Zheng et al proposed a Suggested Time and Motion Procedures (STAMP) checklist based on a review of 24 high quality TMS addressing the effects of health information technology. While the STAMP checklist was designed specifically for health information technology evaluation, it can be used as a reporting checklist for other healthcare- related TMS. An abbreviated and modified version is included in Table 1.1

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[31] Lopetegui et al.

[32] Zheng, Guo, and Hanauer, "Using the Time and Motion Method to Study Clinical Work Processes and Workflow: Methodological Inconsistencies and a Call for Standardized Research"; Tipping et al., "Systematic Review of Time Studies Evaluating Physicians in the Hospital Setting."

Area	Element	Description
Intervention *(if applicable)*	Type System Genre Maturity	Intervention studied Origin or lineage of intervention Time elapsed since intervention
Empirical Setting	Institution type Care area Locale	Ex academics vs non- academic Ex inpatient vs outpatient vs emergency department Geographic characteristics of institution
Research Design	Protocol Duration Shift distribution Observation hours	Protocol type for intervention ex RCT vs before/ after *(only relevant for comparative studies)* Total length of collection period Types and characteristics of shifts observed Total number and distribution of hours observed
Task category	Definition & classification Acknowledgement of prior work New development	Definition of all major and minor task categories Acknowledgement of previous classification schemes, justifications for modifications Development process of novel classification scheme
Observer	Size of team Training Background Inter- observer uniformity Continuity Assignment	Number of observers Observer training process, including pilot collection Professional background with relevant exposure to clinical scenarios encountered Calculation & justification of interobserver variation Continuity across multiple phases *(if applicable)* Process of observer assignment to subjects
Subject	Size Recruitment & randomization Continuity Background	Number of subjects enrolled Process of recruitment and randomization Continuity across phases *(if applicable)* Background demographic and relevant details of subjects (ex training level, age, gender)
Data recording	Multitasking Non- observed periods Between task transitions Collection tool	If/ how multi- tasking is accounted for and analyzed Description of any non- observed periods If & how transitions are accounted for & analyzed Device/ software/ other system used to collect data
Data analysis	Definition of key measures Analytical methods	Key standardized measures of reporting - Average time on major/ minor tasks - Measures of workflow fragmentations - Task switching frequency Statistical methods and software
Ancillary data	Interruption Interaction Location	Descriptor of interruptions Communications & method used to accomplish tasks Specific location where activities take place

Table 1.1 A proposed STAMP procedure for reporting of health- care TMS. Adapted from Zheng et al.[33]

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[33] Zheng, Guo, and Hanauer, "Using the Time and Motion Method to Study Clinical Work Processes and Workflow: Methodological Inconsistencies and a Call for Standardized Research."

1.4.2 TMS use within medical education

Time motion studies have been used to evaluate medical learners several times, most commonly studying internal medicine residents. The largest study to date was a multi-institutional observational TMS of internal medicine study conducted as a sub- study of the iCOMPARE study of flexible vs standard duty hours of internal medicine residents [34]. In this recent, well- conducted trial with over 2000 hours of direct observation, only 7% of time was spent on educational activities, while 66% of time was spent on indirect patient care activities. These results are similar to what was found in other, smaller studies all focusing on internal medicine residents, almost always on core inpatient services [35]. It is clear that at least from a time allocation perspective, service takes priority over education for many residents on inpatient services in internal medicine.

While there are several well conducted TMS for internal medicine residents, it has rarely used to study surgical residents. Hamid et al observed four orthopedic residents over 6 total shifts on the orthopedic consult service. In this specific scenario, residents spent 26% of their time on administrative duties or documentation that was felt to be of limited value [36]. Geryane et al conducted a study of surgical residents completing laparoscopic cholecystectomies but the focus was on improving operating room efficiency as opposed to resident workload [37]. Dassinger et al performed a multi- method analysis of a single pediatric surgery resident's workload including 19 hours of TMS data. Fourteen percent of

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[34] Chaiyachati et al., "Assessment of Inpatient Time Allocation Among First-Year Internal Medicine Residents Using Time-Motion Observations."

[35] Fletcher et al., "The Composition of Intern Work While on Call"; Block et al., "In the Wake of the 2003 and 2011 Duty Hours Regulations, How Do Internal Medicine Interns Spend Their Time?"; Leafloor et al., "Canadian Medical Education Journal Time Is of the Essence : An Observational Time-Motion Study of Internal Medicine Residents While They Are on Duty"; Huang et al., "Time-Motion Studies of Internal Medicine Residents' Duty Hours: A Systematic Review and Meta-Analysis."

[36] Hamid et al., "Orthopedic Resident Work-Shift Analysis: Are We Making the Best Use of Resident Work Hours?"

[37] Geryane, Hanna, and Cuschieri, "Time-Motion Analysis of Operation Theater Time Use during Laparoscopic Cholecystectomy by Surgical Specialist Residents."

time was spent on educational activities with almost no low- value activities recorded [38]. In a study of residents from many different programs, a single 3rd year surgical resident was tracked for a single shift and only 1% of time was spent on educational activities [39]. Both studies are limited by their extremely small sample size and near certainty of sampling bias. One common theme of these studies of surgical residents is the extreme fragmentation of surgical resident workload, which authors of several studies posit may negatively impact the educational value of training; this relationship has not been studied further. There is a signal that only a very small proportion of a surgical resident's time is spent on purely educational activities, which may not be consistent with the goals of CBME.

To date, there is no TMS of general surgery residents of sufficient size to draw significant conclusions regarding what can be done to optimize workload for educational purposes in the era of CBME. In order to make the changes advocated for CBME to be successful, we must have an accurate description of the current workload of surgical residents. The ideal time motion study of surgery residents should be designed using TMS principles to ensure accuracy of data, large enough to allow quantitative comparisons between subgroups and utilize established standards of reporting to ensure external validity. This data can then be used to guide educators in planning the newest iterations of training programs and making plans for changes in the workflow of surgical teams at AHSCs.

1.5 Objectives and Purpose of Thesis

This research platform was designed to better understand the current surgical educational environment in a closed program, specifically how resident workload is perceived by both trainees and educators. Despite the importance of this topic to PGME curriculum design, there is limited previous work in the area and evidence- based curriculum requires further work. Three distinct components were assessed:

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[38] Dassinger, Eubanks, and Langham, "Full Work Analysis of Resident Work Hours."

[39] Gabow et al., "Observations of Residents' Work Activities for 24 Consecutive Hours: Implications for Workflow Redesign."

(1) Resident workload, with a goal of rigorous quantitative assessment of the time spent on various activities

(2) Perceptions of resident workload among surgical residents and faculty

(3) Perceptions of the educational value of resident tasks among both surgical residents and faculty

While this work is exploratory in nature, multiple hypotheses were generated prior to implementation and are noted in each subsequent chapter.

The overall aim is to develop a model for understanding both the true educational environment and how this differs from perception. Both are essential to making evidence-based changes in surgical training to allow CBME to succeed.

Chapter 2

2 A Contemporary Time Motion Analysis of Surgical Residents

Given the paucity of quality contemporary data on the day-to-day workflow of a surgical residents a comprehensive time motion study (TMS) study of a contemporary surgical training program was conducted. The data developed will inform the modification and design of changes to surgical training programs in a competency-based training era. As discussed in Chapter 1, TMS is an ideal tool for developing high- quality quantitative data regarding resident workflow in the workplace.

2.1 Methods

2.1.1 Setting

This study took place at all 3 core teaching hospitals of the Schulich School of Medicine & Dentistry, Western University, General Surgery training program in London, Ontario, Canada. All study protocols were approved by the Research Ethics Board of London Health Sciences Centre and Western University (Appendix 1).

2.1.2 Program Structure

The structure of the General Surgery training program follows the objectives and training and specialty training requirements set out by the Royal College of Physician and Surgeons of Canada. [40] At the time of this study The Western university training program was a time-based 5-year training program with a competency based Surgical Foundations program similar to all other Canadian General Surgery training programs. Core rotation workdays consist of daytime work (approximately 6 AM- 6 PM) and on call work (approximately 5 PM- 7 AM).

[40] Royal College of Physicians and Surgeons of Canada, "General Surgery Training Requirements."

The definition of resident training status and role are defined in time-based terms, by year of training. Junior residents (JRs) are defined as trainees in either the 1^{st} (R1s) or 2^{nd} (R2s) year of training. Intermediate residents are defined as trainees in the 3^{rd} (R3s) year of training. Senior residents are defined as trainees in either the 4^{th} (R4) or 5^{th} (R5) year of training.

R1s training schedules are defined by the training program and they rotate on core surgery rotations split between elective surgery teams (e.g. hepatobiliary, colorectal, etc.) or Acute Care Surgery services (ACS). R2s training schedules are also defined by the training program and they complete rotations in surgical subspecialties and related fields (pediatric, thoracic & community surgery, endoscopy and critical care). Intermediate residents have significant flexibility compared to junior residents in setting their training schedules and may choose a mix of research, surgical electives or community rotations depending on career objectives. Senior residents training schedules involve rotating on all core general surgery services at all training hospitals during the last two years of training. There is no distinction between intermediate and senior residents when engaging in core rotations on general surgery services, their role and workload are identical to senior residents.

Core academic activities in the program vary slightly per rotation but all residents are excused from clinical activities for weekly academic half- days, consisting of a Divisional formal rounds followed by 3 hours of dedicated teaching conference jointly provided by faculty and residents. Other activities vary per service and level but are generally 1-2 hours per week. There is a dedicated journal club but it takes places outside of normal work hours at an off- site location and as such was not captured.

2.1.3 Participants

Data collection took place in two time points, September 2018 and between June-October 2019. All general surgery residents rotating on a general surgery or subspecialty service were eligible to participate. General Surgery residents were given a letter of information and approached to participate by email. Participation was voluntary and all residents gave informed consent before participation. Residents either unwilling to participate or not enrolled in the General Surgery training program were excluded. All residents invited to participate consented.

2.1.4 Data Collection

In order to collect data of time on task an external observer, continuous observation, workflow time methodology of TMS was used (see section 1.4). [41] In the standardized TMS methodology, a trained external observer continuously observed an individual subject in a 1:1 manner and recorded all observed activities and time spent on task for a continuous duty period. Data collection was performed by 3 trained observers (E.W., C.J.Z. and A.M.). A single duty period (daytime or overnight call) was always observed entirely in a continuous manner by a single observer.

Observers were initially trained over a 6-hour period of tandem observation with an experienced observer. Emphasis was placed on minimizing disruption to normal workflow, patient care and collection of granular data. After the observer completed the training period, continuous communication between the members of the observation team was employed to facilitate accurate description of events. Interactions between observers and the resident were limited and actions influencing resident activity or patient care were strictly prohibited unless there was a concern for patient safety, as mandated by the REB. There was one instance during which an observer stepped in to make a collaborative recommendation regarding a patient's capacity to consent. For quality assurance interobserver variability was investigated by tandem observation of participants over two unique duty periods. Categorical agreement was assessed on a per-minute basis for the entire collection period in question. There was good interobserver agreement with a mean kappa coefficient of 0.69 for specific tasks and 0.74 for task category, signifying good agreement between observers.

The observer coordinated with the participant to ensure observations began when the subject arrived on-site for duty and continued until the subject's duty was completed and

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[41] Lopetegui et al., "Time Motion Studies in Healthcare : What Are We Talking About ?"

they left the site for the day. The observer was present continuously with the subject during all tasks that occurred during the day, including patient encounters, team discussion, operating room, etc. Observers excused themselves from patient encounters when direct observation was not necessary, but remained in the immediate vicinity to allow rapid detection if a task switched. Time spent on work activities outside the hospital setting was not recorded. During site changes for teaching or patient care activities, the observer accompanied the subject.

Observations were recorded in a standardized fashion according to TMS principles using digital timekeeping and a combination of immediate categorization and free form notes to enhance the richness of recorded data and facilitate retrospective coding of tasks as required. [42] Observations were recorded to the individual minute and sub-minute events were captured when possible. Multitasking was not allowed in data categorization and capture of rapid task switching was emphasized, with the ultimate designation of a primary activity defined and recorded by the observer.

Given the variable nature of the program and resident assignments, purposeful sampling based on the rotation schedule was used to balance selected duty periods across the various surgical teams including resident level, duty types (daytime/call), training site and day of the week. The use of a purposeful sample ensured that data collected were representative of the typical workload of a general surgery resident across all domains and types of duty periods. Sample size was initially estimated at 40 work periods, split evenly between junior and SRs. An interim qualitative analysis by the authorship conducted prior to reaching this threshold found that saturation had been reached with respect to novel events, but that the types of work periods collected did not match overall resident workload and so additional periods were collected to correct this balance.

One of the observers (E.W.) was a senior resident in the General Surgery training program. It was decided by the research team *a prioi* that E.W. would not collect data for

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[42] Lopetegui et al., “Time Motion Studies in Healthcare: What Are We Talking About?”

other trainees who were less senior. The research team decided that the risk of observer bias was excessive and that junior residents may defer clinical decisions to the observer in the scenario of observation by a senior resident in their training program. Using this principle to avoid conflict observers were more junior that the subject of observation allowing observers to record tasks and time on task with minimal disruption to the normal clinical workflow. Both during observer training and instructions provided to study subjects the minimization of interaction between observer and subject was emphasized. Qualitative feedback from resident subjects overwhelmingly described that after the first few minutes of observation the presence of the observer and the tracking of tasks and time on task had no impact on their activities, and this lack of influence increased especially when clinically busy.

2.1.5 Data Categorization

Through an iterative process of expert consensus building by the authorship group generated a final list consisting of 6 generalized task categories and 26 specific tasks, shown in Table 2.1 and 2.2. The authorship group includes two surgeon content experts (E.W. and M.O.) and two non-clinician medical education research professionals (L.L and S.C.). Iterative review during data collection was used to refine and condense the task-list until no unique tasks (either general or specific) were identified in observations. Initial observation data were recorded with sufficient granularity and detail to facilitate accurate retrospective coding once the task-list had been finalized. The iterative development process for task-list categories ensured that all the categories were comprehensive and did not overlook any observed tasks in a resident's workday. Any discrepancies or difficulties with categorization were resolved with the authorship group through consensus.

Task Category	Specific Task	Description
Direct Patient Care	Operating	Resident scrubbed in as part of an operation
	OR Preparation	Time spent in the OR with a patient prior to or following actual operation facilitating care
	Procedure	Performing or assisting with a non- OR procedure (endoscopy, trauma etc)
	Patient Assessment	Interaction with patients for the purposes of care. Ie assessments on morning rounds or when seeing a patient in consultation.
	Patient Education	Interaction with patients for the primary role of patient or family education- ie informing the patient of a pathology report or a family meeting
	Consent	Obtaining consent for the purposes of an operation, procedure etc
	Call patient	Communicating via telephone with outpatients as part of patient care
Indirect Patient Care	EMR Use	Any interaction with the medical record (chart review, order entry etc).
	Documentation	Dictation or writing of any patient notes.
	Handover	Formal handover at the beginning or end of a clinical period
	Comm- Surgical Team	Any method of communication with within the primary surgical team (faculty surgeon, fellow, residents, medical students, nurse practitioners etc)
	Comm- Other Teams	Any method of communication with another service assisting in patient care (critical care, medicine, emergency medicine etc)
	Comm- Other HCP	Any method of communication with any healthcare provider participating in patient care (nursing, respiratory therapist, pharmacists, allied health etc)
	Answering pages	Any time spent responding (immediately or delayed) to a page/ secure message
	Administrative	Any other task required for care of patients (booking cases, insurance forms, etc)

Table 2.1 Task Categories and Individuals Tasks using during resident tracking and coding.

Task Category	Specific Task	Description
Education	Lecture/ Conference	Formal educational activities including Surgical Rounds, Academic Half-Days etc
	Informal Teaching	Unscheduled teaching during the course of regular workflow. Includes receipt of teaching from a consultant or provision of teaching to junior learners.
	Self- study	Personal time spend reviewing content not as part of the care of a specific patient. May be during periods without clinical activity or as part of dedicated time occasionally provided to residents.
	Clinical Observation	Observation in the OR, trauma bay or other clinical are where the resident is not a part of that patient's care team at that time
	Research	Research activity taking place during work hours including research team meetings, protected research time or unstructured research work.
	Orientation	Provision of information to new residents or medical students specifically for the purpose of orienting them to the service.
	Assessment	Time set aside for formal evaluation or informal feedback. Often included but did not require use of evaluation tool. Includes both receipt or provision.
Transit	Transit (on- site)	Transit occurring within the hospital site.
	Transit (off- site)	Transit outside of hospital- to other site for clinical or educational events, as part of transplant procurement team
Downtime	Break	Time taken for personal activities throughout the day (ie eating, washroom use)
	Wait	Any time without another event waiting for another event (ie during OR turnover or waiting to review with a consultant/ senior resident)
Miscellaneous	Miscellaneous	Events not categorized by our coding system

Table 2.2 Task Categories and Individuals Tasks using during resident tracking and coding (continued)

2.1.6 Statistics

Following collection, all data was de-identified and transcribed into Microsoft Excel to summarize task categories and time spent for the entirety of the duty period observed. All analysis was conducted using SPSS (IBM SPSS Statistics for Macintosh, Version 25.0. Armonk, NY: IBM Corp.). Time spent on various tasks was compared between groups using with independent- samples *T*- test.

2.2 Results

2.2.1 Participant Characteristics

The characteristics of the study subjects and observation periods are presented in Table 2.3. Twenty residents were observed for over a total 54 clinical duty periods. As described, purposeful sampling was performed so that data collection reflected the structure of the program for both JRs (R1 and R2) and SRs (R3, R4 and R5). JRs observations included equal amount observation while on acute care surgery (ACS) services (12/24, 50% of daytime observed duty periods), and elective surgical services (12/24, 50% of daytime observed duty periods). The equal split in time spent on acute care surgery services and elective surgery services reflects the training program structure for JRs. A greater proportion of SR duty period observations were on elective surgical services compared to JRs (19/24, 79% of observed duty periods). This increased time spent on elective surgical services also reflects the training program structure for SR. In addition to daytime duty periods, two SR and four JR call duty periods (5PM until the end of morning handover) were collected.

Characteristic	Clinical periods N=54	Participants N=20
Male, *No. (%)*	21 (38.9)	10 (50)
PGY Year, *No. (%)*		
Junior	28 (51.8)	9 (45)
PGY1	27 (50)	8 (40)
PGY2	1 (1.8)	1 (50)
Senior	26 (48.1)	11 (55)
PGY3	7 (13.0)	3 (15)
PGY4	10 (18.5)	5 (25)
PGY5	9 (16.7)	3 (15)
Primary Site, *No. (%)*		
A	37 (68.5)	-
B	17 (31.5)	-
Service, *No. (%)*		
Acute Care Surgery	19 (33.9)	-
Elective Team	31 (55.4)	-
OR coverage	18 (33.3)	
Clinic coverage	12 (22.2)	
Unscheduled	1 (1.9)	
Overnight call	6 (10.7)	-

Table 2.3 Characteristics of residents observed and clinical shifts.

2.2.2 Workload Distribution

A total of 662.8 hours of observational data was collected during all duty period observations. The total observation period represented 6375 observed discrete events. The mean distribution of events based on generalized task categories and specific task categories including time allocation to task is presented in Table 2.4 and represented in Figure 2.1. Direct patient care (DPC) accounts for 24% of total events on duty and represents 39.7% of workload by time. The most time-consuming events in DPC were operating and clinical assessment that accounted for 21.3% and 10.1% of duty time respectively. An additional 4.5% of time was spent in the OR preparation, immediately before or after operating. Indirect patient care (IPC) accounted for 52% of total events on duty and represents 33.2 % of workload by time. The most time-consuming IPC evens were interacting with the EMR, communicating within the surgical team and formal handover, accounting for 11.3%, 7.5% and 3.5% of total workload respectively. While breaks accounted for 8.6% of total time on duty within the complete series there was significant variation in time spent on break when not on call compared to on call duty periods. Breaks only accounted for only 5.6% of total time on duty of non-call duty periods (mean 40 min, SD 37 min).

Task Category Individual Tasks	Events *Mean number, (SD)*	Proportion of events *(%)*	Time, *Mean hh:mm (SD)*	Proportion of Time *(%)*
Direct Patient Care	**28.5 (9.4)**	**24.1**	**4:52 (2:31)**	**39.7**
Operating	2.8 (4.9)	2.4	2:37 (2:29)	21.3
Patient Assessment	15.5 (7.4)	13.2	1:14 (1:01)	10.1
OR Preparation	6.3 (6.6)	5.3	0:33 (0:35)	4.5
Patient education	3.4 (3.2)	2.9	0:15 (0:15)	2.0
Procedure	1.0 (1.6)	0.9	0:08 (0:13)	1.1
Consent	0.6 (0.9)	0.5	0:03 (0:06)	0.4
Call patient	0.2 (0.5)	0.1	0:02 (0:08)	0.3
Indirect Patient Care	**61.6 (27.5)**	**52.1**	**4:04 (1:42)**	**33.2**
EMR Use	17.6 (8.8)	14.9	1:25 (0:44)	11.3
Comm- Surgical team	18.4 (11.2)	15.6	1:00 (0:42)	7.5
Handover	2.0 (2.0)	1.7	0:27 (0:24)	3.5
Documentation	2.6 (2.6)	2.2	0:19 (0:18)	2.7
Answering pages	10.1 (9.9)	8.5	0:16 (0:19)	1.9
Admin	2.4 (2.5)	1.9	0:10 (0:14)	1.6
Comm- Other HCPs	3.9 (4.5)	3.3	0:10 (0:13)	1.5
Comm- Other Teams	3.4 (3.4)	2.9	0:10 (0:11)	1.3
Downtime	**10.9 (5.4)**	**9.2**	**1:30 (0:27)**	**12.2**
Break	5.8 (3.8)	4.9	1:03 (1:31)	8.6
Wait	5.1 (4.2)	4.3	0:28 (0:28)	3.8
Education	**4.4 (4.0)**	**3.8**	**0:55 (1:12)**	**7.5**
Lecture/ Conference	0.6 (1.0)	0.5	0:26 (1:03)	3.5
Informal Teaching	2.1 (2.2)	1.8	0:10 (0:13)	1.4
Self- study	0.4 (1.8)	0.4	0:07 (0:23)	1.0
Clinical Observation	0.7 (1.7)	0.6	0:06 (0:16)	0.8
Research	0.2 (0.6)	0.2	0:02 (0:09)	0.3
Orientation	0.2 (0.7)	0.2	0:01 (0:05)	0.1
Assessment	0.1 (0.3)	0.1	<0:01 (0:02)	<0.1
Transit	**10.8 (8.2)**	**9.2**	**0:46 (0:45)**	**6.3**
Transit (on- site)	10.3 (8.0)	8.7	0:36 (0:28)	4.9
Transit (off- site)	0.4 (1.3)	0.3	0:09 (0:40)	1.2
Miscellaneous	**1.9 (2.4)**	**1.7**	**0:06 (0:07)**	**0.8**
Total	**118.1 (40.9)**	**100**	**12:16 (2:06)**	**100**

Comm- communication

Table 2.4 Distribution of Task Category and Tasks, both by time allocation and total number of events.

Time spent on task (total time for daytime duty periods) for JR and SR are displayed and compared in Table 2.5, and visually represented in Figure 2.1. There were no differences in total length of daytime duty periods observed between JR and SR. JR spent significantly more time in transit (JR mean 1 hour (SD 59 minutes) vs SR mean 26 minutes (SD 19 minutes), p=0.012), in clinical observation (JR 0:09 (0:17) vs SR 0:00 (0:02), p=0.034) and more times in miscellaneous tasks not categorized (JR 0:07 (0:07) vs 0:03 (0:05), p=0.035). Seniors spent more time in communication with other teams (SR 0:13 (0:12) vs JR 0:05 (0:07). There was a trend towards seniors spending more time operating (SR 3:36 (2:39) vs JR 2:14 (2:07), p=0.056).

Time spent on task (total time for daytime duty periods) for residents assigned to ACS and elective surgery services are compared in Table 2.5 and visually represented in Figure 2.1. Residents assigned an ACS service resulted in significantly longer daytime duty hours compared to elective surgical services (ACS mean time 12:46 (SD 2:10) vs elective 11:27 (1:40), p=0.022). ACS residents also spent more time allocated to indirect care tasks (ACS 4:49 (1:17) vs elective 3:14 (1:39), p<0.001) Other specific tasks in which residents assigned to ACS services spent more time on compared to elective surgical residents includes on- site transit (ACS 0:54 (0:32) vs elective 37 (0:53), p=0.001), obtaining consent (ACS 0:08 (0:09) vs 0:01 (0:06), p=0.009) and handover (ACS 0:48 (0:15) vs elective 0:12 (0:18), p<0.001).

Task Category/ Individual Task	Junior n= 24	Senior n= 24	*p*	ACS n=17	Elective n=31	*p*
Direct Patient Care, *mean time hh:mm, SD*	**4:37 (2:16)**	**5:48 (2:31)**	**0.095**	**4:51 (2:35)**	**5:25 (2:23)**	**0.44**
Operating	2:14 (2:07)	3:36 (2:39)	0.056	2:19 (2:05)	3:15 (2:38)	0.21
Patient Assessment	1:29 (1:12)	0:58 (0:16)	0.096	1:23 (0:45)	1:08 (1:11)	0.43
OR Preparation	0:31 (0:39)	0:42 (0:31)	0.31	0:27 (0:36)	0:42 (0:35)	0.17
Patient Education	0:11 (0:13)	0:18 (0:16)	0.088	0:20 (0:19)	0:11 (0:11)	0.10
Procedures	0:10 (0:15)	0:05 (0:11)	0.21	0:12 (0:17)	0:05 (0:10)	0.17
Consent	0:05 (0:08)	0:02 (0:04)	0.27	0:08 (0:09)	0:01 (0:03)	0.009*
Call patient	0:00 (0:00)	0:04 (0:12)	0.093	0:03 (0:11)	0:01 (0:06)	0.48
Indirect Patient Care	**3:44 (1:49)**	**3:51 (1:37)**	**0.79**	**4:49 (1:17)**	**3:14 (1:39)**	**<0.001***
EMR Use	1:23 (0:49)	1:18 (0:37)	0.71	1:32 (0:39)	1:14 (0:44)	0.19
Comm- Surgical Team	0:49 (0:31)	0:57 (0:37)	0.43	1:02 (0:32)	0:48 (0:34)	0.18
Handover	0:25 (0:25)	0:24 (0:25)	0.87	0:48 (0:15)	0:12 (0:18)	<0.001*
Documentation	0:15 (0:16)	0:23 (0:19)	0.14	0:22 (0:19)	0:17 (0:17)	0.44
Answering pages	0:15 (0:12)	0:11 (0:19)	0.43	0:19 (0:13)	0:10 (0:17)	0.091
Admin Tasks	0:12 (0:10	0:10 (0:12)	0.66	0:13 (0:16)	0:09 (0:15)	0.39
Comm- Other HCP	0:12 (0:14)	0:08 (0:14)	0.45	0:15 (0:16)	0:07 (0:12)	0.12
Comm- Other teams	0:05 (0:07)	0:13 (0:12)	0.017*	0:12 (0:12)	0:07 (0:10)	0.15
Downtime	**1:19 (0:45)**	**1:00 (1:34)**	**0.11**	**1:08 (0:37)**	**1:10 (0:43)**	**0.87**
Break	0:44 (0:41)	0:35 (0:34)	0.42	0:41 (0:39)	0:39 (0:38)	0.89
Wait	0:34 (0:33)	0:27 (0:23)	0.41	0:26 (0:19)	0:33 (0:33)	0.48
Education	**1:10 (1:37)**	**0:40 (0:43)**	**0.19**	**0:56 (1:39)**	**0:55 (1:01)**	**0.96**
Lecture/ Conference	0:43 (1:30)	0:16 (0:25)	0.17	0:35 (1:31)	0:26 (0:50)	0.66
Informal Teaching	0:07 (0:11)	0:10 (0:14)	0.44	0:09 (0:13)	0:09 (0:13)	0.94
Self- study	0:03 (0:11)	0:08 (0:28)	0.44	0:01 (0:05)	0:08 (0:26)	0.22
Clinical Observation	0:09 (0:17)	0:00 (0:02)	0.034*	0:04 (0:11)	0:05 (0:14)	0.83
Research	0:04 (0:12)	0:01 (0:05)	0.32	0:03 (0:12)	0:02 (0:07)	0.59
Orientation	0:02 (0:06)	0:01 (0:04)	0.54	0:00 (0:05)	0:01 (0:06)	0.41
Assessment	0:00 (0:01)	0:01 (0:03)	0.095	0:00 (0:00)	0:01 (0:03)	0.085
Transit	**1:00 (0:59)**	**0:26 (0:19)**	**0.012***	**0:54 (0:32)**	**0:37 (0:53)**	**0.22**
Transit (on- site)	0:44 (0:33)	0:23 (0:18)	0.011*	0:54 (0:32)	0:22 (0:18)	0.001*
Transit (off- site)	0:16 (0:58)	0:03 (0.014)	0.30	0:00 (0:00)	0:14 (0:52)	0.13
Miscellaneous	**0:07 (0:07)**	**0:03 (0:05)**	**0.035***	**0:06 (0:07)**	**0:05 (0:07)**	**0.56**
TOTAL	**11:59 (2:21)**	**11:51 (1:29)**	**0.81**	**12:46 (2:10)**	**11:27 (1:40)**	**0.022***

*- statistically significant (p<0.05)
Comm- communication

Table 2.5 Comparison of daytime workload allocation between JR and ACS and Elective senior residents.

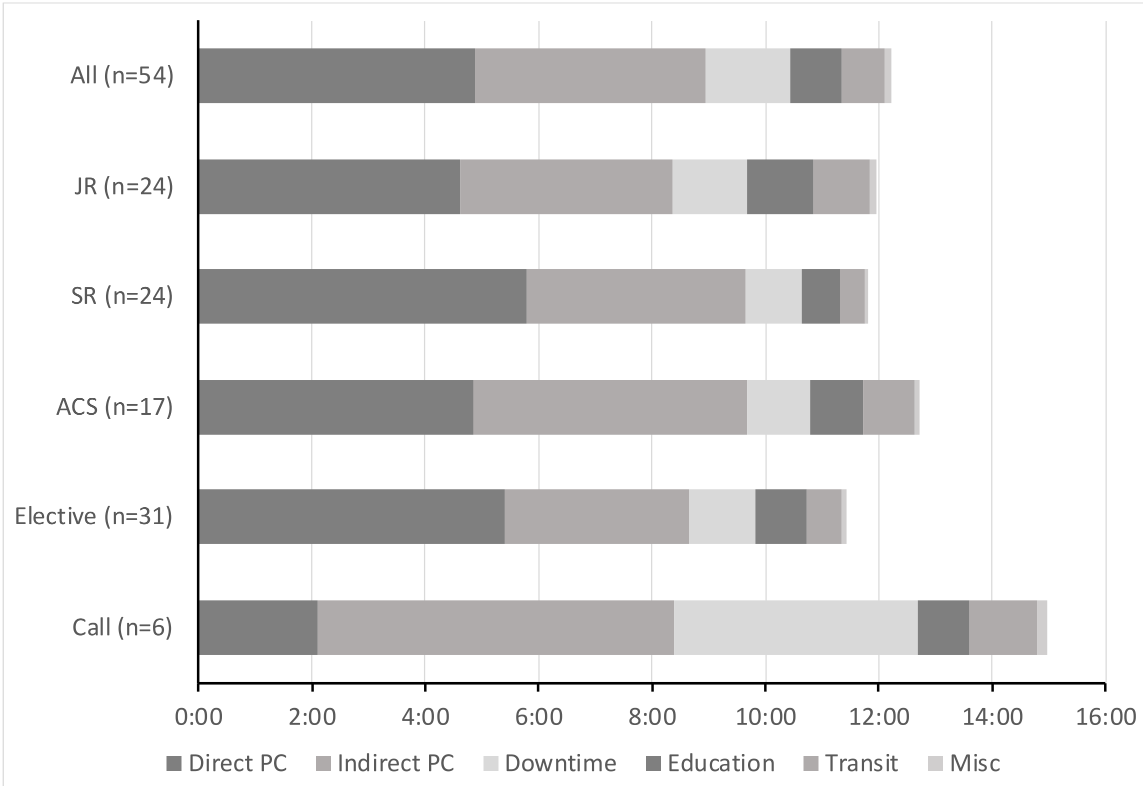

Figure 2.1 Visual representation of workload allocation for all observed data, daytime JR, SR, ACS elective and On- Call activities.

2.3 Discussion

The present study represents the largest TMS of surgical residents to date and provides key information regarding tasks performed, time on task and allocation of overall time in an academic surgical training program. As expected, residents perform a very high volume of clinical care during their days, with an average of only 40 min allocated to personal time (eating, washroom etc.) during a 12-hour day. The largest volume of time spent by surgical residents involves performing direct in-person patient care. This is driven by a mean of almost 3 hours spent in the operating room, when time is averaged over many duty periods which include many days in which residents have non- OR assignments.

Despite the largest volume of time being devoted to direct patient care up to a third of total time is spent in indirect care activities. The most concerning finding was that only

8% of total time observed was allocated towards all educational activities (both formal and informal). Assessment (including both formative and summative feedback) and informal teaching were observed to be allocated 0.1% and 0.8% of total time respectively. The total time allocated to assessment and feedback was the smallest percentage of total time (0.1%) as well as the smallest total amount of time (mean of 1 min) of all tasks observed, on average. One of the hallmarks of CBME is increased feedback and coaching. As surgical training programs transitions to CBME, the minimal amount of time devoted to assessment clearly represents an opportunity and imperative for improvement.

Within the literature TMSs have most frequently been applied to medical specialties, most commonly internal medicine residents on clinical teaching units resulting in data with limited application to surgical training programs. In a multi-institutional observational TMS of internal medicine residents with over 2000 hours of direct observation, 66% of time was spent on indirect patient care activities; only 13% of time was allocated to direct patient care.[43] Similar results are seen from other authors in other smaller studies of medicine residents. However, most of these all focus on internal medicine residents on core inpatient services not outpatient clinical services.[44] Our current study found that surgical residents spent more time in direct patient care activities than previously cited for internal medical residents, likely reflecting central the role of direct patient care occurring in the operating room. In our series, residents allocated 13% of time towards non- OR DPC tasks, similar to what has been demonstrated in these medicine studies. Interestingly, studies of internal medicine residents found similarly low amounts of time (7%) allocated to educational activities. This likely reflects the reality of a low priority given to educational activities in the busy, service- orientated clinical units that exist in academic medical centers, a problem spanning all specialties.

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[43] Chaiyachati et al., "Assessment of Inpatient Time Allocation Among First-Year Internal Medicine Residents Using Time-Motion Observations."

[44] Oxentenko, "Time Spent on Clinical Documentation"; Leafloor et al., "Canadian Medical Education Journal Time Is of the Essence : An Observational Time-Motion Study of Internal Medicine Residents While They Are on Duty."

While the method of TMS have resulted in several well conducted studies for internal medicine residents, it has rarely been applied to the study surgical residents. The most complete TMS study in surgical residents was competed by Victores et al. in which they tracked eight otolaryngology residents for 176 hours.[45] In this study DPC tasks were allocated 40% of time, IPC tasks 34%, didactic education 8% and transit 6% of total time during duty hours; results which are very similar to our results. In another TMS study aimed at surgical residents, Hamid et al. observed four orthopedic surgery residents over a total of 6 duty hour periods on a single orthopedic consult service. Hamid found that residents allocated 26% of their time on administrative duties or documentation that was felt to be of limited educational value.[46] Comparisons to our data is limited by the small sample size and differences in data categorization.

To date there has been no TMS studies in general surgery residents. Cox et. al. in an analysis using health record login information found general surgery residents spent an average 2.4 hours per day using the EMR, less than our observed 1.3 hours.[47] This difference may be due to the method of observation, how interaction with the EMR was classified or the jurisdictional differential emphasis placed on EMR documentation (for reimbursement as an example). Geryane et al. conducted a study of surgical residents completing laparoscopic cholecystectomies but the focus was on improving operating room efficiency as opposed to resident workload and so no real comment can be made of time allocation.[48] Dassinger et al. performed a multi-method analysis of a single pediatric surgery resident's workload including 19 hours of TMS observational data. Fourteen percent of this individual resident's time was spent on educational activities with almost

[45] Victores et al., "Otolaryngology Resident Workflow: A Time-Motion and Efficiency Study."

[46] Hamid et al., "Orthopedic Resident Work-Shift Analysis: Are We Making the Best Use of Resident Work Hours?"

[47] Cox et al., "Documenting or Operating: Where Is Time Spent in General Surgery Residency?"

[48] Geryane, Hanna, and Cuschieri, "Time-Motion Analysis of Operation Theater Time Use during Laparoscopic Cholecystectomy by Surgical Specialist Residents."

no low-educational value activities being recorded.[49] In another study trying to look at resident workload in general residents from many different programs were observed. As part of this group a single 3rd year surgical resident was observed as part of the group and was tracked for a single shift. In this study the surgical resident spent only 1% of total time on educational activities.[50] The majority of TMS applied to surgical trainees are limited by their extremely small sample size and therefore add very little evidence to which conclusions can be made.

While the literature is variable, one common theme identified in all of these small TMSs of surgical residents is the extreme fragmentation of surgical resident daily workload. Many authors of the aforementioned studies posit fragmentation may negatively impact the educational value of training. Despite the obvious potential threat to education the relationship of education and workload fragmentation has not been studied closely. In our data as well as others there is a strong signal that only a very small proportion of a surgical resident's daily time is spent on focused educational activities. This renewed focus on maintaining both formal and informal education, as well as a renewed emphasis on formative feedback and coaching is an area of improvement for surgical residencies, especially as they transition to CBME.

2.4 Conclusion

The current study represents the largest TMS of surgical residents to our knowledge, providing insight into how surgical residents' time is allocated in day-to-day work. Despite the insights gained there are limitations. As a single- center study, the generalizability of these findings is unknown. While the training program involved is similar to all training programs in Canada, program information is included above to allow individuals to assess the similarities, differences and applicability to other programs. Another limitation is the known observer bias (Hawthorne effect) inherent in

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[49] Dassinger, Eubanks, and Langham, "Full Work Analysis of Resident Work Hours."

[50] Gabow et al., "Observations of Residents' Work Activities for 24 Consecutive Hours: Implications for Workflow Redesign."

all TMSs; multiple steps were taken by the research team to minimize this as detailed above. Given the difficulty of capturing the many different experiences of surgical residents, purposeful sampling was used to select specific observation time periods, which may introduce inadvertent selection bias. Lastly, only six call shifts were captured, limiting the ability to make inferences regarding these time periods. Even with the large volume of information captured, making meaningful comparisons between groups is difficult and likely underpowered due to the extreme heterogeneity of data, reflecting the day-to-day variability in the resident daily experience.

Despite these limitations, this represents the most thorough attempt to categorize the daily surgical resident workflow experience. While there may be variations between training programs, it is clear that as part of a transition to CBME, surgical training must adapt to include more educational activities, with specific emphasis on informal teaching and assessment, especially feedback and coaching. In the era of work hour restrictions changes will need occur in training programs to fully implement CBME as ideally envisioned, freeing up resident time to engage in the necessary assessment and feedback. Freeing up residents to fully participate in CBME will mandate the allocation of additional resources including alternative mid-level care providers to assist with tasks of low-educational value and indirect patient care tasks which distract from direct care and education. With the implementation of CBME in general surgery training programs across Canada there is a unique opportunity to study if and how resident workload will change. As we design training programs in the CBME era we need to invest in the resources to ensure the changes are real, meaningful and compatible with the ideals of CBME.

In summary, surgical residents spend the majority of their day-to-day workflow time in DPC, but a large portion of time is still allocated to IPC tasks. We found minimal time is allocated to formal or informal education activities, specifically feedback, coaching and assessment. Time allocation of residents must change to allow successful implementation of CBME theory into practice and surgical training programs to succeed in their goal of training competent surgeons.

Chapter 3

3 Trainee and Faculty Perceptions of Resident Workload

While the actual content of residency workload is important, perhaps as important for planning the future of surgical residency is perception of workload by participants and educators. As part of a pre- planned comparative analysis, we collected faculty and resident perceptions of resident workload prior to the distribution of any of the results from Chapter 2. The perception of resident workload is not a topic that is well- explored in the literature to this point.

3.1 Methods

3.1.1 Setting

This study took place at the Schulich School of Medicine & Dentistry, Western University, General Surgery training program in London, Ontario, Canada. All study protocols were approved by the Research Ethics Board of London Health Sciences Centre and Western University (Appendix 1).

3.1.2 Program Structure

The General Surgery training program at the Schulich School of Medicine & Dentistry is an academic general surgery training program, London, Ontario, Canada. The structure of the General Surgery training program follows the objectives and training and specialty training requirements set out buy the Royal College of Physician and Surgeons of Canada.[51] At the time of this study The Western University training program was a time-based 5-year training program with a competency- based Surgical Foundations program similar to all other Canadian General Surgery training programs.

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[51] Royal College of Physicians and Surgeons of Canada, "General Surgery Training Requirements."

3.1.3 Participants

At the time of data collection, the Division of General Surgery consisted of 25 core general surgery faculty members and 24 general surgery trainees. In addition to their hospital appointment all faculty members had academic appointments with the Schulich School of Medicine & Dentistry. Faculty included all subspecialties of general surgery including colorectal, hepatobiliary, surgical oncology, endocrine, trauma, critical care, breast surgery and minimally invasive surgical subspecialists. Residents included all clinical training years.

All general surgery residents enrolled in the training program and all faculty within the Division of General Surgery were invited to participate. The primary author (a resident) and supervising author (a faculty member) were excluded. Participants were given a letter of information and approached to participate by email. Participation was voluntary and all participants gave informed consent before participation. Residents either unwilling to participate or not enrolled in the General Surgery training program were excluded. Faculty whose primary appointment was not within the Division of General Surgery were excluded.

3.1.4 Data Collection

A web-based secure survey platform (SurveyMonkey Inc, San Mateo, California) was used to develop a survey assessing faculty and resident perceptions of resident workload. Details of the survey can be found in Appendix 2. Survey content was generated based on the task categorization scheme developed previously (Table 2.1). The initial survey was piloted with a test audience consisting of residents, faculty, and non-clinicians at the same institution but outside of the Division of General surgery. Expert opinion and iterative revision by surgical educators were used to select and refine survey questions prior to distribution to the target audience (faculty and trainees in the Division of General Surgery) to ensure ease and clarity. Following piloting of the survey the authorship group (content surgical experts and medical education research experts) refined the full task list used in the survey by consensus to facilitate survey completion rates. Tasks that represented >5% of daytime workload were included, and those felt to be especially relevant to surgical education by consensus were included. The tasks included in the final survey and rationale for inclusion are presented in Table 3.1.

Task Category	**Specific Tasks Included**	**Rational for Survey Inclusion**	
		Workload Allocation >5%	**Especially Relevant**
Direct Patient Care	Operating (OR)	+	+
	OR Preparation	+	
	Patient Assessment	+	+
	Patient Education		+
Indirect Patient Care	EMR Use	+	+
	Comm- Surgical Team	+	
Education	Lecture/ Conference		+
	Informal Teaching		+
	Assessment		+
Transit	-	-	-
Downtime	Break	+	+

Comm- communication

Table 3.1 Task categories and Individual Tasks included in survey with rationale for inclusion.

The survey collected the following information:

(1) basic demographic and practice information

(2) perception of the *actual* proportion of time residents spend on the various tasks outlined in Table 3.1 during an *average* daytime duty period.

(3) Perception of the *ideal* proportion of time residents should spend on the various tasks outlined in Table 3.1 during an average daytime duty period (or what respondents perceived as optimized workload with goal of maximal resident education without service considerations)

(4) Respondent perception of the educational value of tasks outlined in Table 3.1 during an average daytime duty period.

Faculty and residents were solicited via online survey with weekly reminders over a 4-week period. All participants provided informed consent via virtual signature.

3.1.5 Statistical Analysis

Resident and faculty perceptions were not normally distributed and given the relatively small sample size, all data is presented as median inter-quartile ranges (IQR) and analyzed using non- parametric tests. Resident and faculty perceptions were compared using Mann- U Whitney tests. Observed resident workload was collected as described previously (2.1.4) and is presented as a mean value of all daytime encounters (n=48 for all). Correlation between median respondent perception of workload and observed workload was calculated for both task categories and individual tasks. All data analysis was conducted using SPSS.

3.2 Results

3.2.1 Participants

Characteristics of resident and faculty respondents are presented in Table 3.2. Seventeen residents and 16 faculty completed the survey, a participation rate of 74% (17/23) and 67% (16/ 24) respectively for eligible participants. Resident participants were 71% female, reflecting the gender distribution of the program, and had representation from all years. Faculty participants were 62% male, again reflecting gender distribution of all faculty in the Division. All academic ranks and experience levels were represented. 81% and 19% of faculty respondents indicated they were ‘very’ or ‘moderately’ interested in resident education.

Characteristic, *(n, %)*	
Residents (n=17)	
Sex	
Male	4 (24)
Female	12 (71)
Prefer not to say	1 (6)
PGY Year	
1	4 (24)
2	2 (12)
3	3 (18)
4	4 (24)
5	4 (24)
Research	0
Fellowship Intent	
Yes	15 (88)
No	2 (12)
Desired Practice Type	
Academic	11 (65)
Community	5 (35)
Faculty (n=16)	
Sex	
Male	10 (62)
Female	5 (31)
Prefer not to say	1 (6)
Academic Rank	
Professor	5 (31)
Associate Professor	4 (25)
Assistant Professor	6 (38)
Adjunct Professor	1 (6)
Length of Time in Practice	
0-5 years	6 (38)
6-15 years	2 (12)
15+ years	7 (44)
Interest in resident education	
Uninterested	0
Mildly Interested	0
Moderated Interested	3 (19)
Very Interested	13 (81)

Table 3.2 Characteristics of survey respondents.

3.2.2 Learner Perception of Resident Workload

When asked to estimate their own time on tasks compared to observed time on tasks, residents accurately characterize the amount of time on tasks as demonstrated in Table

3.3, Table 3.4 and visualized in Figure 3.1. Correlation between median time on task estimated by residents and the proportion of time on task and mean time on task observed was good (Pearson correlation for Task Categories = 0.91, p=0.032, for Individual Tasks p=0.92, p=0.001). For all task categories except IPC, the observed value of resident time on task was within the IQR of resident estimation of time on task. Residents underestimated the amount of time spent in IPC tasks compared to observed data (perceived 20% [IQR 12- 30] vs observed 31.9%). Observed values for individual tasks were within the IQR of resident estimations for patient assessment, OR prep, EMR use, communication (Surgical Team) and lecture. Residents overestimated the time spent in the OR (perceived 45% [26-56] vs observed 24.5%), patient education (perceived 5% [4-10] vs observed 2.0%), informal teaching (perceived 5% [3-5] vs observed 1.3%), assessment (perceived 2 [1-5] vs observed 0.1%), and breaks (perceived 4% [2-5] vs observed 8.6%). There were no individual tasks that residents underestimated their allocation of time.

When faculty were asked to estimate resident time on tasks compared to observed time on task, faculty were fairly accurate predicting the amount of time residents spent on tasks as demonstrated in Table 3.3, Table 3.4 and visualized in Figure 3.1. Correlation between resident median time on task estimated by faculty and the proportion of resident time on task and mean time on task observed was significant for task Categories (Pearson correlation = 0.90, p=0.04) and for individual tasks (Pearson correlation= 0.78, p= 0.008). The degree of correlation between observed data and faculty perception was slightly less than that of resident perception with the observed data. The observed time allocation was within the IQR of faculty perceptions for DPC, downtime and transit task categories. Faculty overestimated the amount of time spent on education tasks (perceived 15 [IQR 10-20] vs observed 7.7%) and underestimated the amount of time spent on spent in indirect patient care (perceived 18 [10-29] vs observed 31.9%) tasks. The observed value was within the IQR for faculty estimations of resident time spent on patient assessment, OR prep, EMR use, communication (Surgical Team) and breaks, but faculty overestimated the amount of time spent on OR (perceived 30 [30-50] vs observed 24.5%), patient education (perceived 5 [5-10] vs observed 2.0%), lecture (perceived 5 [5-10] vs observed 4.2%) and informal teaching (perceived 10 [10-20] vs observed 1.3%), assessment (perceived 5 [2-5] vs observed 0.1%). There were no individual tasks faculty underestimated allocation of resident workload.

3.2.3 Faculty Perception of Resident Workload

When faculty were asked to estimate resident time on tasks compared to observed time on task, faculty were fairly accurate predicting the amount of time residents spent on tasks as demonstrated in Table 3.3, Table 3.4 and visualized in Figure 3.1. Correlation between resident median time on task estimated by faculty and the proportion of resident time on task and mean time on task observed was significant for task Categories (Pearson correlation = 0.90, p=0.04) and for individual tasks (Pearson correlation= 0.78, p= 0.008). The degree of correlation between observed data and faculty perception was slightly less than that of resident perception with the observed data. The observed time allocation was within the IQR of faculty perceptions for DPC, downtime and transit task categories. Faculty overestimated the amount of time spent on education tasks (perceived 15 [IQR 10-20] vs observed 7.7%) and underestimated the amount of time spent on spent in indirect patient care (perceived 18 [10-29] vs observed 31.9%) tasks. The observed value was within the IQR for faculty estimations of resident time spent on patient assessment, OR prep, EMR use, communication (Surgical Team) and breaks, but faculty overestimated the amount of time spent on OR (perceived 30 [30-50] vs observed 24.5%), patient education (perceived 5 [5-10] vs observed 2.0%), lecture (perceived 5 [5-10] vs observed 4.2%) and informal teaching (perceived 10 [10-20] vs observed 1.3%), assessment (perceived 5 [2-5] vs observed 0.1%). There were no individual tasks faculty underestimated allocation of resident workload.

3.2.4 Comparison of Learner and Faculty Perceptions

There were no significant differences in resident and faculty estimations of time on task allocated to DPC, IPC, downtime, and transit task categories. Residents perceived they spent less time on education tasks than faculty perception (10% [5-10%] vs 15% [10-20], p <0.001); both perceived greater allocation than the observed value of 7.5%. Residents also perceived they spent less time compared to faculty perception on informal teaching (5% [3-5] vs 10% [10-20], p=0.001); both groups drastically overestimated this task compared to the observed rate of 1.3%. There were no significant differences between estimations by residents and faculty for time on task for any other tasks.

Task Category	**Resident N= 17**	**Faculty N=16**	***p***	**Observed**
Direct Patient Care, *median % [IQR]*	55 [40-68]	42 [40- 60]	0.24	43.8
Indirect Patient Care	20 [12-30][#]	18 [10-29][#]	0.63	31.9
Downtime	10 [5- 10]	10 [5-10]	0.66	9.7
Education	10 [5-10]	15 [10-20][###]	<0.001*	7.7
Transit	8 [5-10]	5 [5-10]	0.44	6.0

#- observed value falls outside of IQR (25th- 75th percentile) of perceptions
##- observed value falls outside of 10th- 90th percentile of perceptions
###- observed value falls outside of range (1st- 100th percentile) of perceptions

Table 3.3 Resident and Faculty perception of current daytime resident workload task category allocation.

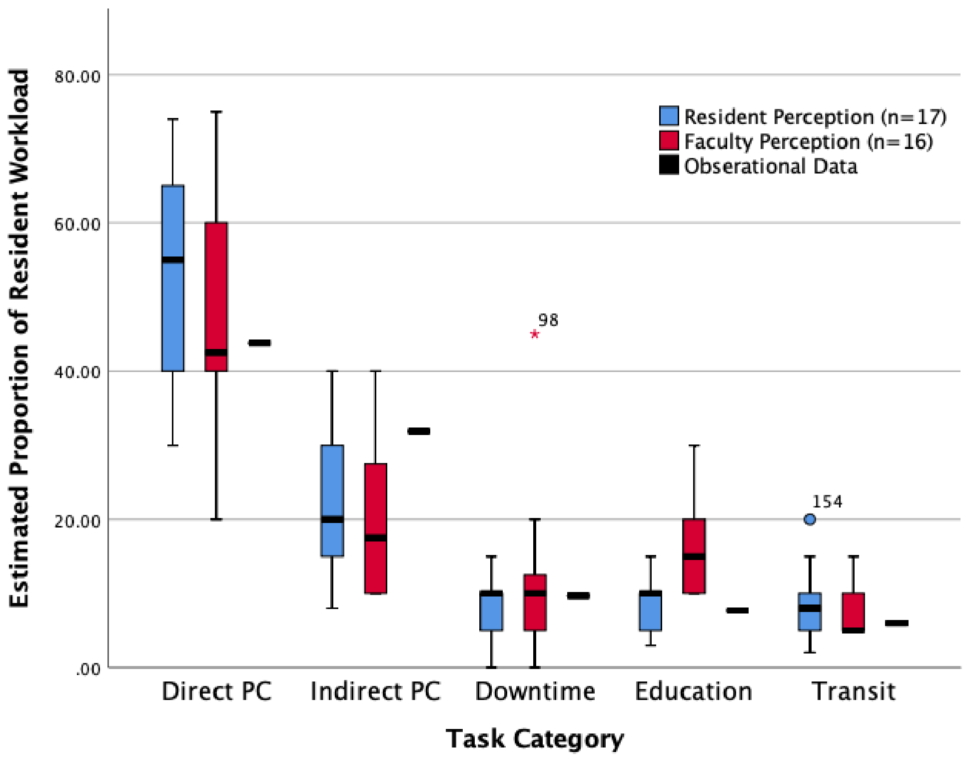

Figure 3.1 Resident and Faculty Perception of current daytime resident task workload category allocation

Task	Resident Perception N= 17	Faculty Perception N=15	*p*	Observed
Direct Patient Care Tasks				
OR, *median % [IQR]*	45 [26- 56]#	30 [30- 50]#	0.32	24.5
Patient Assessment	20 [10- 20]	15 [10- 20]	0.79	10.2
OR Prep	10 [5- 19]	10 [5- 10]	0.65	5.1
Patient Education	5 [4- 10] ##	5 [5- 10] ###	0.94	2.0
Indirect Patient Care Tasks				
EMR	8 [6- 19]	20 [10- 20]	0.083	11.2
Comm- Surgical Team	5 [5-14]	10 [5- 15]	0.87	7.4
Education Tasks				
Lecture	6 [3-10]	5 [5- 10]###	0.28	4.2
Informal Teaching	5 [3-5]###	10 [10- 20]###	0.001*	1.3
Assessment	2 [1-5]##	5 [2- 5]###	0.11	0.1
Downtime				
Break	4 [2- 5]#	5 [5- 10]	0.152	5.6

*- statistically significant ($p<0.05$)
#- observed value falls outside of IQR (25^{th}- 75^{th} percentile) of perceptions
##- observed value falls outside of 10^{th}- 90^{th} percentile of perceptions
###- observed value falls outside of range (1^{st}- 100^{th} percentile) of perceptions
Comm- communication

Table 3.4 Resident and Faculty perception of current daytime resident workload individual task allocation

3.3 Discussion

3.3.1 Key Findings

In this study, residents and faculty reported similar estimations of resident time on tasks, and both groups' estimations were reasonably correlated with observed time spent on various tasks. Both groups were the most accurate in estimating clinical tasks and downtime although residents slightly overestimated the amount of time spent in direct patient care as a component of the daily workload. Both groups underestimate the amount of time spent in indirect patient care and education as a component of daily workload which has important implications for curriculum design.

Perhaps the most striking finding of the current study is the inaccurate faculty estimations regarding the amount of time residents spend on both formal and informal educational tasks, both as a task category and individual tasks (lecture, informal teaching and assessment). While residents were more accurate regarding the amount of time spent on formal education, they also overestimated time spent on informal teaching and assessment, although to a lesser degree than faculty.

The misperception of faculty likely steams both from faculty overestimating the amount of time spent on educational activities and underestimating the total workload of residents. In the current program structure formal teaching is considered protected education time and faculty take a more direct role in patient care during resident protected education time. This increased involvement may influence faculty awareness of residents being away from clinical service and participating in education resulting in them overestimating the amount of time spent in formal education.

Residents and faculty had significantly different estimations of the amount of time allocated specifically to informal teaching, with faculty perceiving it encompassing 10% of workload, and residents 5%. In actuality it comprises only 1% of resident time during their daily workflow. One explanation for this is that residents and faculty may be counting informal teaching occurring while operating, which was not able to be captured and differentiated from participating in the OR. Another reason for the differences in estimation may arise from faculty perceiving some exchanges with residents as informal teaching episodes which are not recognized or categorized in that manner by the resident. While the nature of what constitutes 'educational' activity within a training program is debated, the identification of this disconnect between faculty and residents' merits further exploration.

When comparing the proportion of time spent on DPC and IPC, both learners and faculty underestimated the amount time spent on IPC tasks. Learners also slightly overestimated the amount time spent on DPC tasks. Several potential explanations may lend insight into these inaccurate estimations by residents. Direct patient care tasks and clinical interactions are inherently more meaningful to residents and therefore subject to recall bias adding increased perceived time engaging in direct patient care, especially in the operating room. In an opposite but similar fashion indirect patient care tasks are often considered of little value and described as 'scut' by residents an inaccurate imprint of time spent on task. Researchers have found a decreased value on indirect patient care with residents frequently citing indirect patient care tasks as a detriment to education and impeding learning.[52] While indirect patient care tasks may leave less of an imprint on residents, they are perceived to take up time that could be allocated to tasks with perceived greater educational value. With complexity in health care systems and an increased reliance on electronic medical records there will always be indirect patient care tasks that must be completed as part of patient care. However, while some indirect patient care tasks may be educational depending on training level, often as residents progress indirect patient care tasks cease to have a favorable balance of education to non-education. As indirect patient care tasks increase residents are often seen as inexpensive labor to complete these and more research is required to assess which indirect tasks have educational value and at what stages of training programs. The fact that both faculty and residents underestimate the actual amount of time residents spend on these activities prompts a call for greater focus on this area, and an effort to reduce what both groups agree is of low educational value activities.

While it is likely that perception of resident workload differs from reality in some important ways, there is also potential sources of bias in this study. While every effort was made to ensure clarity of the survey, each question is open to individual interpretation and we cannot control for misinterpretation of the survey questions. Unfortunately, within our program there are not enough residents to allow for meaningful statistical comparisons between perceptions of junior and senior residents.

3.3.2 Comparisons to Current Literature

Given the uniqueness of our approach and research question there are unfortunately limited literature to compare our current work to. It has been shown that residents and faculty have very different perception of feedback specifically.[53] While authors have created datasets of resident workload, to our knowledge resident and faculty perceptions

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[52] Camp et al., “Orthopaedic Surgery Residents and Program Directors Agree on How Time Is Currently Spent in Training and Targets for Improvement”; Boex and Leahy, “Understanding Residents’ Work: Moving beyond Counting Hours to Assessing Educational Value,” 2003.

[53] Liberman et al., “Surgery Residents and Attending Surgeons Have Different Perceptions of Feedback.”

of how overall workflow is distributed during the workday have not been compared. As a novel approach to looking at resident workflow, further work needs to be done and may take one of several avenues. Certainly, expanding our survey and observations to multiple sites may allow for a larger dataset that will allow meaningful comparisons particularly the differences in perception between junior and senior residents. While expanding to multiple training sites may provide more data attempting to expand beyond a single training program may introduce increased heterogeneity. Another option may be to expand to other surgical disciplines beyond general surgery at the same training institution, however, this may again result in more data and more heterogeneity. Qualitative research methodology may be able to generate a more nuanced model of how residents create a perception of workload and exploring how these underlying factors may account for the difference in perception between learners and faculty.

3.4 Conclusion

Residents and faculty are reasonably accurate in their estimations of resident workload and time spent on daily tasks as a percentage of total work. Both residents and faculty underestimate the amount of time spent on indirect patient care tasks. The amount of time participating in indirect patient care represents an opportunity cost as indirect patient care tasks are frequently cited as low educational value tasks by both faculty and residents. Future interventions in surgical residency training programs should aim to reduce indirect patient care tasks and focus on the introduction of higher educational value, underrepresented tasks.

Faculty were found to overestimate the amount of time residents spend on educational tasks and thereby may be inaccurately estimating the amount of educational value within their training program. This overestimation may be caused by faculty overestimating the amount of informal teaching. There was a significant difference in opinion between residents and faculty regarding the amount of time devoted to indirect teaching. As surgical training programs make the transition to competency based medical education educators must inform faculty of resident workload and the importance of informal teaching.

The differences in perception between faculty and residents about the educational value of indirect patient care tasks and the amount of time devoted to informal teaching is likely a source of conflict between teachers and learners. Professional development of faculty highlighting the value of informal teaching and feedback could be used to help address these misperceptions and empower both faculty and residents to protect time for these essential activities.

Chapter 4

4 Educational Value in Surgical Workload Tasks and the Ideal Workload

While an understanding of the day-to-day workload and time allocated to various tasks of performed by surgical residents is important for designing training programs transitioning to CBME, perhaps more important is the educational value of the work performed. Clearly, the goal of any training program should be to maximize educational value of clinical learning experiences. However, which day-to-day tasks provide the most educational value? While the absolute educational value of any given task is difficult to determine, perception of educational value will give insight to both teacher and learner perceived importance. The educational value of individual activities may be perceived differently by the learners and teachers in any residency training program. Learners may lack the experience to recognize the educational value of certain tasks. Similarly, teachers may be so far removed from training that they may place undeserved value on tasks which may actually have very little educational value. Using real world derived data of tasks performed by a surgical resident we can then investigate the perceived educational value. While differences in perceptions may exist, those which are common to both teachers and learners as high value educational activities likely should be maximized. Similarly, those agreed upon tasks of low educational value should be minimized.

In our prior study we used TMS methodology to identify and categorize tasks performed by general surgery trainees as part of their day-to-day workflow. In the current study we used these defined task categories to investigate the perceived educational value of daily tasks performed by surgical residents by both teachers and learners. As a part of a pre-planned comparative analysis, we collected faculty and resident perceptions on educational value of resident tasks identified previously without any of the time-based data, in an attempt to identify high educational value tasks independent of time spent on task.

4.1 Methods

4.1.1 Setting

This study took place at the Schulich School of Medicine & Dentistry, Western University, General Surgery training program in London, Ontario, Canada. All study protocols were approved by the Research Ethics Board of London Health Sciences Centre and Western University (Appendix 1).

4.1.2 Program Structure

The General Surgery training program at the Schulich School of Medicine & Dentistry is an academic general surgery training program, London, Ontario, Canada. The structure of the General Surgery training program follows the objectives and training and specialty training requirements set out buy the Royal College of Physician and Surgeons of Canada. [54] At the time of this study The Western University training program was a time-based 5-year training program with a competency- based Surgical Foundations program similar to all other Canadian General Surgery training programs.

4.1.3 Participants

All general surgery residents enrolled in the training program and all faculty within the Division of General Surgery at the Schulich School of Medicine and Dentistry, Western University, London, Ontario, Canada were invited to participate. Participants were given a letter of information and approached to participate by email. Participation was voluntary and all participants gave informed consent before participation. Residents either unwilling to participate or not enrolled in the General Surgery training program were excluded. Faculty whose primary appointment was not within the Division of General Surgery were excluded.

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[54] Royal College of Physicians and Surgeons of Canada, “General Surgery Training Requirements.”

4.1.4 Data Collection

A web-based secure survey platform (SurveyMonkey Inc, San Mateo, California) was used to develop and distribute a survey to program faculty and residents. Details of the survey can be found in Appendix 2. Using general and specific tasks lists developed from a TMS (Table 3.1) respondents were asked to generate what workload allocation they would advocate for in an ideal situation to maximize education. Respondents were also asked using the general and specific task lists (Table 3.1) to assign a relative educational value to the tasks on a 0-10 ordinal scale with 0 being of no educational value and 10 being maximally educational.

4.1.5 Statistical Analysis

Resident and faculty perceptions as well as estimates of educational value were not normally distributed and given the relatively small sample size, all data is presented as median inter-quartile ranges (IQR) and analyzed using non-parametric tests. Resident and faculty perceptions were compared using Mann- U Whitney tests. Observed resident workload was collected as described previously (2.1.4) and is presented as a mean value of all daytime encounters (n=48 for all). Comparisons are made between observed data and the distribution of resident and faculty responses based on the 25th- 75th, 10th-90th and full range of responses, without statistical interpretation given the limited number of responses. All data analysis was conducted using SPSS.

4.2 Results

4.2.1 Participants

Characteristics of resident and faculty respondents are presented in Table 3.2. Seventeen residents and 16 faculty completed the survey, a participation rate of 74% (17/23) and 67% (16/ 24) respectively. Resident participants were 71% female, reflecting the gender distribution of the program, and had representation from all years. Faculty participants were 62% male, again reflecting gender distribution of all faculty in the Division. All academic ranks and experience levels were represented. 81% and 19% of faculty respondents indicated they were ‘very’ or ‘moderately’ interested in resident education.

4.2.2 Residents and Faculty Perceptions of Ideal Workload

Residents and faculty both indicated that an ideal workload for residents would contain a greater proportion of DPC compared to IPC care tasks (Table 4.1). However, resident's emphasis on IPC was greater than faculty (resident median 60% [IQR 50-70] vs faculty 50% [IQR 40-60], p=0.037). Furthermore, despite similar median values for time spent on IPC tasks from both residents and faculty the IQR range for faculty was much broader suggesting a wider range of time spent on IPC tasks would be considered acceptable by faculty (10% [10-14] vs 10% [10-25], p=0.037). There were no statistically significant differences in ideal workload allocation between faculty and residents for education, downtime and transit task categories (Table 4.1).

Both faculty and residents described the ideal workload as having a greater proportion of education tasks and less IPC and transit time than what was observed in the TMS data. Additionally, residents' ideal workload contained a greater proportion of direct patient care tasks than was observed in the TMS data.

Task Category	**Resident Ideal N= 17**	**Faculty Ideal N=15**	***p***	**Observed**
Direct Patient Care, *median [IQR]*	60 [50- 70]##	50 [40- 60]	0.037*	44.1
Indirect Patient Care	10 [10-14]###	10 [10- 25]#	0.037*	31.4
Education	18 [11-24]#	15 [15- 25]###	0.65	8.1
Downtime	6 [4- 10]	8 [5-10]	0.65	9.7
Transit	5 [2-5]###	5 [5- 5]#	0.28	5.8

*- statistically significant ($p<0.05$)
#- observed value falls outside of IQR (25th- 75th percentile) of perceptions
##- observed value falls outside of 10th- 90th percentile of perceptions
###- observed value falls outside of range (1st- 100th percentile) of perceptions

Table 4.1 Resident and Faculty ideal allocation of daytime resident task categories.

When looking at specific tasks within generalized task categories there was more agreement regarding ideal workload between faculty and residents (Table 4.2). Within specific task categories the only significant difference between faculty and residents was the expectation for time spent on OR prep (5% [2-10] vs 5% [6-10], p=0.033). Both faculty and residents agreed that in an ideal situation, residents would spend more time operating, providing patient education and engaging in all three education tasks (lecture, informal teaching and assessment) than what was observed in the TMS data. Residents described spending less time in IPC and interacting with the EMR than what was observed in the TMS data. Faculty valued OR prep more than residents and described the ideal training situation as having more time in OR prep than what was observed in the TMS data.

Task	**Resident Ideal N= 17**	**Faculty Ideal N=15**	***p***	**Observed**
Direct Patient Care Tasks				
OR, *median [IQR]*	52 [36- 70]###	42 [30- 50]#	0.10	24.5
Patient Assessment	12 [10- 20]	18 [10- 29]	0.38	10.2
OR Prep	5 [2- 10]	10 [6- 10]#	0.033*	5.1
Patient Education	5 [4- 9]##	8 [5- 18]###	0.13	2.0
Indirect Patient Care Tasks				
EMR	5 [2- 10]###	10 [5- 15]	0.13	11.2
Comm- Surgical Team	5 [4- 14]	5 [5- 15]	0.59	7.4
Education Tasks				
Lecture	10 [7-10]###	10 [6- 10]###	1.0	4.2
Informal Teaching	9 [5-10]###	10 [10- 29]###	0.068	1.3
Assessment	3 [2-9]###	5 [5- 5]###	0.20	0.1
Downtime				
Break	5 [2- 10]	10 [5- 14]	0.10	5.6

*- statistically significant (p<0.05)
#- observed value falls outside of IQR (25^{th}- 75^{th} percentile) of perceptions
##- observed value falls outside of 10^{th}- 90^{th} percentile of perceptions
###- observed value falls outside of range (1^{st}- 100^{th} percentile) of perceptions
Comm- communication

Table 4.2 Resident and Faculty ideal allocation of daytime resident individual tasks.

4.2.3 Comparison of Ideal, Perceived and Actual Workload

A comparison of residents perceived and ideal workload within general task categories reveals several differences (Table 4.3). Residents described that in an ideal workload they would spend less time than perceived in IPC (median perceived 20% [12-30] vs median ideal 10% [IQR 10-14], p=0.008) and Transit (8% [5-10] vs 5% [IQR 2-5], p=0.002). Residents also described that in an ideal workload they would have more time than perceived allocated to education tasks (10% [5-10] vs 18% [11-24], p=0.002). Interestingly faculty's ideal resident workload did not differ from their perceived resident workload.

Task Category	Residents N=17			Faculty N=15			Observed
	Perceived	Ideal	*p*	Perceived	Ideal	*p*	
Direct PC, *median [IQR]*	55 [40-68]	60 [50- 70]	0.24	42 [40- 60]	50 [40- 60]	0.68	44.1
Indirect PC	20 [12-30]	10 [10-14]	0.008*	18 [10- 29]	10 [10- 25]	0.77	31.4
Education	10 [5- 10]	18 [11-24]	0.002*	10 [5-10]	15 [15- 25]	0.086	8.1
Downtime	10 [5-10]	6 [4- 10]	0.56	15 [10- 20]	8 [5-10]	0.68	9.7
Transit	8 [5-10]	5 [2-5]	0.002*	5 [5-10]	5 [5- 5]	0.12	5.8

Table 4.3 Comparison of perceived current and ideal allocation of daytime resident task categories.

Similar comparisons of ideal workload and perceived workload for residents and faculty were made at the specific task level (Table 4.4). When comparing specific individual tasks, residents described that in an ideal workload they would spend more time than perceived allocated to lectures (median perceived 6% [IQR 3-10] vs median ideal 10% [IQR 7-10], p=0.020) and informal teaching (5% [3-5] vs 9% [5-10], p=0.004). Faculty's ideal workload and perceived workload did not differ for specific tasks with the exception that faculty described that in an ideal environment, residents would spend less time than they perceived using the EMR (20% [10-20] vs 10% [5-15], p=0.025).

Task Category	Residents N=17			Faculty N=15			Observed
	Perceived	Ideal	*p*	Perceived	Ideal	*p*	
Direct PC Tasks							
OR, *median [IQR]*	45 [26- 56]	52 [36- 70]	0.18	30 [30- 50]	42 [30- 50]	0.28	24.5
Patient Assessment	20 [10- 20]	12 [10- 20]	0.51	15 [10- 20]	18 [10- 29]	0.55	10.2
OR Prep	10 [5- 19]	5 [2- 10]	0.06	10 [5- 10]	10 [6- 10]	0.52	5.1
Patient Education	5 [4- 10]	5 [4- 9]	0.76	5 [5- 10]	8 [5- 18]	0.22	2.0
Indirect PC Tasks							
EMR	8 [6- 19]	5 [2- 10]	0.14	20 [10- 20]	10 [5- 15]	0.025*	11.2
Comm- Surg Team	5 [5-14]	5 [4- 14]	0.32	10 [5- 15]	5 [5- 15]	0.61	7.4
Education							
Lecture	6 [3-10]	10 [7-10]	0.020*	5 [5- 10]	10 [6- 10]	0.26	4.2
Informal Teaching	5 [3-5]	9 [5-10]	0.004*	10 [10- 20]	10 [10- 29]	0.52	1.3
Assessment	2 [1-5]	3 [2-9]	0.245	5 [2- 5]	5 [5- 5]	0.32	0.1
Downtime							
Break	4 [2- 5]#	5 [2- 10]	0.35	5 [5- 10]	10 [5- 14]	0.22	5.6

*- statistically significant ($p<0.05$)

Table 4.4 Comparison of perceived current and ideal allocation of daytime resident individual tasks.

4.2.4 Educational Value of Workload Components

The results of how residents and faculty weighted the educational value of general task categories and specific tasks were explored (Table. 4.5 and Table 4.6). Both faculty and residents highly rated general task categories of DPC and education tasks highly, with no significant differences in the value assigned by either group. Similarly, both faculty and residents rated downtime and transit as low in educational value. Residents rated IPC as less educationally valuable compared to faculty ratings (median resident rating 4.0 [IQR 2.0- 6.0] vs faculty 7.0 [6.0- 8.2], p=0.001).

Task Category	All Respondents N=25	Residents N=12	Faculty N=13	*p*	Observed Allocation
Direct Patient Care, *median [IQR]*	9.0 [8.0- 10.0]	9.0 [8.0- 10.0]	10.0 [8.0- 10.0]	0.18	44.1
Indirect Patient Care	6.0 [4.0- 7.0]	4.0 [2.0- 6.0]	7.0 [6.0- 8.2]	0.001*	31.4
Education	9.0 [7.0- 10.0]	8.0 [7.0- 10.0]	9.0 [7.0- 10.0]	0.37	8.1
Downtime	2.0 [0- 3.0]	1.0 [0- 2.0]	2.0 [0- 5.0]	0.28	9.7
Transit	0 [0- 1.0]	0 [0- 1.0]	0 [0- 1.0]	0.53	5.8

*- statistically significant (p<0.05)

Table 4.5 Comparison of perceived educational value between residents and faculty for task categories.

When faculty and residents were asked to rate the educational value of specific tasks, both rated operating, procedures, patient assessment, lecture, informal teaching, and assessment highly (median ratings >7.0). Both residents and faculty agreed that EMR use, breaks and waiting were tasks that had lower educational value (median rating <5.0). Despite similarities in some tasks residents described less educational value compared to faculty in patient assessment (resident median 8.0/10 [IQR 7.0- 8.8] vs faculty median 9.0 [IQR 8.0- 10.0], p=0.031), OR preparation (resident 5.0/10 [1.2- 6.8] vs faculty 7.0 /10 [5.8- 8.2], p=0.028), patient education (resident 6.0/10 [2.2- 7.8] vs faculty 8.0 /10 [6.0- 9.2], p=0.015), calling patients (resident 4.5/10 [2.0- 5.0] vs faculty 6.5 /10 [5.0- 9.2], p=<0.001), communication with surgical team (resident 6.0/10 [5.0- 6.8] vs faculty 7.5 /10 [6.0- 8.2], p=0.031), handover (resident 4.5/10 [3.0- 6.8] vs faculty 8.0 /10 [7.0- 10.0], p=<0.001), documentation (resident 4.0/10 [1.2- 5.8] vs faculty 7.0 /10 [4.0- 8.2], p=0.027), answering pages (resident 1.5/10 [0.2- 3.0] vs faculty 5.0 /10 [3.0- 6.0], p=0.001), communication to other health care providers (resident 3.0/10 [0.5- 5.8] vs faculty 6.0 /10 [4.8- 7.0], p=0.017),and communication to other teams (resident 4.0/10 [2.0- 6.8] vs faculty 7.0 /10 [6.0- 8.0], p=0.005).

Tasks	All N= 25	Residents N=12	Faculty N=13	*p*	Observed Allocation
Direct Patient Care Tasks					
OR, *median [IQR]*	10.0 [9.0- 10.0]	10.0 [9.0- 10.0]	9.0 [8.8- 10.0]	0.35	24.5
Patient Assessment	8.0 [7.8- 10.0]	8.0 [7.0- 8.8]	9.0 [8.0- 10.0]	0.031*	10.2
OR Prep	6.0 [3.5- 8.0]	5.0 [1.2- 6.8]	7.0 [5.8- 8.2]	0.028*	5.1
Patient Education	7.0 [5.0- 8.0]	6.0 [2.2- 7.8]	8.0 [6.0- 9.2]	0.015*	2.0
Procedure	8.0 [7.0- 10.0]	8.5 [7.0- 9.8]	8.0 [7.5- 10.0]	0.78	1.1
Consent	6.0 [5.0- 8.0]	5.5 [2.0- 6.0]	6.5 [5.0-10.0]	0.053	0.4
Call Patient	5.0 [4.0- 7.0]	4.5 [2.0- 5.0]	6.5 [5.0- 9.2]	<0.001*	0.3
Indirect Care Tasks					
EMR	4.0 [2.0- 5.0]	3.5 [2.0- 4.8]	5.0 [3.0- 5.5]	0.12	11.2
Comm- Surgical Team	6.0 [6.0- 8.0]	6.0 [5.0- 6.8]	7.5 [6.0- 8.2]	0.031*	7.4
Handover	7.0 [4.5- 8.5]	4.5 [3.0- 6.8]	8.0 [7.0-10.0]	<0.001*	3.5
Documentation	5.0 [3.8-7.0]	4.0 [1.2- 5.8]	7.0 [4.0- 8.2]	0.027*	2.7
Answering Pages	3.0 [1.0- 5.2]	1.5 [0.2- 3.0]	5.0 [3.0-6.0]	0.001*	1.8
Comm- Other HCP	5.0 [2.8- 7.0]	3.0 [0.5- 5.8]	6.0 [4.8-7.0]	0.017*	1.4
Comm- Other team	6.5 [4.5- 8.0]	4.0 [2.0- 6.8]	7.0 [6.0- 8.0]	0.005*	1.3
Downtime Tasks					
Break	2.0 [0- 5.0]	1.0 [0- 5.0]	2.0 [0- 6.0]	0.73	5.6
Wait	0 [0- 3.0]	0 [0- 1.0]	0 [0- 4.5]	0.32	4.2
Education Tasks					
Lecture	8.0 [7.0- 10.0]	7.0 [7.0- 9.7]	8.5 [7.5-10.0]	0.25	4.2
Informal Teaching	8.0 [7.8- 9.0]	8.5 [6.2- 9.0]	8.0 [8.0- 9.0]	0.78	1.3
Self- study	8.0 [6.0- 8.2]	8.0 [7.0- 8.0]	6.5 [5.0- 9.25]	0.49	0.7
Clinical Observation	6.0 [5.0- 7.2]	5.0 [3.5- 6.0]	7.0 [5.0- 9.0]	0.20	0.6
Research	6.0 [5.0- 8.0]	5.5 [3.5- 7.0]	7.0 [5.0- 8.25]	0.16	0.3
Assesment	8.0 [5.0- 9.0]	7.0 [5.5- 8.8]	8.0 [4.5- 9.0]	0.70	0.1

*- statistically significant (p<0.05) ME

Table 4.6 Comparison of perceived educational value between residents and faculty for individual tasks.

Figure 4.1 graphically represents the weighted educational value of various individual tasks plotted against the amount of time allocated to the tasks. Some tasks like the operating room are balanced with high educational value and high amount of time allocated. Other tasks like using the EMR are seen to have a disproportionate amount of time allocated based on educational value. Finally, task like assessment and informal teaching are seen to have high educational value but are disproportionately low in time allocation. This graphical representation shows opportunities for intervention.

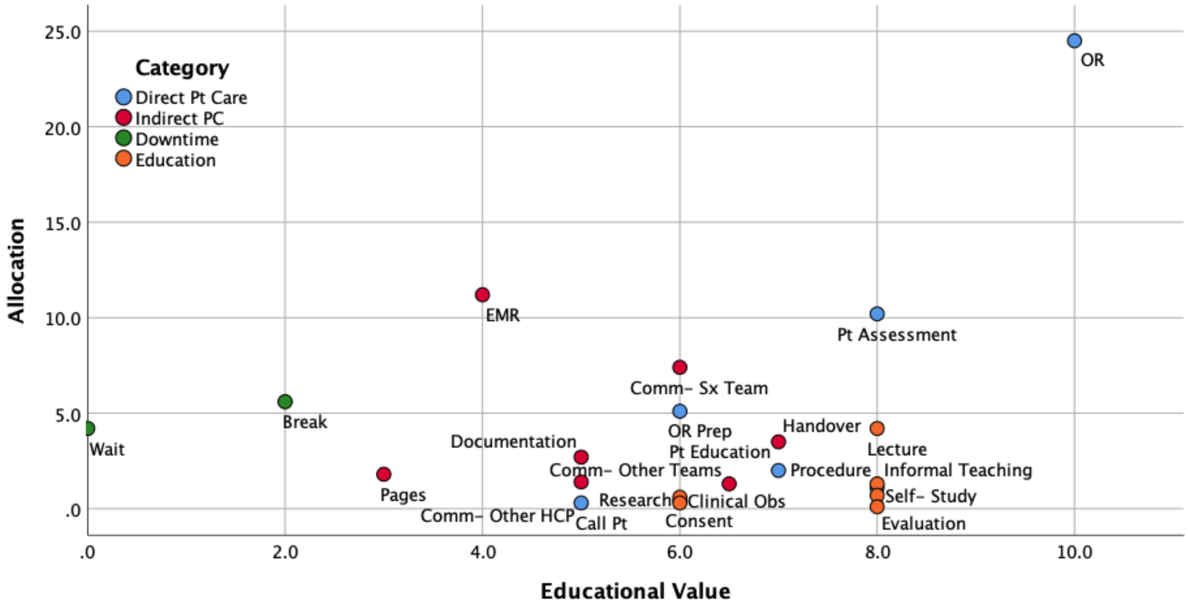

Figure 4.1 Comparison of educational value and time allocation for individual tasks comprising resident workload.

4.3 Discussion

4.3.1 Key Findings

These findings reinforce the findings of Chapters 2 and 3, informing the discussion about that the ideal workload of surgical resident should be and what the educational value of various components of resident workload are. Several differences were identified between resident and faculty perceptions of educational value.

Residents and faculty both found that Direct Patient Care is an extremely valuable part of a resident's day-to-day workflow. While residents generally felt that a greater proportion of their time should be spent in direct care activities than faculty, both groups advocated for at least 50% of time being spent in direct care of patients. This makes intuitive sense and reinforces the central role of learning in the clinical workplace in surgical training. While there were no significant differences between the ideal and perceived amount of time spent in direct patient care tasks for both faculty and residents, the actual observed proportion of time spent on direct patient care tasks was less than the ideal. Training programs should increase the threshold for direct patient care and should maximize direct patient care in future curriculum designs. Both residents and faculty described in the ideal situation residents should be spending far more time operating (median 52% residents and 42% faculty) than was actually observed in our series (24%). Spending 50% of one's time in the operating room is likely not reasonable goal but further reinforces the central role of the clinical learning experience of the OR and direct patient care that is central to general surgery training. The high median educational value scores from both faculty (9/10) and residents (10/10) confirm this finding, which has been the central tenet of surgical training since the time of Halstead.

There was far more disagreement between residents and faculty regarding indirect patient care. Faculty rated indirect patient care significantly higher in educational value than residents and it comprised a greater proportion of faculties ideal resident workload. Unlike faculty, residents described that in an ideal situation they would spend less time on indirect patient care than they currently do. Several explanations may account for this disconnect between faculty and resident ideas around the value of indirect patient care. Indirect patient care tasks are generally less immediately rewarding compared to direct patient care leading to residents potentially underestimating the value of these tasks, confusing immediate positive feedback with educational value. Many of the indirect patient care tasks may actually not have the true educational value recognized by residents, and only become apparent retrospectively as residents' transition to their practice. Faculty who have made the transition recognize the value which may not be directly evident to residents during training leading to a higher educational value being assigned to these tasks. Lastly, it should be acknowledged that faculty benefit significantly from having residents complete many indirect patient care tasks, freeing them for other pursuits including clinical and academic work. While we doubt that faculty directly desire to exploit this, there likely a subconscious incentive to consider indirect patient care tasks educationally valuable that may affect faculty perceptions.

The reality of the value of indirect patient care likely lies between faculty and resident perceptions. A potential important avenue of further study is to explore when and where in training does indirect patient care provide maximal educational value. This would allow training programs to access the value while de- emphasizing components less valuable at various points in training. The only individual indirect patient care task that both faculty and residents agreed did not have inherent educational value was interaction with the EMR. Since both teacher and learner agree that interaction with the EMR is of low educational value and could represent a target for reduction. Faculty in particular felt strongly that residents should spend less time on the EMR than they currently do. Reducing the role of the EMR is an active topic throughout medicine and in reality, requires systemic resource investments well beyond training program design, but is an important point that educators must advocate for.[55]

While there is disagreement regarding the educational value of indirect patient care, there is agreement regarding education tasks. Both residents and faculty rated formal and informal education tasks as high educational value activities. Both faculty and residents described the ideal program as consisting of 15-20% of resident workload being focused on formal and informal education tasks. As discussed above, faculty perceive that education is a greater proportion of resident workload than residents, and residents' perceptions are closer to what was observed in our series. These findings taken together represent a clear mandate for expansion of resident educational activities in curriculum design, as well as expansion of time allocated for informal educational activities. In fact, informal educational activities such as formative assessment and coaching are the cornerstone of CBME, and likely programs need to expand the opportunity to engage in these informal educational activities. Surgical training has not historically included dedicated informal teaching as much as other training programs such as internal medicine, but these results provide support that they would likely be well received.

Another interesting finding is there were no task categories or individual tasks that residents rated as greater value than faculty; in every instance of disagreement the faculty rating was higher than the resident. This may reflect that residents are less optimistic in general about the educational value of their workload, while faculty tend to see value in

[55] Gonzalo et al., "The Return of Bedside Rounds: An Educational Intervention."

all aspects of workload. Again, this is likely due to a combination of faculty finding additional value from their training once they enter independent practice, and residents being in the midst what is a very difficult training path.

4.3.2 Comparison to Similar Works

Our results generally agree with a nation-wide survey of 400 US general surgery residents and 105 program directors (PDs) regarding educational value of various tasks, although results are somewhat difficult to compare given alternate classification schemes. Similar to our findings, there were large discrepancies in educational value assigned by residents and PDs regarding documentation, patient assessments and answering pages; in all cases PD's assigned a much greater educational value compared to residents. Similar to our findings, both groups rated operating, self-study and lectures highly.[56] Agreement from such a large sample lends itself to more external validity than would be assumed from a small- single institution study. Similar to other discussions in this thesis, there is limited other studies to which our results are directly comparable, and additional research in this field is required.

4.4 Conclusion

Residents and faculty both perceive that there is high value in direct patient care and educational activities, but residents perceive less value in indirect care tasks compared to faculty. This disconnect is likely multi- factorial and should be explored further as a means to improve curriculum and program design.

Direct patient care is and should remain the central component of surgical training and taken together this research points to 50% of workload as a goal for curriculum design. This would represent an increase compared to observed workload and bring it closer to both faculty and resident ideal allocations. Indirect care is a contentious issue, but both

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[56] Sanfey, Cofer, and Hiatt, "Service or Education: In the Eye of the Beholder."

faculty and residents signal that time spent using the EMR is excessive. Effort should be made to identify what specific indirect care components provide value and protect them while reducing other components that provide no value. It may also be more valuable to target specific times in residency to focus on indirect patient care tasks for example early in training or as one transitions to practice. Clearly to free residents up from indirect patient care this will require teaching institutions to invest resources to free up resident time to spend of more educationally sound endeavors.

Educational activities either formal or informal and equally highly rated and both faculty and residents. This series identifies areas for improvement in which the allocated time to educational activities should be increased as the amount observed is far less than both faculty and residents define as ideal. This disconnect between ideal allocation and the actual observations were largest for informal teaching and assessment. Targeted interventions and benchmarks are likely required to allow these tasks to take the place in training that is advocated for by both trainees and faculty.

Chapter 5

5 Towards Evidence- Based Surgical Education

Here we summarize the key results of all three phases of this work and use these findings to inform recommendations for future surgical training program design as well as future research to help move forward medical training.

5.1 Summary of Findings

5.1.1 Resident Workload Allocation

As expected, surgical residents are extremely busy and spend 40% of their time engaged in DPC, driven by a high volume of time in the operating room (25%) and at the bedside outside of the OR (12%). Indirect patient care tasks still make up 33% of resident workload, mainly using the EMR (11%) and in communication with their team (8%). When compared to contemporary studies of non- surgical residents, the emphasis on DPC over IPC tasks is admirable, but this still represents a target for improvement.

Only 8% of time was allocated to educational activities. Most of this educational time is in formal/ informal teaching time (3.5% and 1.4% respectively) and self- study (1.0%). In our series, the amount of time allocated to assessment is <0.1% of the total series. The lack of emphasis on educational activities is perhaps the largest threat to surgical education and the introduction of CMBE, which relies on high- quality, high- volume assessment and feedback to improve education.

5.1.2 Perception of Resident Workload

Surgical residents and faculty were able to generally characterize their workload allocation, but resident perceptions were generally more corelated with observations than faculty perceptions, especially for individual task allocations. Both groups underestimated the amount of time spent on IPC tasks. Faculty drastically over-estimated the amount of time allocated to education tasks, especially informal teaching. Interestingly, residents were relatively accurate in their assessment of the amount of time spent on education tasks. Both groups overestimated the amount of time spent in assessment, although this may be expected as the amount of assessment in this series approached zero.

5.1.3 Educational Value and the Ideal Workload

Trainees and faculty both felt that the ideal resident workload would include a majority of time spend on DPC tasks, with less time spent on IPC tasks, although faculty did feel that a lower ratio of DPC: IPC time allocation would be ideal. The ideal faculty workload was similar to their perception of the current workload, while residents' ideal workload would have less time allocated to IPC tasks and transit, with more time allocated to education.

This corresponds to their relative rating of the educational value of components of workload. Both faculty and trainees felt that DPC and education tasks were exceptionally high value, and that downtime and transit were low value. They differed in opinions regarding IPC, which faculty felt was significantly more valuable than trainees.

5.2 Directions for Future Research

5.2.1 Validation in Other Centers

The research questions posed in this thesis apply to a single AHSC and surgical program and the program was designed to maintain the highest possible internal validity. This allows examination of the complex relationships between learner workload, perception of workload and educational value; but there are limits in the external validity of findings given the single- center nature. In order to show that these relationships are found throughout other surgical training programs, this analysis would need to be repeated in other centers, Canadian or otherwise. We propose that while workload composition would vary between sites, the differences between programs are less than often hypothesized, and that relationships between trainee workload, perception and educational value would be similar.

5.2.2 Learner- Centered Outcomes in Medical Education

One of the central conclusions of this thesis is the disconnect between learner and faculty perceptions of value and priorities in medical education. This has been identified in other more focused settings, but these series of findings demonstrate this disconnect broadly across multiple domains of resident workload.[57] While this is an internal study of a single program, the study program has a strong reputation and recent outstanding accreditation findings, and we would posit that these findings would be replicated in most other scenarios and are inherent to medical training.

This has important implications in curriculum design in medical education- when building training programs, should preference be given to learners or to educators' opinions? While this disconnect has been identified, we cannot make inferences about which opinion should hold more sway based on this work or the current literature, but it merits further exploration. It is reasonable to suggest that learners need to be engaged in the process of curriculum design, both due to their unique perspective and their position at the center of educational systems.

In clinical outcomes research, there has been a recent focus on the development of patient- reported and patient- focused outcomes as targets for improvement as opposed to clinician- driven targets.[58] We propose that when developing future qualitative surgical education research studies, efforts should be made to both test curriculum endeavors with outcomes- based and learner- reported outcomes. This acknowledges the central position of the learner in current pedologic philosophy and emphasizes partnership between educators and learners.

5.3 Proposals for Future Training Programs

The introduction of CBME represents an opportunity for thoughtful and evidence-based changes to surgical training to reflect the needs of trainees. Based on our current work we provide recommendations for future curriculum design. One overarching theme

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[57] Camp et al., "Orthopaedic Surgery Residents and Program Directors Agree on How Time Is Currently Spent in Training and Targets for Improvement."

[58] Gabriel and Normand, "Getting the Methods Right — The Foundation of Patient-Centered Outcomes Research."

to these recommendations is the inclusion of learner perspective in curriculum development, as explored above.

5.3.1 Emphasis on Education

There is broad agreement amongst residents and faculty regarding the value of education tasks, both as a broad group and as individual tasks. These are considered some of the most high- value components of resident workload but are allocated less time than much less meaningful tasks (see Figure 5.1). The reasons for- and solutions to- this problem are complex and beyond the scope of this research but there is a clear mandate for increased time allocation to education tasks, especially the least- emphasized but highly valuable assessment and informal teaching components. Both of these tasks are thought to occur far more often than they do in reality, especially in the case of faculty. For CBME to succeed these tasks must be elevated, studied, protected and encouraged amongst both faculty and learners.

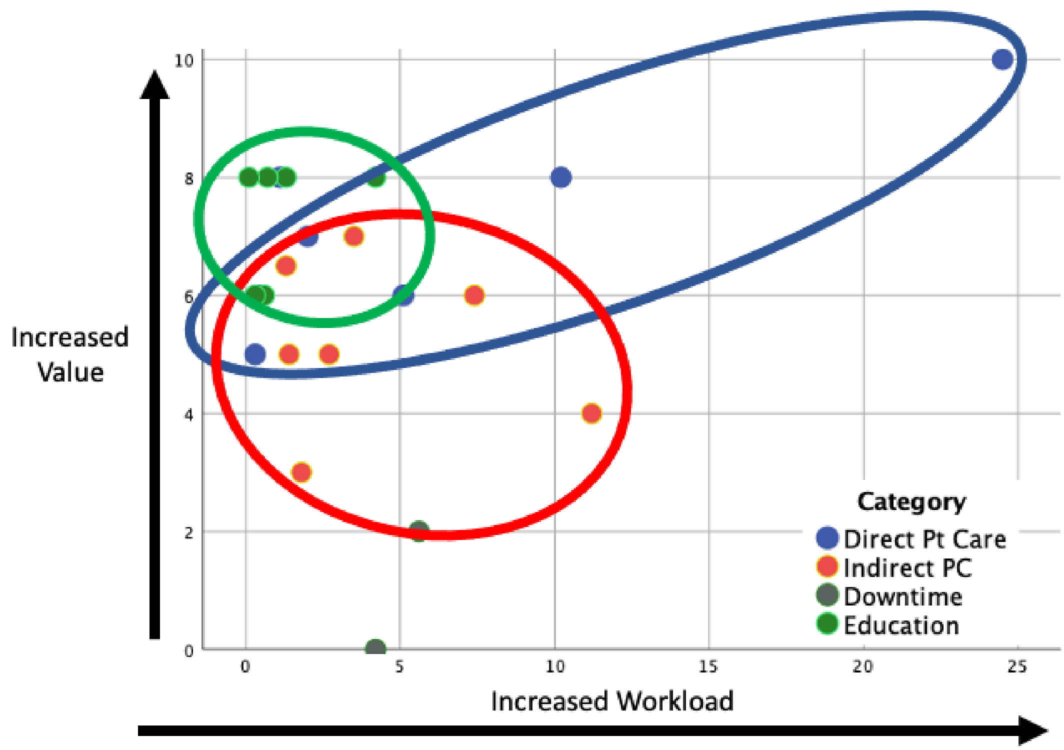

Figure 5.1 Educational value and allocation of resident time for individual tasks, grouped by category. Four groupings emerge- DPC tasks are high- value and well- represented,

IPC tasks are less- highly valued but still common, Downtime tasks have minimal value with a reasonable allocation, while Education tasks are extremely valuable but have very little time allocated.

5.3.2 Protection for Direct Patient Care

A key strength of the surgical residency is the central role of bedside care, both within and outside of the operating room. This is further emphasized with current findings. Residents spent a large quantity of time engaged in DPC tasks, which was rated highly in educational value by both faculty and learners and formed a large component of both group' ideal workload. Residents desired even more time spent in DPC tasks, while faculty felt that current levels were more appropriate. Literature in other fields has emphasized a 'return to the bedside' and in this regard surgical training is likely withstanding some of forces that drive learners away from the bedside. [59]

A focus on DPC be protected in future curriculum design. Surgical training in the current environment is a zero- sum balance, where increases in one component of workload must necessarily lead to decreases in others. As we apply interventions to increase the amount of time spent in educational activities, thought must be given to protecting time spent at the bedside.

5.3.3 Transparency in Resident Workload

One of the most important findings of this work is that, generally, faculty and learners feel that more time is spent in high- value activities than is actually the case, especially in assessment. This represents an opportunity for education leaders to alter behavior by increasing transparency. If it can be demonstrated that the amount of assessment does not meet the stated goals of both faculty and residents, one would hope that behavior would change to bring about the stated goals of both groups.

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[59] Fletcher et al., "The Composition of Intern Work While on Call"; Dennis et al., "The Effect of the 16-Hour Intern Workday Restriction on Surgical Residents' in-Hospital Activities."

Another advantage of increasing transparency is that it may decrease friction between faculty and learners. Disconnects in perception of workload likely affects everything from program- level discussions regarding curriculum design to day- to- day conversations between faculty and residents. Initiatives to decrease transparency regarding resident workload will likely reduce friction between parties and may lead to increase in emphasis on the portions of resident workload that both parties feel is high-value and under-represented.

5.3.4 Evidence- Based Surgical Education

In an ideal world surgical training would be designed based on research studying the effect of such curriculum on educational outcomes. While qualitative medical and surgical education research has dramatically improved education theory, there is limited qualitative data to support most educational principles. While the present thesis represents likely the most thorough examination of surgical resident workload to date, it is imperfect in many ways described above.

High- quality outcomes research has dramatically altered clinical surgery in the past decades, without a similar change in educational research. In the current environment, clinical practice is informed by well- designed randomized control trials, prospective cohort studies and database analyses. Despite the efforts of dedicated researchers and educators, this cannot yet be said about surgical education. The FIRST trial demonstrated that such studies are possible with collaboration and the support of regulatory bodies and answered one of the key questions in the last 30 years regarding resident work hours and the effects of changes. [60] We believe such high- quality work should be the standard and not the exception and hope that this work contributes towards that goal.s

[60] Bilimoria et al., "National Cluster-Randomized Trial of Duty-Hour Flexibility in Surgical Training."

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Appendices

Appendix 1. REB Approval Letter

Date: 1 August 2018

To: Dr. Michael Ott

Project ID: 111541

Study Title: General surgery resident work patterns, educational value and economic value added: a prospective cohort study and economic analysis.

Application Type: HSREB Initial Application

Review Type: Delegated

Meeting Date / Full Board Reporting Date: 21/Aug/2018

Date Approval Issued: 01/Aug/2018

REB Approval Expiry Date: 01/Aug/2019

Dear Dr. Michael Ott

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above mentioned study as described in the WREM application form, as of the HSREB Initial Approval Date noted above. This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date	Document Version
Faculty Participant Study Email Version 1 July 19 2018	Email Script	19/Jul/2018	1
Faculty Participants LOI and Consent Version 3 July 25 2018	Written Consent/Assent	25/Jul/2018	3
Observer Guide Version 3 July 19 2018	Non-Participant Observation Guide	19/Jul/2018	3
Online Survey Version 3 July 19 2018	Online Survey	19/Jul/2018	3
Protocol Version 4 July 19 2018	Protocol	19/Jul/2018	4
Resident Participant Study Email Version 4 July 19 2018	Email Script	19/Jul/2018	4
Resident Participants LOI and Consent Version 5 July 25 2018	Written Consent/Assent	25/Jul/2018	5

Documents Acknowledged:

Document Name	Document Type	Document Date	Document Version
References	References	20/May/2018	2

No deviations from, or changes to, the protocol or WREM application should be initiated without prior written approval of an appropriate amendment from Western HSREB , except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the TriCouncil Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations; Part 4 of the Natural Health Products Regulations; Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000940.

Please do not hesitate to contact us if you have any questions.

Appendix 2. Electronically distributed survey

Surgery Resident Workload and Educational Value

Consent

* 1. Background
You are being asked to be in this study because you are a resident or consultant in the division of General Surgery. The purpose of this study is to evaluate what aspects of resident workload are considered educational and which are not. This relates directly to the resident tracking data collected previously.

Purpose
There are two main purposes of this research study:
1) Compare attitudes of residents and staff regarding resident workload
2) To identify the educational value of the components of general surgery workload

Study Procedures
If you agree to participate, you will be responsible for completing an electronic survey. All data will be anonymized and confidential. Survey content will pertain to your professional background. The electronic survey will be distributed by email and can be completed on your own time. It will take approximately 10 minutes to complete. You may also be asked to perform a follow-up survey, though you will not be obligated to do so.

Benefits
The only benefit is to potentially improve the training for residents in our division in the future. There are no costs and no compensation.

Risk
The only foreseeable additional risk to participation is the unlikely loss of your personal information. This study was approved by the Lawson REB and safeguards are in place.

◯ I have read the above information

* 2. Do you consent to participating in the above described study to evaluate resident workload?

◯ I DO consent to participating in the current study

◯ I DO NOT consent to participating in the current study

Surgery Resident Workload and Educational Value

Decline Consent

Thank you for your time to consider the survey. If you reconsider and wish to participate please request a novel link from the authors. Results will be distributed to the Division after analysis and may be included in peer- reviewed publication.

Eric Walser & Michael Ott

Surgery Resident Workload and Educational Value

* 3. What role do you hold within the Division?

- ◯ Resident
- ◯ Faculty

Surgery Resident Workload and Educational Value

Faculty Demographic Information

* 4. How long have you been in independent practice?

- ◯ 0-5 years
- ◯ 6- 10 years
- ◯ 11- 15 years
- ◯ 16- 19 years
- ◯ 20+ years

* 5. What is your current academic rank?

- ◯ Adjunct Professor
- ◯ Assistant Professor
- ◯ Associate Professor
- ◯ Professor

* 6. What is your gender?

- ◯ Female
- ◯ Male
- ◯ Prefer not to say

* 7. How interested are you in resident education?

- ◯ Uninterested
- ◯ Mildly Interested
- ◯ Moderately Interested
- ◯ Very Interested

Surgery Resident Workload and Educational Value

Resident Demographic Information

* 8. What PGY year are you?

- ◯ PGY1
- ◯ PGY2
- ◯ PGY3
- ◯ PGY4
- ◯ PGY5
- ◯ Research Resident

* 9. What is your gender?

- ◯ Female
- ◯ Male
- ◯ Prefer not to say

* 10. Are you/ do you intend on pursuing fellowship training?

- ◯ Yes
- ◯ No

* 11. What is your desired practice type?

- ◯ Academic
- ◯ Community

Surgery Resident Workload and Educational Value

Task Category Allocation- Current

* 12. Please indicate what you believe is the **current** percentage of resident daytime activities allocated to each type of task (ex 15% of time)
Please ensure that all answers sum to 100%.

Transit
Moving from one place to another within or outside of the hospital for the purposes of patient care or educational activities.
Ex: Walking from the inpatient ward to the OR

Educational Activities
Formal or informal resident education activities. Includes formal educational events, time spent in research activities, evaluation and self- study
Ex: Half day teaching or journal club

Direct Patient Care
Any patient care activity in the presence of the patient including but not limited to patient assessment in clinic/ wards/ ER, operating, procedures etc
Ex: Seeing a patient in clinic or consult in ER

Indirect Patient Care
Any patient care activity that occurs away from the patient. Includes but not limited to communicating with other team members, EMR use and documentation.

Downtime
Any unscheduled time in a residents day including forced or unforced breaks or waiting for clinical events.
Example: Waiting for OR turnover

Transit	
Educational Activities	
Direct Patient Care	
Indirect Patient Care	
Downtime	

Surgery Resident Workload and Educational Value

Individual Task Allocation- Current

13. Please indicate what you believe the **current** percentage of resident daytime activities of residents allocated to each specific task.
Note: this list of tasks is not exhaustive and the sum does not have to equal 100

Lecture/ Teaching
Formal educational activities including Surgical Rounds, protected Academic Half- Days and Multi-disciplinary Tumor Boards where the resident does not participate.

Informal Teaching
Informal teaching during the course of a work day. Includes receipt (ie from staff or senior resident to tracked resident) or provision (ie from tracked resident to medical student) of teaching.

Evaluation
Time set aside for formal evaluation. Often included but did not require use of evaluation tool (OSAT, EPA forms). Includes receipt or provision of teaching.

Operating
Time spent scrubbed in.

OR Preparation
Time spent in the OR with patient either prior to or following actual operation facilitating care. Includes preparation prior to OR, transfer following OR until patient is in PACU.

Patient Clinical Assessment
Interaction with patient for the purposes of patient care- ie assessments on morning rounds or when seeing a patient in consult.

Patient Education
Interaction with patient for the primary role of patient or family education- ie informing the patient of a pathology report or discussing a patient's course with a family member

Communication- Surgical Team
Communication with any member of team (staff surgeon, fellow, residents, medical students, nurse practioners etc)

EMR use
Order Entry or Chart Review in the EMR.

Break
Time taken for personal activities during day (meals, washroom etc)

Lecture/ Formal Teaching	
Informal Teaching	
Evaluation	
Operating	
OR Preparation	
Patient Clinical Assessment	
Patient Education	
Communication- Surgical Team	
EMR use	
Break	

Surgery Resident Workload and Educational Value

Task Category Allocation- Optimal

14. Please indicate what you believe the **optimal** percentage of resident daytime activities allocated to each task category- ie in a perfect environment how much time would be spent in each category.
Please ensure that all answers sum to 100.

Transit
Moving from one place to another within or outside of the hospital for the purposes of patient care or educational activities.
Ex: Walking from the inpatient ward to the OR

Educational Activities
Formal or informal resident education activities. Includes formal educational events, time spent in research activities, evaluation and self- study
Ex: Half day teaching or journal club

Direct Patient Care
Any patient care activity in the presence of the patient including but not limited to patient assessment in clinic/ wards/ ER, operating, procedures etc
Ex: Seeing a patient in clinic or consult in ER

Indirect Patient Care
Any patient care activity that occurs away from the patient. Includes but not limited to communicating with other team members, EMR use and documentation.

Downtime
Any unscheduled time in a residents day including forced or unforced breaks or waiting for clinical events.
Example: Waiting for OR turnover

Transit ______

Educational Activities ______

Direct Patient Care ______

Indirect Patient Care ______

Downtime ______

Lecture/ Formal Teaching	
Informal Teaching	
Evaluation	
Operating	
OR Preparation	
Patient Clinical Assessment	
Patient Education	
Communication- Surgical Team	
EMR use	
Break	

Surgery Resident Workload and Educational Value

Individual Task Allocation- Optimal

15. Please indicate what you believe the **optimal** percentage of resident daytime activities allocated to each task.
Note: this list of tasks is not exhaustive and the sum does not have to equal 100

Lecture/ Teaching
Formal educational activities including Surgical Rounds, protected Academic Half- Days and Multi-disciplinary Tumor Boards where the resident does not participate.

Informal Teaching
Informal teaching during the course of a work day. Includes receipt (ie from staff or senior resident to tracked resident) or provision (ie from tracked resident to medical student) of teaching.

Evaluation
Time set aside for formal evaluation. Often included but did not require use of evaluation tool (OSAT, EPA forms). Includes receipt or provision of teaching.

Operating
Time spent scrubbed in.

OR Preparation
Time spent in the OR with patient either prior to or following actual operation facilitating care. Includes preparation prior to OR, transfer following OR until patient is in PACU.

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Interaction with patient for the purposes of patient care- ie assessments on morning rounds or when seeing a patient in consult.

Patient Education
Interaction with patient for the primary role of patient or family education- ie informing the patient of a pathology report or discussing a patient's course with a family member

Communication- Surgical Team
Communication with any member of team (staff surgeon, fellow, residents, medical students, nurse practioners etc)

EMR use
Order Entry or Chart Review in the EMR.

Break
Time taken for personal activities during day (meals, washroom etc)

Surgery Resident Workload and Educational Value

Task Category Value

Please rate the following resident task categories in terms of **educational value**, 0 being no educational value and 10 being exceptionally valuable.

16. Transit

Moving from one place to another within or outside of the hospital for the purposes of patient care or educational activities.
Example: Walking from the inpatient ward to the OR

0 5 10

17. Educational Activities

Formal or informal resident education activities. Includes formal educational events, time spent in research activities, evaluation and self- study
Example: Half day teaching or journal club

0 5 10

18. Direct Patient Care

Any patient care activity in the presence of the patient including but not limited to patient assessment in clinic/ wards/ ER, operating, procedures etc
Example: Seeing a patient in clinic or consult in ER

0 5 10

19. Indirect Patient Care

Any patient care activity that occurs away from the patient. Includes but not limited to communicating with other team members, EMR use and documentation.
Example: Computer order entry or dictating consultation note

0 5 10

20. Dowtime

Any unscheduled time in a residents day including forced or unforced breaks or waiting for clinical events.
Example: Waiting for OR turnover, lunch

0 5 10

Surgery Resident Workload and Educational Value

Individual Task Value

Please rate the following resident tasks in terms of **educational value**, 0 being no educational value and 10 being exceptionally valuable.

21. Transit (onsite)
Transit within physical hospital

0 5 10

22. Transit (off-site)
Transit outside of hospital- to other site for clinical or educational events.

0 5 10

23. Lecture/ Teaching
Formal educational activities including Surgical Rounds, protected Academic Half- Days and Multi-disciplinary Tumor Boards where the resident does not participate.

0 5 10

24. Research
Research activity taking place during work hours including research team meetings, protected research time or unstructured research work.

0 5 10

25. Clinical Observation
Observation in the OR, trauma bay or other clinical area where the resident is not a part of that patient's care team at that time- ie observing an elective OR while on the ACCESS team.

0 5 10

32. Procedure

Performing or assisting with a non- OR procedure.

0 5 10

33. Patient Clinical Assessment

Interaction with patient for the purposes of patient care- ie assessments on morning rounds or when seeing a patient in consult.

0 5 10

34. Patient Education

Interaction with patient for the primary role of patient or family education- ie informing the patient of a pathology report or discussing a patient's course with a family member

0 5 10

35. Consent

Obtaining consent for the purposes of an operation or procedure.

0 5 10

36. Call patient

Communicating with outpatients as part of patient care

0 5 10

37. Handover

Formal handover at the beginning or end of a clinical period

0 5 10

38. Communication- Surgical Team

Communication with any member of team (staff surgeon, fellow, residents, medical students, nurse practioners etc)

0 5 10

39. Communication- Other Team

Communicating with any other service assisting in patient care (critical care, medicine, gastroenterology, emergency medicine etc)

0 5 10

40. Communication- Allied HCP

Communication with any non- MD/ NP healthcare provider participating in patient care (nursing, respiratory therapist, pharmacists, PT, OT etc)

0 5 10

41. Answering Pages

Any communication responding (immediately or in delayed fashion) to a page/ secure message

0 5 10

42. EMR use

Order Entry or Chart Review in the EMR.

0 5 10

43. Documentation

Any written or dictated documentation (OR notes, consults, discharge summaries etc)

0 5 10

44. Break

Time taken for personal activities during day (meals, washroom etc)

0 5 10

45. Wait

Time spent waiting in some way to proceed with clinical task that is not occupied in some other way (ie junior resident waiting for senior, waiting for OR turnover)

0 5 10

Surgery Resident Workload and Educational Value

Thank you for completing this survey. Results will be distributed to the Division after analysis and may be included in peer- reviwed publication.

Eric Walser & Michael Ott

Eric Walser

CURRICULUM VITAE

Academic Background and Training:

General Surgery Residency
University of Western Ontario
Current PGY4, Expected graduation Sept 2022

Masters of Science (Surgery)- ongoing concurrent
Western University
June 2019- *Sept 2020*
Thesis: Surgical residency workload, perceptions and educational value: implications for competency- based medical education.

Doctor of Medicine (MD)
University of Toronto
2013- 2017

Honours Bachelor of Medical Sciences (Physiology & Pharmacology)
University of Western Ontario
2009- 2013
Honors Thesis: PPARdelta modulation affects endochondral ossification in an ex- vivo murine model

Journal Publications:

1. Axelrod D, **Walser E**, Hoit G, J Lee. What makes a good surgical experience for the naïve leaner? *MedEd Publish*. May 9, 2018.

2. Ratneswaran A, LeBlanc EA, **Walser E,** et al. PPARdelta promotes progression of post-traumatic osteoarthritis. *Arthritis & Rheumatology*. 67 (2), Feb 2015.

3. Sarvas JL, Niccoli S, **Walser E**, Khaper N, Lees SJ. Interleukin-6 deficiency causes tissue-specific changes in signaling pathways in response to high-fat diet and physical activity. *Physiological Reports.* 2(1) July 2014.

Abstracts Presented (Presenter underlined):

1. **Walser E,** Murphy PB, Makish A et al. Standardization of opioid prescription after trauma (STOP- Trauma): a prospective intervention to reduce excessive opioid prescription. *Quickshot Presentation at the American Association for the Surgery of Trauma 2020*. Virtual conference due to COVID-19.

2. **Walser E**, Zhang CJ, Cristancho S, Lingard L, Mierza A, Ott M. General surgery resident work patterns, results of a time- motion analysis study. *Accepted as Oral Presentation at the Canadian Conference on Medical Education 2020- cancelled due to COVID-19; abstract*

published. Vancouver, April 20, 2020.

3. **Walser E,** Davidson J, Ralph-Edwards R, Carey N, McNeely B, Jones S, Butter A. Evaluating the Suturing Ability of Medical Students Throughout Clerkship: Does Interest in a Surgical Career Influence Performance? *Oral Presentation at Canadian Conference for the Advancement of Surgical Education 2019.* Ottawa, Sept 26, 2019.

4. **Walser E**, Murphy P, Leslie K, Maciver A. Cancer is common in missed appendicitis, a retrospective cohort study. *Oral Presentation at Canadian Surgery Forum 2019.* Montreal, Sept 8, 2019.

5. **Walser E**, J Hallet, T Harth, L Gotlib- Conn, PJ Karanicolas. Enhancing patient- centered care of pancreatic cancer surgery: a multinational survey of practices and patterns for patient education. *Poster at Canadian Surgery Forum 2016.* Toronto, Sept 10, 2016

6. Hoit G, **Walser E**, Axelrod A, Rutka J, Lee J. Factors affecting value of preclerkship surgical observerships in a prospective cohort. *Poster at the Association for Surgical Education Annual Meeting.* Boston, MA. April 12, 2016.

7. **Walser E,** Kagedan D, Qing L, Earle C, Coburn N. Patterns of chemotherapy for recurrent pancreatic cancer following resection: a population level- analysis. *Mini- Oral Presentation at the International Hepatopancreatiobiliary Association World Congress 2016.* Sao Paulo, Brazil. April 21, 2016.

8. **Walser E,** Brown V, Peskun C, Rumble T. Factors Affecting Functional Outcomes of Uncomplicated Total Knee Arthoplasty: A Retrospective Cohort Study. *Poster at the University of Toronto Medical Student Research Day 2015.* Toronto ON, Feb 3 2015.

Peer- Reviewed Grants (funded):

1. McLachlin Surgical Education Resident Research Grant, Western University Department of Surgery. *Multimodal Identification of Coachable Moments in General Surgery.* Funded Jan 2021 for $5000. Role: Resident Principal Investigator. Supervisor: Dr Michael Ott.

2. Resident Research, Western University Department of Surgery. I*mmediate versus delayed appendectomy for adult patients with acute appendicitis: A randomized controlled trial.* Funded Dec 2020 for $3200. Role: Co-investigator. Principle Investigator: Dr Madeleine Lemke, Supervisor: Dr Rob Leeper.

3. Resident Research Grant, Western University Department of Surgery. *Standardization of Outpatient Narcotics after Emergency General Surgery and Trauma (STOP-2 Narcotics).* Funded Jan 2018 for $5000. Role: Principle Resident Investigator. Supervisor: Dr Ken Leslie.

Book Chapters:

1. **Walser E**, Murphy PB, Pain Management, *Dynamic Practice Guidelines for Emergency*

General Surgery, Committee on Acute Care Surgery, Canadian Association of General Surgeons. Ottawa ON.

2. **Walser E,** Deghan S, Brar S, A Wei, A Behzadi, General and Thoracic Surgery, *Toronto Notes 2017.* Toronto ON.

Awards and Distinctions:

Western Delegate to 2020 Canadian Association of Chairs of Surgical Research Competition
- Selected as best resident research abstract from all surgical residents at Western

Ontario Graduate Scholarship, Western University. June 2019
- $15 000 merit graduate scholarship; awarded for previous academic success and scholarly potential

1st place nationally (PGY2) CAGS In-Training exam, Canadian Association of General Surgery. Dec 2018.

AAST Research and Education Foundation Scholarship, July 2019.

Mary Cassidy Award, University of Toronto Faculty of Medicine. 2016
- Outstanding contributions to extracurricular activities within the Faculty of Medicine

Academic Activities:

Reviewer, Canadian Journal of Surgery
- Sept 2019- current
- Relevant topics: opioid prescription following surgery

Reviewer, Journal of Trauma and Acute Care Surgery Open
- March 2020- current

Oral Session Moderator, Canadian Conference for the Advancement of Surgical Education, September 2019.

ATLS Instructor, Western University/ ACS Committee on Trauma
- June 2018- current

TEAM Instructor, Western University Undergraduate Medical Education
- July 2017- current

Resident Lecturer, Transition to Residency Course, Western University PGME
- Lecturer, Abdominal pain and GI Bleeding
- 2018- current

Resident Instructor, Foundations of Surgery course, Western University Department of Surgery
- Lecturer (multiple topics), Trauma Simulation leader
- Jan 2019- current

Canadian Collaborative on Urgent Care Surgery (CANUCS) Committee Member

- 2019- current

Canadian Undergraduate Surgical Education Committee Member

- 2018- current

ACS-Resident and Associate Society Education Committee Member, American College of Surgeons

- July 2019- current

PGME Residency Advisory Committee on CBME, Schulich School of Medicine, Western University

- Jan 2018- current

Department of Surgery Residency Wellness Committee, Department of Surgery, Western University.

- September 2019- current

General Surgery Residency Training Committee, Division of General Surgery, Western University

- July 2018- current

Surgery Clerkship Curriculum Committee, Department of Surgery, Western University.

- Aug 2019- current

OAGS Resident Liaison (Western), Ontario Association of General Surgeons

- July 2019- current

Learning Environment Working Group member, University of Toronto Faculty of Medicine

- 2016- 2017
- Established guidelines and provided recommendations to Deans regarding the learning environment within University of Toronto academic hospitals

Peters-Boyd Academy Director Search Committee student representative

- 2016
- Search committee for new Academy Director; responsible for reviewing and interviewing candidates

Trauma Lead, Surgical Exploration and Discovery Program, Department of Surgery, University of Toronto

- 2014-2016
- Coordinated Trauma lectures and on- call experiences for 1st year medical students as part of two- week intensive summer program

Courses and Certificates:

ACS Residents as Teachers and Leaders delegate, American College of Surgeons, Chicago Ill.

- March 2019
- Professional development course focusing on the application of effective teaching and leadership principles during and following residency

SAGES Advanced Laparoscopy Upper GI and Bariatric Surgery Workshop, SAGES, London ON
- Oct 2019

Residents as Teachers Workshop 2018, Schulich School of Medicine, Western
- February 2019
- Selected as General Surgery nominee for Faculty- level course designed for future clinician- educators

Basic Endovascular Skills for Trauma, American College of Surgeons Committee on Trauma
- Aug 2018

Teaching, Research and Medical Education elective (participant)**,** University of Toronto Faculty of Medicine.
- 2014
- 10 part seminar series focusing on the design and implementation of Medical Education research

Professional Memberships & Conference Attendance:

Memberships

American Association for the Surgery of Trauma (Associate)	2020- current
Canadian Association of General Surgeons	2014- current
American College of Surgeons	2017- current
Association for Surgical Education	2019- current
Trauma Association of Canada	2020- current
Society of American Gastrointestinal and Endoscopic Surgeons (Candidate)	2020- current
Ontario Association of General Surgeons	2014- current
Canadian Medical Association	2013- current
Ontario Medical Association	2013- current

Certifications

ATLS Instructor	2018
ATLS	2017
Stop the Bleed Instructor	2019
ACLS	2017
LMCC I/II	2017/ 2019
USMLE Step 1/ 2 CK	2015/ 2017

Conferences Attended
AAST Congress (2019, 2020)
Canadian Surgery Forum (2016, 2019)
IHPBA World Congress (2016)
Canadian Conference for the Advancement of Surgical Education (2019)
Ontario Association of General Surgeons (2014- 2016, 2018- 2019)