Canadian Medical Education Journal

Brief Reports

Benchmarking a Canadian Anesthesiology Resident Research Program against national norms using a logic model framework: a quality improvement study.

Évaluation d'un programme de recherche canadien pour les résidents en anesthésiologie par rapport aux normes nationales à l'aide d'un modèle logique : une étude d'amélioration de la qualité

Erin Barbour-Tuck,[1] Thomas Mutter,[2] Jennifer M O'Brien,[1] Linda Girling,[2] Eugene Choo,[1] Jonathan Gamble[1]

[1]Department of Anesthesiology, Perioperative Medicine and Pain Management, College of Medicine, University of Saskatchewan, Saskatchewan, Canada; [2]Department of Anesthesiology, Perioperative and Pain Medicine, Max Rady College of Medicine, University of Manitoba, Manitoba, Canada

Correspondence to: Dr. Erin Barbour-Tuck, Provincial Research Coordinator, Provincial Department of Anesthesiology, Perioperative Medicine and Pain Management, College of Medicine, University of Saskatchewan, Saskatoon, SK, Canada; phone: (306) 655-1183; email: e.barbourtuck@usask.ca

Published ahead of issue: Feb 15, 2023; published: Mar 21, 2023. CMEJ 2023, 14(1). Available at https://doi.org/10.36834/cmej.75306

Abstract

Background: Canadian specialty training programs are expected to deliver curriculum content and assess competencies related to the CanMEDS Scholar role. We evaluated our residency research program and benchmarked it against national norms for quality improvement purposes.

Methods: In 2021 we reviewed departmental curriculum documents and surveyed current and recently graduated residents. We applied a logic model framework to assess if our program's inputs, activities, and outputs addressed the relevant CanMeds Scholar competencies. We then descriptively benchmarked our results against a 2021 environmental scan of Canadian anesthesiology resident research programs.

Results: Local program content was successfully mapped to competencies. The local survey response rate was 40/55 (73%). In benchmarking, our program excelled in providing milestone-related assessments, research funding, administrative, supervisory, and methodologic support, and requiring a literature review, proposal presentation, and local abstract submission as output. Acceptable activities to meet research requirements vary greatly among programs. Balancing competing clinical and research responsibilities was a frequently reported challenge.

Conclusions: The logic model framework was easily applied and demonstrated our program benchmarked well against national norms. National level dialogue is needed to develop specific, consistent scholar role activities and competency assessments to bridge the gap between expected outcome standards and education practice.

Résumé

Contexte : Les programmes de spécialité canadiens doivent proposer un contenu de formation en lien avec le rôle CanMEDS d'érudit et évaluer les compétences qui s'y attachent. Nous avons évalué notre programme de résidence en recherche par rapport aux normes nationales en la matière à des fins d'amélioration de la qualité.

Méthodes : En 2021, nous avons examiné les documents du programme d'études du département et interrogé des résidents et des médecins récemment diplômés. Nous avons utilisé un modèle logique pour déterminer si les intrants, les activités et les extrants de notre programme couvraient adéquatement les compétences pertinentes liées au rôle CanMeds d'érudit. Nous avons ensuite comparé de façon descriptive nos résultats à une analyse du milieu des programmes de résidence canadiens en recherche en anesthésiologie effectuée la même année.

Résultats : Nous avons établi une correspondance entre le contenu du programme local et les compétences. Le taux de réponse à l'enquête était de 40/55 (73 %). D'après l'analyse comparative, notre programme se démarque par l'offre d'évaluations d'étape, de fonds de recherche, de soutien administratif, de supervision, d'orientation méthodologique, et, en ce qui concerne les extrants, par l'exigence d'une analyse documentaire, de la présentation d'une proposition et de la soumission d'un résumé à l'université. Les activités admissibles pour répondre aux exigences de la recherche varient considérablement d'un programme à l'autre. De nombreux répondants ont signalé la difficulté de concilier les responsabilités cliniques et de recherche.

Conclusions : L'application du modèle logique a été aisée et elle a permis de montrer que notre programme respecte les normes nationales. Un dialogue au niveau national est nécessaire pour définir de manière précise et cohérente les activités et les évaluations des compétences en lien avec le rôle d'érudit afin de combler le fossé entre les normes quant aux résultats attendus et les pratiques des programmes.

Introduction

Canadian residency training programs are expected to teach and assess competencies related to the Scholar role, one of seven roles that make up the Royal College of Physicians and Surgeons of Canada's (RCPSC) CanMEDS physician competency framework.[1] The Scholar role includes Key and Enabling competencies related to evaluating evidence and contributing to scholarship.[2,3] These competencies are typically achieved through participation in a resident research project, and are supported by measurable targets (milestones) that mark trainee progression.[4–7] These milestones serve as guides that clarify learning expectations and provide assessment opportunities for feedback.[8]

Despite this national criterion-referenced framework, research requirements vary across Canadian anesthesiology residency programs in their extent and rigor.[9] In residency programs generally, methods of assessment may not be suitable or consistently applied.[5,10,11] The resultant inconsistencies in curricula, resource inputs, expected outputs, and evaluation threaten the validity of a national standard for scholar role competency. The RCPSC has embarked on a process to update the CanMEDS framework in 2025 (CanMEDS 2025) with goals that include "anticipating and supporting the practical needs of medical education programs" and "considering the practical implementation needs of partnering organizations."[12] This presents an opportunity to reexamine the alignment of education practice with concepts underpinning the CanMEDS competency framework for the Scholar role.

We evaluated our RCPSC accredited anesthesiology resident research program to provide perspective for other Canadian programs and to inform discussions around scholarly activity in residency related to CanMEDS 2025. Specifically, we sought to answer the following research questions: How well is our local program addressing and assessing CanMEDS Scholar competencies? What gaps can be identified in how Scholar competencies are addressed and assessed?

Methods

Study design.

We undertook benchmarking of our local program's scholarly activity against national norms. Benchmarking is a practice grounded in continuous quality improvement that allows an organization to compare key metrics, strategies, and performance to those of other organizations, to identify best practices and develop improvement plans.[13–17] Benchmarking of research skills is a noted gap in medical education.[16] Following a local program evaluation consisting of a resident survey and program document review, we used strategic benchmarking to compare our methods of addressing and assessing scholar competencies in the Anesthesia postgraduate program at the University of Saskatchewan to those of other Canadian anesthesia programs (Figure 1). This evaluation and benchmarking[15,16] project was deemed exempt from ethical review by the institutional Research Ethics Board (Local Program Evaluation: Beh-REB 3291 Feb. 28, 2022; Benchmarking: Beh-REB 3354 Mar 18, 2022).

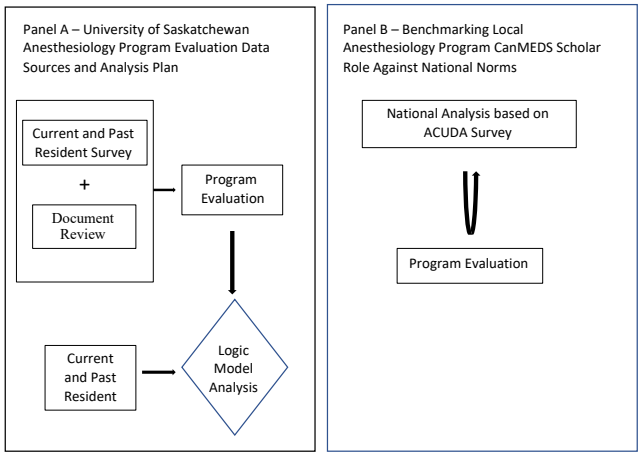

Figure 1. Flow diagrams of data sources and analysis plans

Local program evaluation.

For the local program evaluation, we used data from: 1) a survey of current and past residents, and 2) review of local program documents. We developed the resident survey following a literature review. Survey questions arose from three sources: 1) a previously published needs assessment used in a similar context, consisting of four domains: demographics, current research activities, prior research training, and a research knowledge self-assessment;[20] 2) two authors (EBT, JG) iteratively developed questions *de novo* pertaining to residents' experiences and perceptions of useful resources, departmental support, and overall success in achieving research program objectives; and 3) select questions borrowed from the concurrent ACUDA questionnaire pertaining to challenges. From the previously published survey, we modified questions pertaining to current research activities (e.g. frequency of meeting with supervisor) and self-assessed research knowledge (e.g. areas for additional training) for appropriateness to our setting and activities (eSupplement

A). The survey was pre-tested by four people: a research staff person, a faculty person, and two residents (a senior and a junior), resulting in changes to balance Likert response options, and the addition of a brief description of the Resident Research Program components to preface the questions.

The questionnaire was distributed electronically via Survey Monkey by department administrative staff to 55 current and past residents (graduating classes of 2017-2025) between March 18 and April 26 of 2021. Two reminders were sent. The questionnaire was anonymous except IP addresses, which were removed from the data prior to analysis.

We reviewed local program documents for two purposes: 1) to illustrate program components and outputs in a logic model, and 2) to inform comparisons with the ACUDA Resident Research report. Documents included the annual calendar, the Resident Research Program outline, a Research Orientation presentation offered to new residents, and a research progress database that tracks resident projects, team members, progress, funding, and publications and is administered by the research coordinator.

Logic model

We used a logic model framework,[18,19] a process tool for program planning, implementation and evaluation to illustrate the local program and its various components including inputs, activities and outputs, and to inform comparisons with the ACUDA report. The department's Research Coordinator (EBT) generated a logic model using data obtained from the resident survey, program documents, and publicly available Anesthesiology Scholar competencies (key and enabling competencies) published by the RCPSC[2] and assessed whether these components were aligned with and logically led to the intended outcomes. The logic model was reviewed and revised through an iterative process with local experts- the Postgraduate Program Director (EC) and Executive Director of Research (JG).

Benchmarking

Benchmarking against national norms allowed us to contextualize our findings, identify best practices,[16] and support program evolution to achieve the CanMEDS Scholar competencies. National scholarly activity norms were established by a report conducted by and circulated to the Research Committee of the Association of Canadian Universities of Anesthesia (ACUDA), "*Resident Research in the CBME Era: A report of a survey of ACUDA research committee members"* (eSupplement B). ACUDA is an organization with representation from all 17 Canadian Anesthesiology programs regulated by the RCPSC, and the Research Committee's membership consists of the Research Director or designate from each program. Their survey was developed concurrently to the local program evaluation, but independently by the committee, through iterative feedback and consensus on content. It asked committee members to provide basic data about their residency program, the types of resident research activities and assessments, and the challenges the program faced related to resident research. Thirteen ACUDA programs (13/17, 76%), including our own program, completed the ACUDA questionnaire.

Analysis

We tabulated descriptive statistics for the local program resident survey, using all responses (even partial ones). We report key findings from the local program document review in the logic model framework as inputs, activities, outputs, outcomes, and challenges. Finally, we compared key metrics and findings related to inputs, activities, outputs, outcomes, and challenges against the national norms established by the ACUDA research report.

Results

Local program evaluation.

Forty respondents (40/55, 73% response rate) participated in the local program questionnaire. The logic model provided a framework to illustrate local program inputs, activities, outputs, outcomes, and challenges (Table 1).

Benchmarking

Like most (13/17, 7676%) ACUDA programs, the local resident research program has between 25-35 residents. A comparison with national norms is presented in Appendix A, Table 2.

Inputs. Residents rated the availability of local resources more favorably than national norms. Most of our residents agreed the local program has sufficient resources to ensure their research success; the most important resources were identified as supervisor mentorship (33/35, 94%) followed by research staff (31/35, 88%); ACUDA programs identified finding supervisors to be challenging. The ACUDA report identified more challenges with faculty and leadership promotion of scholarly activity than the local program.

Table 1. A logic model for a resident research program in anesthesiology

Program Delivered		Program Results	
Inputs *Resources invested*	Activities *Training opportunities*	Outputs *Assessment opportunities*	Outcomes *Scholar Key and Enabling Competencies*[2]
Human resources: Resident Research Coordinator [1], Research Associate, Statistician Research Active Faculty [2] (*n* = 16) Financial resources: Resident Research Day Awards Internal research funding (amount determined on year-to-year basis)	Resident Research Orientation [3] Librarian Tutorial [4] Clinical Research Methodologies (CLR800) Course [5] CLR800 Tutorials Biostatistics and Research Methods Academic Half Day Journal Club Biannual Check-in/Research progress meeting with coordinator Resident Research Day Protected research days (30) [6]		3. Integrate best available evidence into practice
		1a. CLR800 assignment – Overview of Research Process and N=1 Trials 1a. CLR800 assignment – Literature Review 1c. CLR 800 assignment – Develop Research Question 1b. Journal Club - Critical Appraisal x1 1a. CLR800 assignment - Project Proposal 2a. Project Proposal 2b. Early Peer Review - Proposal Poster Presentation	3.1 Recognize practice uncertainty and knowledge gaps in clinical and other professional encounters and generate focused questions that address them
		1b. Journal Club - Critical Appraisal x1	3.2 Identify, select, and navigate pre-appraised resources
		1a. CLR800 assignment - Research Process 1b. CLR800 assignment - Critical Appraisal x2	3.3 Critically evaluate the integrity, reliability, and applicability of health-related research and literature
		1a. CLR800 assignment - Research Process 1b. CLR800 assignment - Critical Appraisal x2 2b. Early Peer Review - Resident Research Day Proposal Poster	3.4 Integrate evidence into decision-making in their practice
			4. Contribute to the creation and dissemination of knowledge and practices applicable to health
		1a. CLR800 assignment - Project Proposal 2a. Project Proposal to Research Coordinator 2c. Late Peer Review - Journal Club Proposal Presentation 2f. Resident Research Day - Dissemination of Results 2e. Data Collection and Analysis	4.1 Demonstrate an understanding of the scientific principles of research and scholarly inquiry and the role of research evidence in health care
		1a. CLR800 assignment - Research Process 1a. CLR800 assignment - Project Proposal 1b. Journal Club - Critical Appraisal 2a. Project Proposal to Research Coordinator 2c. Late Peer Review - Journal Club Proposal Presentation 2d. Obtain Research Ethics and other Approvals 2d. Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2e. Data Collection and Analysis	4.2 Identify ethical principles for research and incorporate them into obtaining informed consent, considering potential harms and benefits, and considering vulnerable populations
		2 a-f. Mentored Research or Scholarly Project	4.3 Contribute to the work of a research program
		1a. CLR800 assignment - Research Process 1a. CLR800 assignment - Project Proposal 1b. CLR800 assignment - Critical Appraisal x2 2a. Project Proposal 2c. Late Peer Review- Journal Club Presentation 2b. Early Peer Review- Resident Research Day Proposal Presentation	4.4 Pose questions amenable to scholarly inquiry and select appropriate methods to address them
		1b. Journal Club - Critical Appraisal x1 2f. Resident Research Day - Dissemination of Results 2f. Dissemination/Presentation at Conferences (encouraged) 2.f Publication (encouraged)	4.5 Summarize and communicate to professional and lay audiences, including patients and their families, the findings of relevant research and scholarly inquiry
Challenges: Residents have difficulty balancing the demands of research with clinical requirements, and difficulty finding research projects that are small enough to complete yet still important enough to justify their execution.			

[1]The resident research coordinator is a university employee responsible for matching residents with projects and evaluating their progress against the milestones listed in the competencies.
[2] Research active faculty have a track record of completing research projects with residents, medical students, or independently
[3] The resident research orientation is a 3-hour session that outlines the scholarly curriculum for the residents
[4] The librarian tutorial is a 3-hour session that orientates residents to library resources and databases.
[5] The Clinical Research Methodologies course is an online 16-week graduate level course offered by the College of Medicine and open to graduate studies students of various faculties. It is mandatory for residents in our program.

[6] Protected research days are days without clinical responsibilities during which the resident is to dedicate their time to the completion of their research. These are in addition to research related tasks completed at other times.

Activities. Most ACUDA programs permit residents to complete a Case Report as a research project, but these are insufficient alone to meet the research requirement in our program. Other acceptable project types and quantity are similar across programs.

Outputs. In our program, residents are assessed for Scholar competencies through a literature review, presenting a proposal to an intramural audience, and submitting a written abstract for an intramural research day; this is not the case in about half of ACUDA programs. In most ACUDA programs, most residents give an oral research presentation at an intramural forum; our local program requires all residents to present interim or completed study results at the annual Resident Research Day.

Outcomes. The local resident research program has established eight assessment opportunities for Scholar competencies (Table 1), whereas the minority of ACUDA programs reported having milestones (or Entrustable Professional Activities; EPAs) related to the scholarly project.

Challenges. Both local and ACUDA respondents report the greatest challenge to research project success is the difficulty of balancing resident scholarly activity with clinical responsibilities. Slightly more of our residents reported difficulty finding research projects that are important but small enough to complete, compared to ACUDA programs. Substantially more local respondents valued research as important, whereas nearly half of ACUDA programs report residents undervalue the importance of research.

Discussion

Our study evaluated and compared our program's scholarly activity program to national norms and highlighted gaps in the mobilization of Scholar competencies. The logic model framework[18,19] allowed us both to describe the program and guide evaluation and benchmarking with national norms. This study illustrates how an evaluation and benchmarking analysis can identify gaps to refine both a local and national approach to structure, deliver, and assess competencies related to the Scholar role. This approach could be replicated in other residency programs and specialties to improve the teaching and assessment of the Scholar role.

Our program was in the minority of ACUDA programs with specific assessment opportunities for milestones related to scholarly activities. CanMEDS describes the Scholar competencies (*Outcomes)*; Competency by design (CBD) and related assessments are developed at the national program level by the specialty committee and incorporate CanMEDS milestones. Because scholarly competencies are poorly assessed in a work-based setting, it will be important to identify specific and consistent assessment opportunities for Scholar competencies (*Outputs*). Experts in CBD suggest competencies should be assessed in a stepwise, sequenced manner, with multiple circumstances repeatedly over time using Direct Observation, In-Training Evaluation Reports, and Portfolios.[4–7,21] Specialty Committees should clarify learning expectations for trainees through standardized assessment tools.

Individual PGME programs are responsible to resource (*Inputs*), design (*Activities*), and determine *Outputs* of the curriculum. A realist review of strategies and mechanisms for encouraging resident research in clinical settings identified three best practices: 1) opportunities to engage in practice-informed research supported by longitudinal curricula; 2) guidance by clinician-researchers; and 3) assessing residents' research readiness and promoting their intentionality for engagement.[22] While our local research program demonstrated strengths in providing resources and supports including guidance from 16 research-active clinical faculty (*Inputs*), longitudinal practice-informed structure (*Activities*), and several assessment opportunities (*Outputs),* our logic model highlights areas where those inputs and activities are ill-fitted to outputs and outcomes. This may relate to the relative difficulty with assessing non-medical expert roles compared to clinical CanMEDS competencies.[10,11,23,24] Our evaluation suggests that the existence of substantial resources, and training and assessment opportunities did not ease residents' challenges in balancing clinical and research responsibilities. Working groups to develop and share resources among programs have been proposed as a solution to fill the need for teaching and assessment tools.[24]

Strengths of this research include benchmarking our local findings against national norms to frame the inputs, activities, outputs, and challenges within the larger context of PGME Anesthesiology scholarly programs in Canada. Other programs and specialties may reproduce this work in their own contexts using the ACUDA report for reference (eSupplement 2). Limitations include those inherent to the secondary use of data; the national findings allowed us to

compare program inputs, activities, and challenges more comprehensively than outputs and outcomes because the latter were not a focus of the original work. Further, local findings were obtained from current and past residents whereas national findings were obtained from members of the ACUDA research committee using different survey instruments; it is possible these different perspectives and methods contributed to discrepancies in attitudes towards resources and barriers.[25] Benchmarking methods can be employed to compare high level structures, strategies, and performance to inform and identify gaps despite disparate sources of data.[13–17]

Conclusions

We identified a gap between national standards for outcomes versus national standards for education and assessment of the Scholar role. We found our local residency research scholarly requirements to be similar and at times, more stringent than other Canadian Anesthesiology programs, and the challenges faced by residents to be shared with other programs. The Anesthesia Specialty Committee could improve the consistency and quality of assessments of the Scholar role. As the Royal College reconsiders, the CanMEDS competency framework, we encourage progressive and regular assessment of Scholar role milestones related to the resident research requirement–with the intention of helping residents complete scholarly work and enhancing resident perception of competence. We hope the CanMEDS 2025 will guide Anesthesia's CBD program to develop better assessments at the national level.

Conflicts of Interest: The authors have no conflicts of interest to declare.

Funding:

Acknowledgements: We gratefully acknowledge the contributions made by the members of the Association of Canadian University Departments of Anesthesia (ACUDA) research committee.

References

1. Frank JR, Snell L, Sherbino J. *CanMEDS 2015 physician competency framework*; 2015.
2. The Royal College of Physicians and Surgeons of Canada. *Anesthesiology Competencies (2017 - Editorial Revision 2021; Version 1.0)*; 2021.
3. Richardson D, Oswald A, Chan M, Lang E, Harvey B. Scholar. In: Frank J, Snell L, Sherbino J, eds. *CanMEDS 2015 physician competency framework*. Royal College of Physicians and Surgeons of Canada; 2015; 2015.
4. The Royal College of Physicians and Surgeons of Canada *CanMEDS. Milestones*. Available from https://canmeds.royalcollege.ca/en/milestones [Accessed April 7, 2022].
5. The Royal College of Physicians and Surgeons of Canada. *EPAs and CanMEDS milestones.* Available from https://www.royalcollege.ca/rcsite/cbd/implementation/cbd-milestones-epas-e [Accessed on Feb 2, 2023].
6. Van Melle E, Frank JR, Holmboe ES, Dagnone D, Stockley D, Sherbino J. A core components framework for evaluating implementation of competency-based medical education programs. *Acad Med*. 2019;94(7):1002-1009. https://doi.org/10.1097/ACM.0000000000002743
7. ICE Blog. *Introducing a core components framework for competency-based medical education.* Nov 18, 2021. Available from https://icenetblog.royalcollege.ca/2021/11/18/introducing-a-core-components-framework-for-cbme/ [Accessed on Feb 2, 2023].
8. The Royal College of Physicians and Surgeons of Canada. *What is CBD?* Available from https://www.royalcollege.ca/rcsite/cbd/what-is-cbd-e [Accessed on Feb 2, 2023].
9. Mutter T, Girling L. *Resident Research in the CBME Era: A Report of a Survey of ACUDA Research Committee Members*.; 2021.
10. Chou S, Cole G, McLaughlin K, Lockyer J. CanMEDS evaluation in Canadian postgraduate training programmes: tools used and programme director satisfaction. *Med Educ*. 2008;42(9):879-886. https://doi.org/10.1111/J.1365-2923.2008.03111.X
11. Binnendyk J, Pack R, Field E, Watling C. Not wanted on the voyage: highlighting intrinsic CanMEDS gaps in Competence by Design curricula. *Can Med Educ J*. 2021;12(4):2021. https://doi.org/10.36834/cmej.70950
12. The Royal College of Physicians and Surgeons of Canada. *CanMEDS 25.* Available from https://www.royalcollege.ca/rcsite/canmeds/canmeds-25-e [Accessed on Feb 3, 2023].
13. Dattakumar R, Jagadeesh R. A review of literature on benchmarking. https://doi.org/10.1108/14635770310477744
14. Ettorchi -Tardy A, Levif M, Michel P. Benchmarking: a method for continuous quality improvement in health. *Healthc Policy*. 2012;7(4):e101. https://doi.org/10.12927/hcpol.2012.22872
15. Flesher J, Bragg D. *Evaluation and benchmarking module*.; 2013. https://occrl.illinois.edu/docs/librariesprovider2/ptr/evaluation-benchmarking-module.pdf [Accessed April 7, 2022].

16. Wilkinson TJ, Hudson JN, Mccoll GJ, Hu WCY, Jolly BC, Schuwirth LWT. Medical teacher medical school benchmarking-from tools to programmes. Published online 2014. https://doi.org/10.3109/0142159X.2014.932902
17. Lankford WM. Benchmarking: Understanding The Basics. *Coast Bus J*. 2002;1(1):57-62.
18. Anastasopoulos V. Logic models for program evaluation: purpose and parts. In: D'Eon M, ed. *CanMedEd-Ipedia: The CORAL Collection. Concepts as online resources for accelerated learning*. University of Saskatchewan Teaching and Learning; 2018. https://teaching.usask.ca/articles/logic-models-purpose-and-parts.php [Accessed April 7, 2022].
19. McLaughlin J, Jordan G. Using Logic Models. In: Wholey JS, Hatry HP, Newcomer KE, eds. *Handbook of practical program evaluation second edition*. Vol 2004. 2nd ed. Jossey-Bass. http://surjonopwkub.lecture.ub.ac.id/files/2018/02/Handbook_of_Practical_Program_Evaluation__Essential_Texts_for_Nonprofit_and_Public_Leadership_and_Mana_.pdf#page=55 [Accessed April 7, 2022].
20. Jain S, Menon K, Piquette D, Gottesman R, Hutchison J, Gilfoyle E. The development of a critical care resident research curriculum: a needs assessment. *Can Respir J*. 2016;2016. https://doi.org/10.1155/2016/9795739
21. Bandiera G, Sherbino J, Frank J. The CanMEDS assessment tools handbook. an introductory guide to assessment methods for the CanMEDS competencies. In: *The Royal College of Physicians and Surgeons of Canada*; 2006.
22. Noble C, Billett SR, Phang DTY, Sharma S, Hashem F, Rogers GD. Supporting resident research learning in the workplace: a rapid realist review. *Acad Med*. 2018;93(11):1732-1740. https://doi.org/10.1097/ACM.0000000000002416
23. Whitehead CR, Kuper A, Hodges B, Ellaway R. Conceptual and practical challenges in the assessment of physician competencies. *Med Teach*. 2015;37(3):245-251. https://doi.org/10.3109/0142159X.2014.993599
24. Gaboury I, Ouellet K, Xhignesse M, St-Onge C. Strategies identified by program directors to improve adoption of the CanMEDS framework. *Can Med Ed J*. 2018;9(4):e26-34. https://doi.org/10.36834/cmej.43049
25. Silcox LC, Ashbury TL, Vandenkerkhof EG, Milne B. Residents' and program directors' attitudes toward research during anesthesiology training: a Canadian perspective. *Anesth Analg*. 2006;102(3):859-864. https://doi.org/10.1213/01.ane.0000194874.28870.fd

Appendix A.

Table 2. Benchmarking of local program against national norms.

	Local program document review [1]	Local program resident survey [1]	ACUDA research report
Inputs			
Scholarly activity project is mandatory	Yes		11/13 (85%) mandatory 2/13 (15%) optional
Method of connecting residents with mentors	May approach researcher directly		13/13 (100%) residents may approach researcher directly
	May discuss with Research Director or Coordinator		12/13 (92%) residents may approach research director directly
	Project ideas list is centrally available		3/13 (23%) projects are centrally posted by researchers
Readily available funding for extramural conference presentations	Yes, via PGME fund		10/13 (77%)
Monetary awards at internal research symposia	Yes, via sponsorship [3]		10/13 (77%)
Program has adequate:			
Resources and supports		≤4% identify inadequate funding, administrative support and methodological consultants as a challenge	≤4/13 (31%) report 1 (no challenge) or 2 for funding, administrative support and methodological consultants on 5-point Likert scale
Supervisors/ mentorship		≤4% identify inadequate number of supervisors available as a challenge	5/13 (31%) report 1 (no challenge) or 2 for number of supervisors available to supervise residents on 5-point Likert scale
Research staff		22% identify inadequate research assistant support as a challenge	2/13 (15%) report 1 (no challenge) or 2 for access to research assistants on 5-point Likert scale.
Activities			
Acceptable project types			
Original investigations	Yes		12/12 (100%)
Quality improvement work	Yes		13/13 (100%)
Curriculum development without metric measurement	No		5/13 (38%)
Curriculum development with metric measurement	Yes		8/13 (62%)
Advanced academic course work	Yes		7/13 (54%)
Advanced clinical course work	No		3/13 (25%)
Case reports	No		10/13 (83%)
Literature reviews	No, not in isolation		7/13 (54%)
Typical number of protected research days within the curriculum	30 days		Mode = 30 days (6/12 respondents) Range = 0 to 90 days
Number of projects residents are involved in			
1 project in its entirety		52%	8/13 (62%) report 81-100% of residents meet this criterion
2 or more projects in their entirety		17%	12/13 (92%) report ≤20% of residents meet this criterion
1 project in its entirety plus smaller roles in other projects		22%	13/13 (100%) report ≤40% of residents meet this criterion
Resident's role in research tasks:			
Statistical analysis and interpretation	Residents interpret the analysis carried out by a statistician		5/13 (39%) report ≥81% of residents are involved in interpreting data analyzed by another team member or organizing data into tables and figures

Work in a basic science wet lab	Very rarely		5 (39%) report residents never work in a basic science wet lab; 7 report they do so rarely (<20% of the time)
Outputs			
Literature review, proposal presentation, abstract submission for internal research day	Yes, 100%		7/13 (54%)
Manuscript preparation & publication	Not required by program, required by some supervisors; approx. 30% publish		3/13 (23%) report 81-100% of residents write a complete manuscript
Oral presentation to internal audience	Yes, 100%		8/13 (62%) report 81-100% of residents give an oral research presentation at an intramural forum
Outcomes			
Entrustable professional activities or milestones related to scholarly activity project [4]	Yes		4/13 (31%)
Challenges			
Balancing responsibilities		65% report difficulty	9/13 (69%) report this to be a major challenge (4 or 5 on a 5-point Likert)
Finding appropriately sized projects		52% report difficulty	5/13 (38%) report this to be a major challenge (4 or 5 on a 5-point Likert)
Inadequate access to research assistants for consent, data collection, and related tasks		22% identified this challenge	6/13 (46%) report this to be a major challenge (4 or 5 on 5-point Likert)
Faculty inadequately promote the value of research		4% identified this challenge	3/13 (23%) report this to be a major challenge (4 or 5 on a 5-point Likert)
Residents undervalue the importance of research		9% identified this challenge	6/13 (46%) report this to be a major challenge (4 or 5 on a 5-point Likert)

1 Color coding-- green exceeding national norms; yellow falling behind national norms
2 More than one response was allowed in the ACUDA questionnaire
3 Saskatchewan Division of the Canadian Anesthesiologists Society
4 All programs have EPAs and milestones as set out by the RCPSC. We interpreted this to mean that programs had not clearly outlined assessment opportunities for EPAs and milestones.
5 Residents could select more than one in the local program evaluation