

Best practices for enhancing surgical research: a perspective from the Canadian Association of Chairs of Surgical Research

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SUMMARY

The Canadian Association of Chairs of Surgical Research was created in 2014, with representation from every departmental surgical research committee across Canada, to establish Canadian surgical research as a beacon for health care innovation and to propose solutions for the daily challenges facing surgeon-researchers. Our key mandate has been to identify challenges for surgeons and scientists performing research to prevent further erosion of this vital area of activity that benefits patients, health care service providers and Canadian society. This article outlines the findings of a nationwide survey sent to all members of departments of surgery across Canada, seeking input on current threats and potential solutions. The results suggest that surgical research in Canada is experiencing a decline in funding and an increase in challenges affecting research productivity of academic surgeons, such as pressures to be clinically active, unpredictable surgical schedules, growing administrative demands, and increasing complexity of patient populations. Although surgeons are productive in their research endeavours, institutional changes and sharing of best practices are needed to ensure sustainable growth of research programs.

For surgical research in Canada to flourish, we need to implement a successful strategy that addresses the issues facing surgeon-researchers/scientists. The Canadian Association of Chairs of Surgical Research (CACSR; www.cacsr.ca) was created in 2014, with representation from every departmental surgical research committee across Canada, to establish Canadian surgical research as a beacon for health care innovation and to propose solutions for the daily challenges facing surgeon-researchers/scientists. The objectives of this article are to review the current state of surgical research, including the current roadblocks facing surgeon-researchers, and to provide a list of recommendations that focus on increasing the productivity of surgeons doing research across Canada. To ensure the recruitment and success of future academic surgeons, we must work together with funding bodies, universities and hospitals to establish guidelines that are geared toward a surgical practice.

CHALLENGES FACING SURGICAL RESEARCH IN CANADA

The mark of surgeons on the history of innovations in medicine and pioneering life-saving techniques is both rich and impactful. The Scottish surgical scientist John Hunter (1728–1793) is one of the founding fathers of modern scientific surgery. He was admired for his rigorous scientific method and efforts to collect evidence for surgical practice. Developments in pain control and anesthesia in the mid-19th century triggered the evolution of surgery, allowing surgeons to expand their practice beyond quick and dirty amputations and removal of external tumours. In the second half of the 19th century, the development of antiseptic surgical technique spearheaded by Joseph Lister further stimulated progress, allowing for many new and previously

unimaginable procedures that led to several surgeons receiving Nobel Prizes, including Theodore Kocher, Alexis Carrel and Joseph Murray.¹ By the first half of the last century, surgeons were at the forefront of medical discovery and contributed at least half the contents of the *New England Journal of Medicine and Surgery*.¹ This dominance did not last; by the last quarter of the 20th century, only 10% of the *New England Journal of Medicine's* contents were related to surgical research.¹

Despite transforming modern health care, investment in surgical research has diminished. As long ago as 1996, Richard Horton, then editor of *The Lancet*, wrote a very provocative editorial highlighting the lack of high-quality surgical trials with a sound methodology. In a quick environmental scan of the surgical literature, he found that almost half of surgical research relied on case series and inferred that surgeons appeared not to be concerned with incorporating surgical research as a critical component to their practice.² Unfortunately, this thinking has persisted; 68% of department leadership surveyed across highly productive research hospitals in the United States do not believe that surgeons can be as successful as basic scientists in today's research environment.³ Although these prevailing thoughts are difficult to accept, they highlight the undertone on which many institutions and funding agencies base their decisions when making fundamental and potentially crippling choices about the future support of surgical research.⁴ In the last few decades, the focus of surgical departments has shifted toward clinical care and surgical education. The causes frequently cited for this shift are a lack of time for surgeons to devote to research, a lack of departmental resources available to support research endeavours of surgeons, and insufficient training and mentorship to ensure success as an academic surgeon.^{5,6}

Clinical practice, education and research are the 3 pillars of most academic surgical departments. As with clinical practice and education, research requires an environment conducive to delivering the level of services and programs expected of and by the academic surgical community. Universities, faculties and departments of surgery have a responsibility to foster these conditions by defining and prioritizing goals and objectives; encouraging collaborative partnerships within a discipline or through multidisciplinary teams; and providing the necessary tools, education and resources to support excellence in surgical research. Our group's collective experience is antithetical to some of these prevailing themes. Herein, we address these and other challenges that surgeons face in performing research in academic departments of surgery across Canada and suggest possible solutions.

SURVEY ON CANADIAN RESEARCH NEEDS

To identify the current impediments to success for surgeon-researchers and surgeon-scientists in Canada, CACSR

developed a survey that was distributed to all academics in surgical departments across Canada to gather information on the demographics of the group and to ask about the challenges to conducting surgical research. The questions were developed through a consensus meeting among the CACSR membership and consisted of 20 questions (Table 1); the respondents had the opportunity to change their answers during the survey.

The closed survey data were collected anonymously using a web-based program, Qualtrics, and amalgamated at Western University. The Qualtrics program ensures that a single IP address does not submit more than 1 entry. The survey was distributed via each department of surgery research office to all their institutional members through an internal email system. The email provided a description of the study as well as a link to the anonymous web-based questionnaire. The survey remained open from September 2016 to February 2017. No personal information was collected other than institution of academic practice. No incentives offered for filling out the survey.

We received 164 responses from 17 participating institutions across Canada, with all of the respondents having answered all 25 questions (Fig. 1). The respondents represented all academic ranks: 33% at the assistant professor, 37% at the associate professor and 30% at the full professor level. Of all of the respondents, 9 (6%) were basic scientists working within departments of surgery and 24 (15%) identified themselves as surgeon-scientists; the respondents also identified that they were cross-appointed to other departments in 42% of cases. This range lends further support to the validity of our findings. Contrary to what was reported in the United States, the majority (76%) of the respondents had been working in the same surgical department for more than 6 years.^{3,7} We inquired about the number of hours the respondents spent on research-related endeavours and found that 28% spent fewer than 5 hours per week, 33% spent 5–20 hours per week and 11% spent more than 20 hours per week (Fig. 2A). The time commitment was not linked to remuneration across all the surgical departments; only 57% of respondents received salary support to offset their clinical time and dedicate time toward their research programs. The ranges of salary support varied from \$4000 to \$200000 per year (mean \$81785 ± \$50900). Salary support to protect time for research needs to be addressed at the both departmental and institutional levels to ensure a sustainable model of productivity.⁸

Of all the respondents, we found that operational funding for individual research programs ranged from internal departmental research funds (45%) to tri-council (Canadian Institutes of Health Research [CIHR]/Natural Sciences and Engineering Research Council [NSERC]/Social Sciences and Humanities Research Council [SSHRC]) funding (29%), with most people (53%) holding 1–4 competitive operating grants (Fig. 2B). Interestingly, 59% of

Table 1. List of questions and possible answers to the national research needs assessment survey sent to all academic departments of surgery across Canada

Question	Possible answers
1. Please identify your institution.	Drop-down list of all Canadian academic institutions
2. What is your current rank of job family?	Assistant; associate; full professor; basic scientist; clinician-scientist
3. Are you cross-appointed to another department at your institution?	Yes; no
4. If you answered "yes" to question 3, please indicate what department you are cross-appointed to.	Free-text entry
5. What do you think should be the minimum protected time for a surgeon-researcher/scientist/investigator?	Free-text entry
6. Do you consider yourself a surgeon-researcher/scientist/investigator?	Yes; no
7. If you answered "yes" to question 6, do you receive money for the protected time listed above?	Yes; no
8. If you answered "yes" to question 7, how much money do you receive for your protected time?	Free-text entry
9. Indicate the approximate number of years that you have been with your department of surgery.	< 5; 6–10; 11–20; > 20 yr
10. Indicate all areas where you feel your research and current research activities fall (check all that apply).	Big data; clinical trials; surgical education; translational science; quality assurance/patient-centred research
11. The majority of research I participate in is funded by (you may choose multiple answers)...	Unfunded; tri-council; non-tri-council; industry-sponsored; agreements with other universities; nonprofit or donations; internal research funding; self supported
12. Approximately how many hours per week do you spend on all aspects of your research?	0; 1–4; 5–10; 11–15; 16–20; 21–25; 26–30; 31–35; > 36 h
13. How many grants do you currently hold?	0; 1–4; 5–10; > 11
14. How many undergraduate students did you have working directly with you during the time period July 1, 2015, to June 30, 2016?	Free-text entry
15. How many graduate students did you have working directly with you during the time period July 1, 2015, to June 30, 2016?	Free-text entry
16. How many medical students did you have working directly with you during the time period July 1, 2015, to June 30, 2016?	Free-text entry
17. How many clinical fellows did you have working directly with you during the time period July 1, 2015, to June 30, 2016?	Free-text entry
18. What is the approximate dollar amount of grant funding you were awarded during the time period July 1, 2015, to June 30, 2016?	Free-text entry
19. See Table 2	—
20. Are there additional resources and services that your department of surgery can provide that you think would be of value for you and your own research?	Free-text entry

the respondents indicated that they have in the past and currently do carry out independent research that is not funded directly by a particular entity, highlighting the high level of enthusiasm for scientific discovery from this group. Although almost half of the respondents considered themselves to be surgeon-scientists or surgeon-researchers, most had strong feelings about a need to modify the definitions that tri-council agencies place on the classification of these professional designations. The consensus among respondents about time spent on research per week and suggested designation title for academic role purposes was 0.5–1 day per week (< 20% of protected time) for a "surgeon-investigator"; 1–2 days per week (30% of protected time) for a "surgeon-researcher"; and 2–3 days per week (50% of protected time) for a "surgeon-scientist." In other fields (e.g., medicine), 75% research time is considered necessary to warrant the title "clinician-scientist"; however, this has previously been deemed not to be possible for surgeons.^{9,10} An important aspect of doing research in an academic institution is providing solid mentorship and guidance for junior researchers. Our survey revealed

that, on average, each of the respondent surgeons was directly involved in the supervision of undergraduate students, graduate students, medical students and clinical/postdoctoral fellows. This finding highlights the exceptional mentorship that academic surgeons provide across all our surgical departments.

Finally, we evaluated the themes of research being carried out across the country to determine whether national research themes/nodes could be created to foster new national collaborations. The framework chosen was based on the newly implemented one at Western University and included 5 themes: big data, clinical trials, surgical education, translational science, and quality assurance and patient-centred research. The respondents could select more than 1 area of interest. Overall, respondents felt that their areas of research fell into those 5 themes as follows: 11%, 27%, 15%, 23% and 24%, respectively (Fig. 2C).

To create a more comprehensive and supportive institutional research infrastructure, we asked respondents to identify how best their departmental research office could help them succeed (Table 2). The most important needs

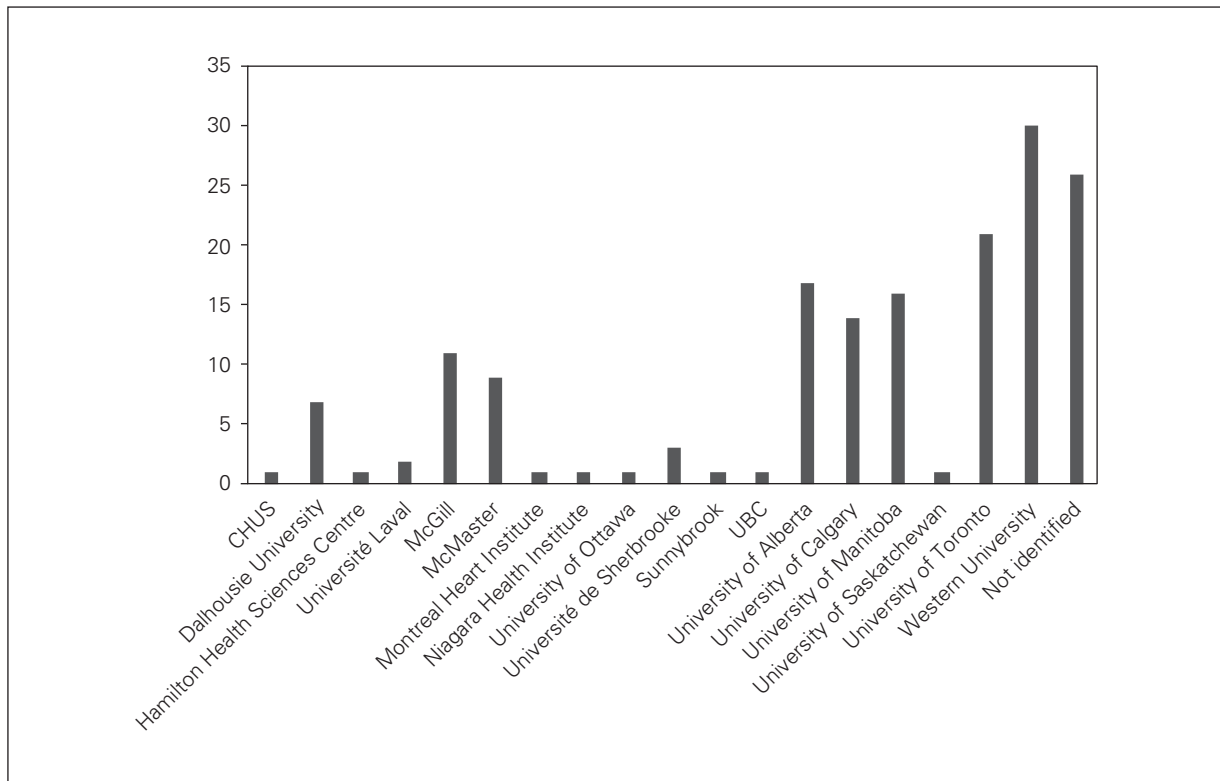


Fig. 1. Response rates of participating institutions in the national research needs assessment survey. CHUS = Centre hospitalier universitaire de Sherbrooke; UBC = University of British Columbia.

identified were assistance with the coordination/facilitation of research services, such as statistical support and grant review panels; help with identification of new funding opportunities; establishment of strong mentorship committees for new faculty; and assistance with navigation through the lengthy human and animal ethics processes. The next highest needs included the facilitation of research collaborations both within and outside the department, and the development of educational resources for researchers and information technology services.

INCREASING THE FOOTPRINT OF SURGERY IN BIOMEDICAL RESEARCH

The origin of many of the challenge areas identified in the nationwide survey are rooted in the culture or environment in which surgeons practise. A culture that is conducive to excellence in research is one in which a strong institutional value is placed on encouraging leadership in research, and celebrating and recognizing the achievements of department members.^{11,12} Fundamental to such a culture is ensuring that there is an anchor for research carried out within the department through the establishment and global transparency of a surgical research committee. Although many of our departments have a formal committee, we propose sharing best practices across institutions to ensure that all academic surgeons have adequate support.

ESTABLISHING AN INFRASTRUCTURE FOR SURGICAL RESEARCH

Departments of surgery across Canada have variable corporate structures; however, a common theme is the presence of a research committee that oversees various aspects of ongoing surgical research within the department. Our discussions highlighted optimal attributes of research committee structures across Canada, which led us to identify best practices that could then be used to establish or improve upon our respective committees. The role of the department of surgery research committee is to help and encourage new faculty and existing faculty to get involved in research through transparently articulated formal processes. The committee provides members of the department with information and support to apply for both internal and external research funding. To achieve this aim, the committee should ideally comprise representatives from each of the surgical divisions within the department of surgery as well as basic science leads associated with the department, the director of a graduate program of surgery/clinician investigator program housed within the department as well as the chair of the department. This structure enables all stakeholders and decision-makers to be involved in shaping the direction and future of research within the department. A critical role of departmental research committees should be to provide infrastructure support for members through a central

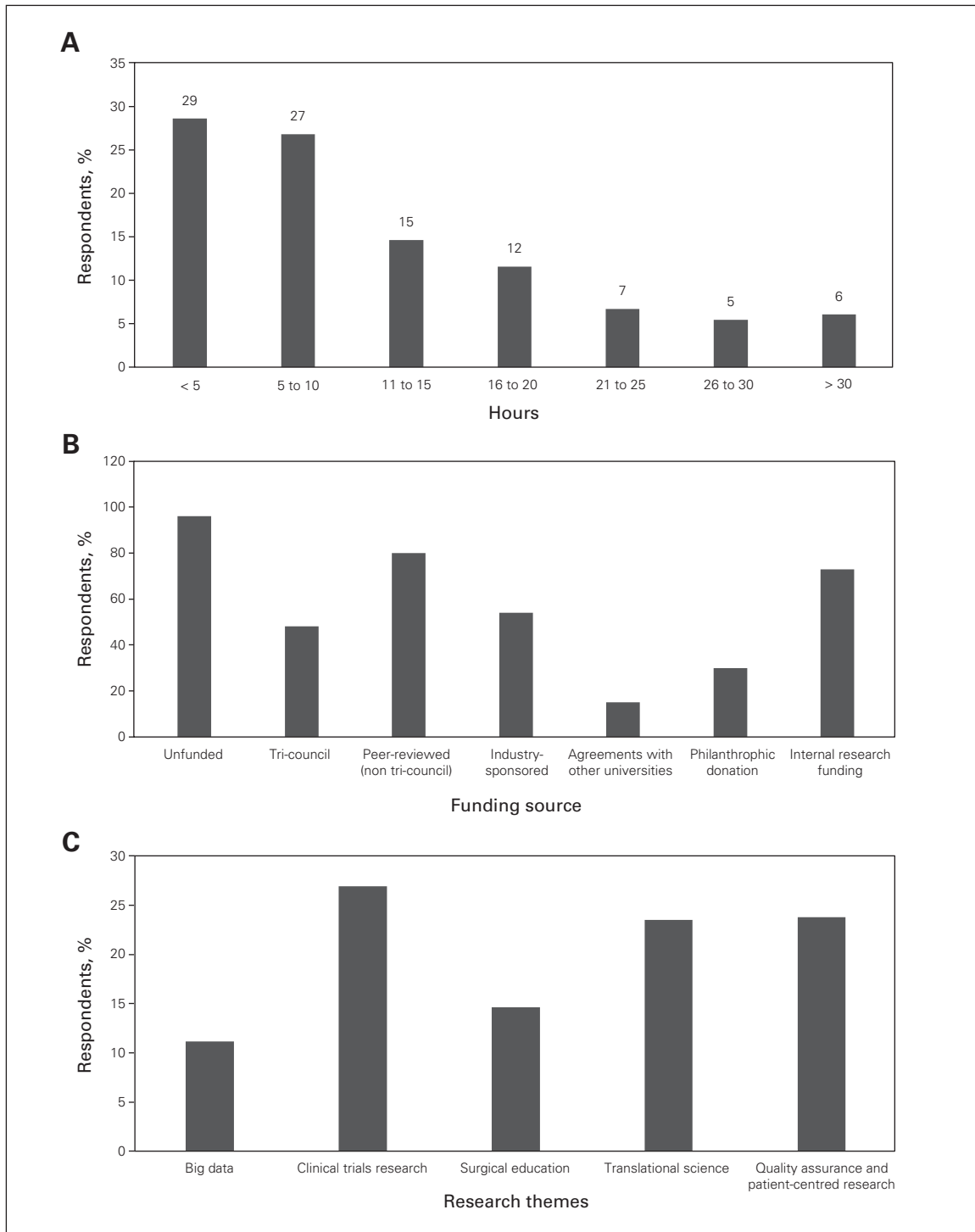


Fig. 2. Select results from the Canadian national surgical research assessment survey showing A) the number of hours spent by the respondents on research-related activities per week, B) the number and source of research funding held in the previous year and C) how the respondents classify their existing research programs.

research office, which could facilitate (either internally or via institutional support) grant-writing workshops and establish internal review panels for larger grants (combination of basic and clinical researchers) to increase research funding success. One of the greatest challenges for new and existing surgeon researchers is to navigate

through the process of complying with research ethics board and animal care research requirements; a supportive and guiding role for the research office should be to help researchers manage these potential hurdles to surgical research.⁵ We need to utilize the strengths of external departments and programs at our institutions to help push

Table 2. Roles identified by respondents as being ideal to ensure the growth and sustainability of successful research in departments of surgery across Canada

Roles of a departmental research office	Respondents, %
Coordination/facilitation of research services (i.e., statistical support, grant development and review)	71
Identification of new funding opportunities and programs	68
Research-related guidance, mentorship and coaching for junior faculty members	68
Facilitation of human and animal ethics applications	67
Assistance in the development of collaborations and research teams	55
Development of educational resources for researchers	36
Information services	29

surgical research initiatives. The research office should either subsidize or provide links to other institutional resources, which may include biostatistical support and Health Canada clinical trial applications, that can be daunting for less experienced researchers and have been identified as major barriers to new investigators.

Another important role of the departmental research office should be establish partnerships with other research offices to link their researchers; fostering inter- and intradepartmental research initiatives is a key to the future success of surgical research.¹³ Having a central office coordinating research efforts enables departments to create and manage a database to track research funding and generate accurate metrics annually on internal and external funds received by its members. The information from these databases can be used for public relations, philanthropic and annual alumni donation request reports. All surgical research offices should maintain a frequently updated research website with active links highlighting an investigator each month, announcing new publications/grants awarded to its members, listing an active list of potential funding sources available to members, and housing an updated and current list of existing infrastructure/equipment accessible to all members to foster collaboration. This latter initiative is also key to ensuring that departments across Canada maintain active links through the CACSR website (www.cacsr.ca). Our goal is to facilitate and elevate Canadian surgical research productivity, and establishing a strong Web presence for each department across our nation is an important building block to achieving this objective.

Additionally, a departmental research committee should provide and adjudicate annual internal research grants available to both surgeons and residents/fellows/scientists that should favour new initiatives, collaborations and “moonshot” projects that will ultimately lead to more substantial external grants. In the current climate of reduced competitive funding resources, the departmental research office should be committed to identifying novel sources of research funding from industry partnerships,

philanthropic support, annual giving campaigns and alumni relations. Other initiatives that can be managed through the departmental research committee include the adjudication of annual clinician and institute scientist awards, which would provide much-needed salary support for both surgeon researchers and scientists, respectively, working within the department. Ultimately, promotion of research activities is best demonstrated through an annual department-wide research day highlighting the accomplishments of its clinical and basic science members, residents and graduate students. In smaller academic surgical departments across Canada, the annual surgery research day could be an opportunity for sharing limited resources by holding a joint annual research day with another clinical department (e.g., pathology and laboratory medicine, ophthalmology, anesthesiology), fostering increased interaction and competition among faculty, residents, medical students and graduate students. The broadness of the research presented during a research day is key to ensuring the success of its researchers. In fact, several institutions across Canada have found it to be the perfect opportunity to present annual awards to the most productive surgical division or investigator to not only highlight their achievements, but also to foster healthy competition. Our experience is that these formats are the ideal way to not only create new collaborations through collective engagement in ongoing broad research activities within the department, but also in engaging external departments and programs at our institutions.

OPTIMAL CONDITIONS FOR RECRUITMENT AND RETENTION OF SURGEON SCIENTISTS

A big challenge for academic departments of surgery across Canada is the recruitment and retention of surgeon-scientists in an era of shrinking federal budgets for research support both at the faculty operational funding level as well as at the level of training programs, such as the critically important MD/PhD program, which has previously been identified as a key determinant of future productivity of clinician-scientists; this program is unfortunately no longer funded by CIHR.^{5,14-16} This latter issue is an important dilemma, as we need to foster innovation, drive and the pursuit of scientific inquiry among our trainees, but the mixed message from the funding agencies can be a deterrent for some applicants to these already competitive streams of training. As departments of academic surgery across Canada, we must be united in our voice to the tri-council funding groups and insist, through efficient lobbying, that changes be implemented to preserve support for scientific discovery.

As shown by the data obtained from our nationwide survey, there is a significant discrepancy in the remuneration received by surgeon-scientists across the country. This discrepancy can be explained by differing provincial programs

and grants, but highlights an importance of establishing nationwide standards for academic departments of surgery. The departments should, in conjunction with their respective universities, consider instituting minimum salary requirements for surgeon-scientist positions. One of the best systems across the country for surgeon-scientist funding is in Quebec. In 2009, the province of Quebec developed an agreement that was geared toward enhancement of health research as part of general salary negotiations between the Fédération de médecins spécialistes du Québec (FMSQ) and the province's ministry of health. This agreement set aside 1% of the total monetary sum allotted to the FMSQ for physician reimbursement of medical services to support salaries of clinician-scientists granted scholar status by the Fonds de recherche en santé du Québec (FRQS). This fund was created to allow scholars to access competitive salary support based on their own medical/surgical specialty to a level of 110% of the given specialty mean annual salary, with 50% of the clinician-scientist time spent in research activities. Since the program's inception, there have been 79 recipients of this prestigious award, with 16% of the awardees from surgical subspecialties and 84% from medical specialties. Initially, surgical specialists (at the Université de Montréal) were slow to embrace this type of reimbursement, as most academic surgeons involved in research activities tended to be in the upper tiers of reimbursement for their specialty. Over time, however, the program has gained popularity with researchers from the department of surgery in several specialties (orthopedic surgery, urology, cardiac surgery and general surgery), as it decreased the pressure for profitable clinical activities and enabled increasing research activities and scientific productivity with competitive levels of reimbursement that were well above the levels of the former system, which was associated with \$45 000 in annual research salary grants from the FRQS. The Quebec model is an excellent example of how to provide funding and protect the time of surgeons who spend more than 50% of their time on dedicated research activities.

Although the Quebec model is unlikely to be applied across Canada, other innovative and sustainable approaches to enable adequate protected time for surgeons dedicated to research are needed. It may be worthwhile to deploy lobbying efforts at the provincial levels to reproduce this kind of successful model, although gains may be achieved only in the mid- to long term. Other models have been applied across the country, including established research chair positions, salary awards, and the base remuneration strategies. Although these options provide a measure of goodwill from institutions, they are unfortunately not compensatory to the degree of clinical salary sacrifice that many surgeons make to build and sustain their research programs.^{8,17} Institutions spend so much time and effort on training and fostering successful surgeons who shine early on in their careers, but ultimately, clinical/surgical

and financial pressures too often lead to the demise of many bright research programs. Interest and drive for research productivity is quite high among Canadian surgeons and should not be discounted. In fact, the majority of surgeons responding to our survey indicated that they were well funded with competitive operating grant awards, but receive minimal salary support for these research activities; this finding highlights the important fact that our institutions contain highly motivated surgeons who demonstrate significant research productivity despite a lack of financial remuneration. It is imperative that Canadian academic institutions and stakeholders consider sustainable and fair salary support for their surgeon-scientists to continue to attract and retain the best and the most brilliant candidates and prevent them from going to more advantageous positions in the United States, where almost all academic surgical positions are competitively salaried and offer dedicated and protected research time.

Apart from the importance of protected time to ensure the success of surgeon-researchers/scientists, our survey showed a significant range in operational funding received by surgeons across various departments of surgery. Notably, there was a substantial amount of research brought carried out without any specific source of funding as well as from internal research funds (Fig. 2B). These findings highlight 2 very important characteristics: first, lack of financial support does not seem to deter the curiosity of most Canadian surgeons, and research continues to be carried out by piecemeal amalgamation of funds; and second, departments of surgery should continue to support annual internal research awards, as these appear to fund a large quantity of research and, hence, form the backbone of many research endeavours. Our survey findings did not bring to light any geographic variation in internal funding, which appears to be prevalent across most institutions. Not highlighted in the survey, however, was the value and quantity of the individual internal research funds awarded annually. The CACSR recommends that departments continue to foster and develop their internal funding mechanisms to fuel pilot projects that may otherwise never come to fruition.

Another important hurdle faced by surgeon-scientists globally is maintaining a balance between the unpredictability of a surgical practice and the amount of time required by institutions and funding agencies to retain their surgeon-scientist status. There is substantial debate over the definition of a surgeon-researcher and surgeon-scientist, and a common ground needs to be established between institutional and funding body (i.e., CIHR) definitions. Also, it is imperative that the definition comes with the necessary support (both financial and infrastructure) from individual departments of surgery to ensure the success of these individuals in the current environment. Based on a review of the literature and comparing a variety of definitions across the country, we believe that

the most optimal time base for a surgeon-scientist should be defined as a surgeon spending 50% or more time on research, whereas a surgeon who spends less than 50% of their time on research should be classified as a surgeon-researcher. This is not congruent with the CIHR definition, as they define a clinician-scientist as having 75% protected research time. Although this criterion is sustainable in a medical practice where patient loads and on-call responsibilities are shared among groups, it does not fit with the model of many surgical practices, where patients are often assigned to a particular surgeon. The CACSR recommendation is that the current CIHR definition should be challenged, especially in the present funding climate, as this definition is not realistic for surgeons and was likely initially determined for new internal medicine applicants. Also, the definition set by CIHR does not clarify how many hours are in the work week, and consideration needs to be given to the fact that surgeons do not work 40-hour work weeks. Several institutions, including the University of Manitoba and Western University, define a work week in 50-hour units. This should be challenged at the level of CIHR and other national funding bodies.

MENTORSHIP AND ESTABLISHMENT OF A SOLID NETWORK FOR RESEARCH SUCCESS

One of the most important building blocks of a junior surgeon-scientist's career is the establishment of a solid and broad infrastructure of experienced mentors to help them find a niche and to help guide them to establish a research network within or outside their academic institution. Numerous studies highlight the importance of early mentorship and its proportional relationship to research success.^{11,18} The CACSR has identified mentorship for surgeon-researchers/scientists as a critical element required for surgeons to develop the tools and resources needed to have productive research careers. The CACSR recommends that all new surgeon-researchers/scientists have access to a mentorship committee for the first 5 years of their careers. The structure of the committee may vary depending on the type(s) of research that the surgeon is undertaking, but the committee should include a minimum of 1 individual with expertise in the surgeon's research interests as well as 1 divisional or departmental leader. Biannual discussions should not focus only on research progress, but also on clinical load, teaching responsibilities, on-call schedule and remuneration for protected research time. In addition, mentorship should be encouraged to be multi-institutional. The CACSR is working to create a nationwide surgical research mentorship program that will bring together investigators from clinical and nonclinical departments across the country to create a robust and sustainable foundation for Canadian surgeon-researchers.

The most successful research programs attribute their continual achievements to the amalgamation of ideas and expertise from bringing together a group of individuals who share a common research vision. There are models being implemented across Canada with the interest of ensuring that investigators from various disciplines are brought together with the aim of improving research productivity. Often, these can be based on the model of "research by proximity," where surgeons are either cross-appointed to basic/social sciences departments or are given laboratory space in an environment surrounded by basic scientists. Although such models can be successful, they rely on collaboration based on either accidental interactions or interactions created by the need for technical support; often, such collaborations are not long-lasting and can be situational. One of the biggest hurdles is the unpredictable time commitment on the part of the surgeon-researcher, which often leads to a decline in collaborations. This time factor is an important determinant of success.

One potential novel model developed at Western University that has proven successful in circumventing some of the aforementioned challenges has been the creation and implementation of multidisciplinary research nodes. Before establishing these virtual nodes, an in-depth assessment of the research needs of all stakeholders, including all clinical and research members in the department of surgery, hospital research institutes and vested members of Western University, was carried out. This information, combined with data from a SWOT (strengths, weaknesses, opportunities, threats) analysis led us to create 4 virtual research nodes that fit best with the existing strengths of research programs at our institution: big data, surgical education, patient-centred research, and fundamental sciences and surgical innovation (Fig. 3). Once these were established, an extensive list of all potential partners across the university was made, including the medical and surgical specialties; all research institutes and programs; and social sciences, mathematics, engineering and business faculties. Subsequent town hall sessions were arranged with each of the groups to disseminate the concept. Clinicians and researchers from across these disciplines were then invited to join the research nodes so that individuals interested in similar research themes could connect and partner to build stronger research programs. Through creation of these virtual research nodes, we have been able to facilitate research activities, promote cross-pollination of ideas among divisions and foster external grant applications that had never previously materialized.¹⁹ These new networks have since helped build a culture that is more conducive to research success. This has transcended the activities of the department of surgery and has spilled into other departments across Western University. This broader collaborative approach, which brings together researchers and clinicians from diverse backgrounds and experiences to converge on a common theme or goal has a disproportionately high chance of leading to innovation and hence alter the course of future surgical therapies.²⁰⁻²²

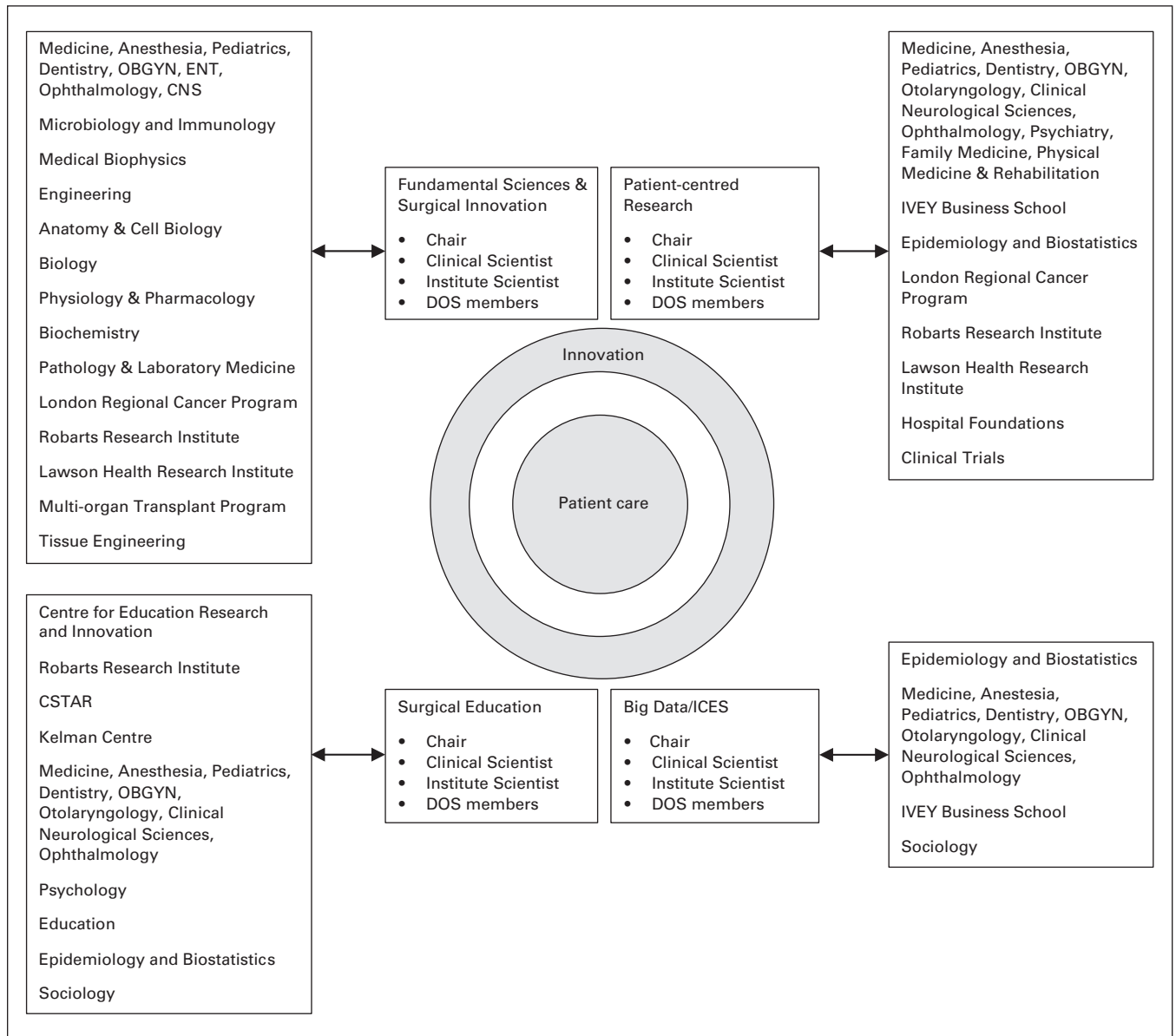


Fig. 3. Department of surgery virtual research nodes created at Western University to facilitate innovation in various domains. Each research node has distinct leadership with a chair and several clinician and institute (basic) scientists in addition to being populated by members of the department. Each node is then linked to other extradepartmental research centres and departments to further enhance collaboration, innovation and patient care. CNS = central nervous system; CSTAR = Canadian Surgical Technologies & Advanced Robotics; DOS = department of surgery; ENT = ear, nose and throat; OBGYN = obstetrics and gynecology.

Of interest, these virtual nodes were similar to those presented in our nationwide research needs assessment survey, which showed similar uptake across Canada as at Western University. This congruence is highly predictive that departments of surgery across all institutions could implement a similar arrangement that could then be used to link research programs across Canada through the network created by the CACSR. This sort of grand scale collaboration would be the first of its kind in the world, linking potentially thousands of researchers across common research themes and programs, and would have great impact on the caliber of surgical research coming out of Canada.

The optimal way of establishing research networks both within and outside the institution may not always be evident. In the current funding environment, collaboration is the recipe for success, and this holds even greater value for junior investigators. To establish a strong foundation for research success, surgeon-scientists should be encouraged to align themselves with nonsurgical departments vis-à-vis a cross-appointment to the external department that fits with their research direction. Similarly, departments of surgery should actively recruit strategically aligned cross-appointees from other departments. The notion of cross-departmental appointment

should be intended not only for surgeons involved in basic sciences research, but for all forms of surgical research ranging from the physical sciences, social sciences, engineering and mathematics. Strategic recruitment is a key component of ensuring the success of a productive academic department. Departments of surgery that are committed to creating a solid infrastructure for global research productivity should consider a recruitment plan with the goal of creating a team that includes clinician-scientist and basic scientist collaborators, to create competitive research teams with a translational focus. These approaches not only create almost immediate linkages, but also draw high-performing and interested undergraduate and graduate students to the research program. In addition, new opportunities created by cross-appointment can be beneficial for future academic promotion with respect to mentoring, teaching, interdisciplinary collaboration and potential grant funding.

THE FUTURE OF SURGICAL RESEARCH IN CANADA

Surgeons have been at the cutting edge of research for more than a millennium. This torch has been carried by many surgeon innovators, leading to many significant achievements that have shaped the face of medicine, including 9 Nobel Prizes.²³ Pioneering surgical research has transcended many fields, including education, clinical trials and patient-centred research, all of which are equally important in pushing the field of surgery and medicine forward. The challenges faced by Canadian surgeon-scientists in the current environment, for the most part, were identified more than 20 years ago.¹¹ Many of the initial suggestions put forth by the Research Development Committee of the Canadian Association of Surgical Chairs (CASC), including the establishment of clinician investigator programs, have already been implemented. However, as identified by our Canadian surgical research needs assessment survey, new issues have come to light that have created a discrepancy in resource allocation, which includes salary support and protected time, compared with our medical specialist colleagues whose research careers have flourished.³ Moving forward, we must build on our collective wisdom from the past 20 years and dedicate our departmental and institutional resources to ensure that surgical research is an integral part of the mission statement of all academic programs across Canada. We must collectively promote and impart the importance of this endeavour to our medical students, residents and fellows so that they realize the impact that a surgeon-scientist can have on the direction of medical and surgical care of our patients.

With the support of CASC, the newly formed CACSR will pave the way for the implementation of a broad research network that transcends medical disciplines and surgical subspecialties. Over the next 5 years, we plan to

work with CASC to develop a centralized website (www.cacsr.ca) that will directly link all academic departments of surgery across Canada and to establish a database of surgeons and scientists to enable cross-pollination of research ideas, infrastructure and sharing of resources across the country. In addition, CACSR will provide an avenue for surgeon-scientist leaders to share best practices and host educational and learning opportunities. In September 2017, CACSR co-hosted the first session of its kind with the Canadian Association of General Surgeons at the Canadian Surgery Forum in Victoria, British Columbia, in a session aptly named “The past, present and future state of surgical research in Canada.” This half-day session provided a venue for new, mid-career and experienced surgeon-researchers to learn what other institutions are doing to increase research productivity as well as to discuss key issues faced by surgeon scientists across Canada.

CONCLUSION

It is the vision of CACSR that tri-council funding agencies, universities and departments of surgery across Canada should work tirelessly and collaboratively to foster excellence in surgical research through advocacy, education, research infrastructure support that are in congruence to the clinical demands of a surgical career. This global effort will ultimately create an environment that cultivates and rewards research excellence, leadership and the translation of discoveries to patient care, thus spring-boarding surgical ingenuity and research to the forefront of medical innovation.

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