Anesthesia environmental sustainability programs—a survey of Canadian department chiefs and residency program directors

Les programmes de durabilité environnementale en anesthésie – sondage auprès des chefs de département d’anesthésie et des directeurs de programmes de résidence canadiens

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Abstract

Introduction Anesthesia-related activities contribute to operating room waste impacting climate change. The aim of this study was to ascertain 1) the current existence and scope of department and education programs concerned with anesthesia “green” practice; and 2) perceived barriers to environmental sustainability efforts among Canadian anesthesia department chiefs and residency program directors.

Methods Association of Canadian University Departments of Anesthesia-affiliated anesthesiology department chiefs ($n = 113$) were invited to complete an online survey ascertaining current efforts in, and barriers to, environmentally sustainable anesthesia practice. Similarly, Canadian anesthesiology residency program directors ($n = 17$) were invited to complete an online survey delineating current educational programs on environmental sustainability and identifying interest in, and barriers to, developing a Canada-wide curriculum.

Results The response rates for department chiefs and program directors were 23% (26/113) and 41% (7/17), respectively. Department chiefs indicated that their departments participate in sustainability efforts such as donating medical equipment (65%) and recycling (58%). Despite interest in environmental sustainability, department chiefs identified inadequate funding (72%), lack of a mandate (64%), and inadequate knowledge (60%) as barriers to implementing environmentally sustainable practices. Only 29% of responding Canadian anesthesiology programs include environmental sustainability in their curriculum. Responding residency program directors believe residents would benefit from more teaching on the topic (86%) but identified barriers including a lack of faculty expertise (100%) and time constraints (71%). Respondents (71%) also indicated an interest in developing a Canadian curriculum on the topic.

Conclusion Our results highlight current attitudes, gaps, and barriers to environmentally sustainable anesthesiology practice among departmental and educational leadership. Furthermore, this study identifies potential opportunities to

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develop cross-Canada collaborative educational programs in this field.

Résumé

Introduction *Les activités liées à l'anesthésie contribuent aux déchets de salle d'opération qui ont un impact sur les changements climatiques. L'objectif de cette étude était d'établir 1) l'existence et la portée des programmes départementaux et de formation s'intéressant à une pratique écoresponsable de l'anesthésie; et 2) les obstacles perçus aux efforts en matière de durabilité environnementale parmi les chefs de départements et les directeurs de programmes de résidence en anesthésie canadiens.*

Méthode *Les chefs des départements d'anesthésiologie affiliés à l'Association canadienne universitaire des départements d'anesthésie (ACUDA) (n = 113) ont été invités à remplir un sondage en ligne afin de déterminer les efforts actuels et les obstacles à une pratique durable de l'anesthésie. Les directeurs de programmes de résidence en anesthésiologie canadiens (n = 17) ont également été invités à remplir un sondage en ligne décrivant les programmes de formation actuels portant sur la durabilité environnementale et identifiant l'intérêt pour et les obstacles à la création d'un cursus s'appliquant à tout le Canada.*

Résultats *Les taux de réponse des chefs de département et des directeurs de programme étaient de 23 % (26/113) et 41 % (7/17), respectivement. Les chefs de département ont indiqué que leurs départements prenaient part aux efforts de durabilité en faisant don des équipements médicaux (65 %) et en recyclant (58 %). Malgré un intérêt pour la durabilité environnementale, les chefs de département ont fait mention d'un financement inadéquat (72 %), de l'absence de mandat (64 %), et d'un manque de connaissances (60 %) en tant qu'obstacles à la mise en place de pratiques durables. Seuls 29 % des programmes d'anesthésiologie canadiens ayant répondu comportaient un volet sur la durabilité environnementale dans leur programme. Les directeurs de programmes de résidence ayant répondu étaient d'avis que les résidents bénéficieraient d'une augmentation de l'enseignement à ce sujet (86 %) mais ont identifié divers obstacles, notamment un manque d'expertise du corps enseignant (100 %) et des contraintes de temps (71 %). Les répondants (71 %) ont également indiqué leur intérêt pour la création d'un cursus canadien à ce sujet.*

Conclusion *Nos résultats résument les attitudes, écueils et obstacles actuels à une pratique durable de l'anesthésiologie parmi les directions des départements et des programmes de formation. En outre, cette étude identifie des occasions potentielles de création de programmes éducatifs collaboratifs pancanadiens dans ce domaine.*

The Lancet Commission on Climate Change identified global warming and environmental degradation as major threats to public health.^{1–3} Healthcare itself has been shown to be an important contributor to global warming, being responsible for about 5–10% of the total national greenhouse gas (GHG) emissions in Canada and the United States.^{4,5} In particular, the environmental footprint of surgical suites has been found to be approximately three to six times higher than the hospitals within which they operate,⁶ with anesthetic practice contributing significantly not only to the GHG emissions but also to the waste production associated with surgery.⁷

In a recent study, our group highlighted a strong interest among Canadian anesthesiologists to participate in environmental sustainability efforts in the operating room (OR). However, significant perceived barriers to these efforts included lack of support from hospital and OR leadership and an inadequate level of education on the topic.⁸ Departmental leadership plays a pivotal role in knowledge dissemination and translation through budgeting funds, and spearheading and enforcing policies in support of evidence-based practice implementation. Furthermore, the "formal" and "hidden" curricula that are training future generations of medical practitioners can exert a durable effect on their practice patterns or habits,^{9,10} thereby highlighting the importance of training programs in incorporating evidence-based environmentally sustainable practice.

Understanding the anesthesiology leadership and educational landscape may reveal strategies to help Canadian anesthesiology departments effectively implement robust environmental sustainability initiatives. In Canada, anesthesia department chiefs are leaders of anesthesia clinical departments while anesthesia residency program directors oversee and lead the education of residents in anesthesiology. The current study aimed to survey anesthesia department chiefs on the current state of environmentally sustainable anesthesia practice and to understand educational endeavours from anesthesia residency program directors.

Methods

Ethics, recruitment, and data collection

Approval for this study was obtained from the University of Toronto Research Ethics Board. Electronic surveys (Appendix 1 and Appendix 2) were emailed to all department chiefs of anesthesiology departments affiliated with the Association of Canadian University Departments of Anesthesiology (ACUDA) as well as all ACUDA-affiliated anesthesiology residency program directors.

These were identified using information from a recent publication¹¹ that was verified and updated using department websites and contacting support personnel. Potential respondents were notified by e-mail containing a link to an online survey (www.fluidsurveys.com) with a reminder e-mail sent two weeks later. All responses were anonymous, and consent was implied by participation in the survey. The survey remained open between May and August 2016.

Sample size

We identified 113 anesthesia department chiefs and 17 anesthesia residency program directors who were invited to participate in our survey. Given the number of potential participants, the minimum sample size required was estimated *a priori* to be 88 and 17, respectively, for a margin of error of 5% with 95% confidence.¹² Anticipating an overall survey response rate of 10–40%, we invited all department chiefs and residency program directors to participate.

Study design

Following a literature review including the American Society of Anesthesiology (ASA) guidelines for environmentally sustainable anesthesia¹³ and other published reviews on environmental sustainability in the perioperative setting,^{14,15} surveys were developed to:

1. Ascertain current environmental sustainability efforts in anesthesia practice; future plans to implement such programs; and perceived barriers to their implementation by anesthesia department chiefs.
2. Ascertain the existence and format of current teaching of environmental sustainability in anesthesiology residency programs; interest in developing such a curriculum; and perceived barriers to their implementation by anesthesia residency program directors.

The survey targeting department chiefs included 13 questions (Appendix 1). Questions 1–4 included information regarding each respondent's hospital and department. Questions 5–8 ascertained current and planned environmental sustainability initiatives. All initiatives probed by the survey were based on the ASA guidelines to improve environmental sustainability of anesthesia practice.¹³ Questions 9–12 ascertained potential barriers to implementing such initiatives, and question 13 provided an opportunity for free comment.

The survey targeted towards residency program directors also included 13 questions (Appendix 2). The survey questions were adapted from a previously published curriculum assessment survey of program directors.¹⁶

Questions 1–6 ascertained whether programs included an environmental sustainability curriculum as well as the format, duration, timing, content, and evaluation of the teaching of this topic. Questions 7–12 were concerned with plans for future lectures, optimal format, barriers to expanding this curriculum, and interest in participating in the development or implementation of a cross-Canada collaborative curriculum. Question 13 provided an opportunity for unstructured comments.

Survey testing

The surveys were tested according to previously published guidelines.¹⁷ The process included internal piloting for clarity, flow, and timing using a convenience sample of two former anesthesiology residency program directors and two former department chiefs. No significant changes were needed following their feedback.

Data analysis

Data were collected and managed using fluidsurvey.com, a secure online electronic data capture tool hosted in Canada. Data were summarized as proportions of respondents using Microsoft Excel (Microsoft Software, Redmond, WA, USA). Because respondents had the option of skipping questions, all proportions are relative to the number of respondents for each question.

Results

Department chiefs

Twenty-six of 113 (23%) department chiefs responded to the survey, with 17 (65%) representing academic/tertiary hospitals, six (23%) representing community/teaching hospitals, and three (12%) representing community hospitals. A majority worked in medium-sized hospitals (151–400 beds) and headed departments that provided 2,000–10,000 anesthetics per year (Table 1).

Department chiefs indicated that their departments participated in a variety of environmental sustainability efforts, including donating unused medical equipment and supplies to medical missions (17/26, 65%), appropriate segregation of biohazardous and nonhazardous waste (16/26, 62%), recycling (15/26, 58%), choosing anesthetic gases based on their environmental footprint (15/26, 58%), and using reusable alternatives for anesthetic products (15/26, 58%), Table 2. Furthermore, a majority of department chiefs indicated there was either interest or active efforts to expand these programs (Table 2). Despite this interest, only 46% (12/26) of respondents indicated having included

Table 1 Anesthesia department chiefs’ hospital characteristics

Characteristic	<i>n</i> (%)
Type of facility (<i>n</i> = 26)	
Community	3 (12)
Community/teaching	6 (23)
Academic/tertiary	17 (65)
Size of facility (beds) (<i>n</i> = 26)	
0–150	4 (15)
151–400	11 (42)
401–800	6 (23)
> 800	5 (19)
Number of anesthetics provided by department in the last year (<i>n</i> = 26)	
< 2,000	0 (0)
2,000–10,000	13 (52)
10,001–20,000	5 (20)
20,001–30,000	1 (4)
30,001–50,000	3 (12)
> 50,000	3 (12)
Number of years as chief of anesthesia department at your institution (<i>n</i> = 26)	
< 1	3 (12)
1–3	7 (27)
4–5	6 (23)
6–7	6 (23)
8–10	2 (8)
> 10	2 (8)

department meeting agenda items on the topic of environmental sustainability, with 65% (17/26) having spent less than ten hours discussing or instituting these efforts over the last two years. Respondents indicated they

did not have a current budget (22/25, 88%), human resources (17/25, 68%), or a clear mandate from hospital leadership (12/25, 48%: no mandate; 7/25, 28%: unsure of mandate) to aid with the introduction of sustainable practices. Reported barriers to the implementation of environmentally sustainable practices in the OR included inadequate funding to implement such programs (18/25, 72%), lack of a mandate from hospital leadership (16/25, 64%), inadequate knowledge on sustainability topics (15/25, 60%), and inadequate time to plan and implement such measures (14/25, 56%) (Table 3). Department chiefs provided six free text responses. While they were not enough to conduct a thematic analysis, the text responses underscored the importance of individual champions alongside hospital and national leadership in engaging commercial suppliers, improving and understanding environmentally sustainable practices, and helping to coordinate research and implementation efforts across the country (Table 4).

Residency program directors

Seven of 17 (41%) residency program directors responded to the survey. Of these, two (28%) indicated formal teaching on the topic of environmentally sustainable anesthetic practice, which consisted of a lecture/seminar (0.5–2 hr) presented to residents (postgraduate years 1–4). Topics included the environmental effect of anesthetics, the principles of life-cycle assessment methodology, and appropriate waste segregation into hazardous and non-hazardous streams. Neither of the two programs included any formal evaluation of the effectiveness of teaching in this area. Six program directors (6/7, 86%) indicated that

Table 2 Current and planned sustainability efforts indicated by department chiefs

	Current <i>n</i> = 26 (%)	Future <i>n</i> = 22 (%)
Donating unused medical equipment and supplies to medical missions	17 (65)	11 (50)
Appropriate segregation of biohazardous and nonhazardous waste	16 (62)	11 (50)
Recycling	15 (58)	18 (82)
Choosing anesthetic gases based on their environmental footprint	15 (58)	12 (55)
Using reusable products (gowns, laryngeal mask airway, anesthesia circuits, etc.) instead of single-use products	15 (58)	9 (41)
Evening shut-off of anesthesia machines and other equipment in the operating room	12 (46)	7 (32)
Reprocessing single-use medical equipment	11 (42)	4 (18)
Using anesthetic gas capture/reflection modalities	6 (23.1)	8 (36)
Using pre-filled medication syringes	4 (15)	4 (18)
Using reusable sharps containers	3 (12)	5 (23)
Partnering with industry to promote greener packaging practices	1 (4)	6 (27)
I am not aware of any such programs	1 (4)	4 (18)
Other	1 (4)	3 (14)

Table 3 Perceived barriers to implementing and/or expanding environmental sustainability programs by department chiefs

	<i>n</i> = 25(%)
Inadequate funding to implement such measures	18 (72)
Lack of mandate from hospital leadership	16 (64)
Inadequate knowledge on sustainability topics	15 (60)
Inadequate time to plan/implement such measures	14 (56)
Lack of perceived staff interest	10 (40)
Inadequate facilities	10 (40)
Time/turnover pressures between cases	9 (36)
No foreseen barriers	1 (4)
Other	2 (8)

residents would benefit from more teaching on this topic. Despite this, a majority (5/6, 83%) indicated that they had no plans to implement or expand the curriculum on this topic, with identified barriers including lack of faculty expertise (7/7, 100%), lack of time within the structured curriculum (5/7, 71%), and lack of institutional support (4/7, 57%, Table 5). All program directors indicated that they would be willing to implement a cross-Canada collaborative curriculum in this field with two program directors (2/7, 29%) indicating they would be willing to participate in the development of such a curriculum. Four (4/7, 57%) program directors indicated that the most effective method of delivering this curriculum would be an e-module (Table 6).

Discussion

Our results highlight the current interest in environmentally sustainable programs among anesthesia department chiefs

Table 5 Residency program directors' perceived barriers to implementing and/or expanding an environmental sustainability curriculum during residency training

	<i>n</i> = 7 (%)
Lack of faculty expertise	7 (100)
Lack of time within structured curriculum	5 (71)
Lack of institutional support	4 (57)
Lack of funding for resource development	3 (43)
Lack of interest from trainees	2 (29)
The topic is not relevant or important	0 (0)
Other	1 (14)

and residency program directors. While barriers to implementation of such programs were identified, we also identified actionable opportunities to improve the translation and impact of environmentally sustainable practice in anesthesia. These levels of leadership are particularly important because of their central role in influencing present and future generations of practitioners.

A frequently identified barrier was inadequate funding. Nevertheless, several studies have indicated that when taking a life-cycle view (i.e., considering all the inputs and outputs from the perspectives of production, use, reuse, and disposal) of products and processes through life-cycle costing methodology, implementation of environmentally sustainable practices may actually save money and be financially sustainable.^{18–20} By highlighting potential cost savings and quality improvements arising from environmentally sustainable solutions, anesthesia department chiefs may be able to precipitate a mandate from hospital leadership. This mandate can be a powerful driver of institutional change and innovative solutions, as has been proven by the acceleration of environmental

Table 4 Free text responses from anesthesia department chiefs (*n* = 6)

"One of our anesthetists has a particular interest in OR recycling. He volunteers his own time to advance this agenda via Health Centre administration. Practical support to implement initiatives is very slow. I am told that we will soon be the first hospital in Canada to collect polyvinyl chloride products for recycling."
"This is a very important initiative. There is general apathy by most OR personnel, which I think is the main barrier. These are the same people who throw their beverage cans and plastic water bottles in the trash because it would take three steps more to use the recycling bucket."
"Recent initiatives to recycle have been brought about by changes in city legislation mandating cardboard and plastic recycling. These initiatives [in the hospital] are often thwarted because of infection prevention and control concerns, e.g., recent introduction of single-use prep containers."
"National leadership would help reduce duplication in research/effort and help lead hospitals on appropriate practices. National leadership would be able to engage commercial suppliers on improving and understanding environmentally sustainable practices."
"Our hospital leadership supports environmental sustainability. This is the way to get everyone on board. We recently purchased low flow anesthesia machines based on the philosophy and cost savings of low flow. We have been using the Blue Zone recycling of anesthetic gases for many years."
"In a huge multi-sites organization, each with a strong local culture, it will likely prove difficult to coordinate efforts and steer towards a greener hospital future."

OR = operating room

Table 6 Most effective method to implement an environmental sustainability curriculum during residency training, as perceived by program directors

	<i>n (%)</i>
E-module	4 (57)
Suggested reading on the topic	1 (14)
Grand-rounds presentations	1 (14)
Longitudinal program	1 (14)
Lecture/seminar, journal club, workshop, research-based, case-based learning	0 (0)

sustainability practice across the National Health Services with the creation of the Sustainable Development Unit.²¹

Department chiefs have the potential to serve as an important catalyst by fostering an interest in environmental sustainability practice that is widely held by anesthesiology staff working at Canadian institutions.⁸ Furthermore, collaborations with others, including surgical colleagues, nursing staff, infection control personnel, procurement managers, and custodial services can generate innovative solutions to reduce the environmental footprint of anesthesia and surgery. Indeed, the creation of an “OR Green Team” has been identified by the ASA as a powerful method of spearheading the greening of the OR.¹³ The very existence of such a team may influence less engaged colleagues through norming, messaging, and priming.^{22,23}

The results of this study highlight the current educational landscape on the topic of environmental sustainability in anesthesiology. Our survey suggests that only a small proportion of Canadian anesthesia residency programs have a formal curriculum to teach residents about the environmental impact of our practice. While the program directors indicated that residents should have more exposure to this important topic, they also identified several barriers including lack of faculty expertise, dedicated time, institutional support, and funding for resource development. Many of these barriers could be surmounted with the development of online resources, which could be easily adaptable towards developing a cross-Canada collaborative curriculum. Trainees could be further recruited towards sustainability development through locally-, provincially-, and nationally sponsored research projects and by the creation of fellowships in environmental sustainability.²⁴ The newly created section for Environmental Sustainability of the Canadian Anesthesiology Society (CAS) should take the opportunity to fill the leadership and educational gaps we identified by preparing a national curriculum and developing questions for inclusion in the Royal College examination.

The limitations of the current study include responder bias, a common problem with surveys. In our case, this may have led to a higher representation of department chiefs and program directors who have a specific interest in environmental issues. Furthermore, because the list of department chiefs was generated based on their affiliation to ACUDA, there is likely to be an under-representation of smaller and more remote community hospitals that do not have a university affiliation. We acknowledge that some respondents to this survey may have also participated in our previous survey of CAS members regarding their environmental sustainability practice. This may have influenced responses to the present survey. Since some environmental sustainability methods have other associated benefits such as cost-saving and improved quality of care, it is difficult to parse the motivations driving changes in anesthesia practice that impact the environment. Importantly, our survey aimed to ascertain the implementation of strategies which have been shown to contribute to environmental sustainability. Thus, participation in this survey may have also educated respondents, informing them of potential strategies that can be adopted in their departments.

In summary, our results highlight current attitudes, gaps, and barriers to environmentally sustainable anesthesiology practice among departmental and educational leadership. Furthermore, this study identifies potential opportunities to develop cross-Canada collaborative educational programs in this field.

Author contributions Clyde T. Matava and Maria-Alexandra Petre contributed to all aspects of this manuscript, including study conception and design; acquisition, analysis, and interpretation of data; and drafting the article. Mark Crawford, Adriaan van Rensburg, Mark Levine, and Lisa Bahrey contributed to the interpretation of data and drafting the article.

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Appendix 1: Recycling/sustainability survey: anesthesia department chiefs

1. How many years have you been chief of the anesthesia department at your institution?
 - a. < 1 yr
 - b. 1–3 yr
 - c. 4–5 yr
 - d. 6–7 yr
 - e. 8–10 yr
 - f. > 10 yr
2. What is the size of your facility?
 - a. 0–150 beds
 - b. 151–400 beds
 - c. 401–800 beds
 - d. > 800 beds
 - e. I don't know
3. How many anesthetics were provided by your department in the last year?
 - a. < 2,000
 - b. 2,001–10,000
 - c. 10,001–20,000
 - d. 20,001–30,000
 - e. 30,000–50,000
 - f. > 50,000
4. At what type of facility do you work?
 - a. Community
 - b. Community/teaching
 - c. Tertiary/academic
5. Does your department currently participate in any of the following: (choose all that apply)
 - a. Recycling
 - b. Choosing anesthetic gases based on their environmental footprint (including managing fresh gas flows and carrier gases)
 - c. Using anesthetic gas capture/reflection modalities
 - d. Using pre-filled medication syringes
 - e. Using reusable products (gowns, LMA, anesthesia circuits, etc.) instead of single-use products
 - f. Reprocessing single-used medical equipment
 - g. Using reusable sharps containers
 - h. Donating unused medical equipment and supplies to medical missions
 - i. Partnering with industry to promote greener packaging practices
 - j. Appropriate segregation of biohazardous and nonhazardous waste
 - k. Evening shut-off of anesthesia machines and other equipment in the OR
 - l. No, our department does not participate in any sustainability practices.
 - m. Other: _____
6. Over the past two years, how many agenda items on the topic of environmental sustainability have been included in your department meetings (including recycling and appropriate waste-stream segregation, anesthetic gas management, reusable/reprocessed products, donating unused medical equipment and supplies to medical missions, electricity conserving methods etc.)
 - a. None
 - b. 1–2
 - c. 3–5
 - d. 5–10
 - e. > 10

7. Is there currently any interest in, or active efforts to introduce/expand any of the following in your department?
 - a. Recycling
 - b. Choosing anesthetic gases based on their environmental footprint
 - c. Using anesthetic gas capture/reflection modalities
 - d. Using pre-filled medication syringes
 - e. Using reusable products (gowns, LMA, etc.) instead of single-use products
 - f. Reprocessing single-used medical equipment
 - g. Using reusable sharps containers
 - h. Donating unused medical equipment and supplies to medical missions
 - i. Partnering with industry to promote greener packaging practices
 - j. Appropriate segregation of biohazardous and nonhazardous waste
 - k. Evening shut-off of anesthesia machines and other equipment in the OR
 - l. Institution of a “green team” to champion environmentally friendly practices within the OR
 - m. No there are no current efforts to introduce or expand any environmental sustainability efforts
 - n. Other: ____
 8. How many hours have you or other anesthesia staff in your department spent on these efforts in the last 2 years?
 - a. < 10
 - b. 11–20
 - c. 21–30
 - d. 30–40
 - e. > 40
 9. Does your department have a mandate from hospital leadership to encourage environmentally sustainable practices in the operating room?
 - a. Yes
 - b. No
 - c. Unsure
 10. Does your department have a current budget to facilitate the introduction of environmentally sustainable practices into the operating room?
 - a. Yes – and of adequate size
 - b. Yes – but inadequate size
 - c. No
 11. Does your department have any human resources to aid with the introduction of environmentally sustainable practices in the OR?
 - a. Yes – OR “Green” team
 - b. Yes – Anesthesia staff with a particular interest in this area
 - c. Yes – other ____
 - d. No
 12. What barriers have you experienced or do you foresee in the implementation of environmentally sustainable practices in the OR?
 - a. No mandate from hospital leadership
 - b. Inadequate time to plan/implement such measures
 - c. Time/turnover pressures between cases
 - d. Inadequate funding to implement such measures
 - e. No perceived staff interest
 - f. Inadequate knowledge on sustainability topics
 - g. Inadequate facilities
 - h. Other: ____
 13. Do you have any additional comments related to this survey or this topic?
- LMA = laryngeal mask airway; OR = operating room.

Appendix 2: Recycling/sustainability survey: anesthesia residency program directors

1. Does your program curriculum include any formal teaching on the topic of environmentally sustainable anesthesia practice (including recycling, environmental impact of anesthetic agents, life-cycle assessment, reusable options etc.)?
 - a. Yes
 - b. No
2. What format does this teaching currently take? (check all that apply)
 - a. Lecture/seminar
 - b. E-module
 - c. Suggested reading on this topic
 - d. Grand-rounds presentations
 - e. Journal club
 - f. Workshop
 - g. Research-based
 - h. Longitudinal program
 - i. Case-based learning
 - j. Other: ____
3. How many hours are spent on this topic in the current curriculum throughout residency?
 - a. None
 - b. 1–2 hr
 - c. 3–5 hr
 - d. > 5 hr
4. At what PGY level is this material presented?
 - a. PGY1
 - b. PGY2
 - c. PGY3
 - d. PGY4
 - e. PGY5
5. Which of the following topics are currently being taught within your curriculum?
 - a. Environmental footprints of anesthetic gases and drugs
 - b. Methods to decrease the footprint of anesthetic gases/drugs (gas capture/reflection)
 - c. Concept of life-cycle assessment in choosing reusable vs disposable products (i.e., methodology to examine the full impact of a various products throughout their life-cycle from production, to use, to disposal)
 - d. Appropriate waste-stream segregation into hazardous and nonhazardous streams
 - e. Recycling of anesthesia-related waste (where facilities are available)
 - f. Other: ____
6. How do you measure the effectiveness of the teaching in this area?
 - a. Audits of sustainability practices of residents following program
 - b. Surveys of resident satisfaction with the program

- c. Resident's self-evaluation of gained expertise or attitudes after program
 - d. Staff evaluation of resident environmentally sustainable practice
 - e. Other: ____
7. How do you feel about the amount of teaching residents receive in this area?
- a. It is more teaching than residents need.
 - b. It is just about the right amount of teaching.
 - c. Residents would benefit from more teaching in this area.
8. Are there any plans for your program to include teaching on this topic if not already implemented or to expand the currently-existing curriculum on this topic?
- a. Yes
 - b. No
9. What are the barriers to implementing/expanding such a curriculum?
- a. The topic is not relevant/important
 - b. Lack of interest from trainees
 - c. Lack of faculty expertise
 - d. Lack of institutional support
 - e. Lack of time within structured curriculum
 - f. Lack of funding for resource development
 - g. Other: ____
10. What is the best format to deliver this curriculum? (check only 1)
- a. Lecture/seminar
 - b. E-module
 - c. Suggested reading on this topic
 - d. Grand-rounds presentations
 - e. Journal club
 - f. Workshop
 - g. Research-based
 - h. Longitudinal program
 - i. Case-based learning
 - j. Other: ____
11. Would your program be interested or willing to participate in the development or implementation of a cross-Canada collaborative curriculum in this field?
- a. Yes – We would be willing to participate in the development of such a curriculum
 - b. Yes – we would be willing to implement such a curriculum
 - c. No
12. If you wish to be included in a mailing list for a working group focusing on curricular development in this field, please e-mail Maria-Alexandra Petre (principal investigator) at maria.petre@utoronto.ca
13. Do you have any additional comments on this survey or this topic?

PGY = postgraduate year.

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