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Canadian medical student perceptions of the Choosing Wisely Canada campaign

Les perceptions des étudiants en médecine canadiens concernant la campagne Choisir avec soin

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Abstract

Background: Medical student investment in resource stewardship (RS) is essential as resource overuse continues among physicians, but it is unclear whether this is influenced by hidden curriculum. This study investigated medical student perceptions of Choosing Wisely Canada (CWC).

Methods: Canadian Medical students completed a bilingual questionnaire. Chi-square and student's T-tests were used to analyze Likert responses capturing student attitudes toward questions grouped by theme, including the importance of the CWC campaign, the amount of CWC represented in undergraduate medical curriculum, the application of CWC recommendations in medicine, and the barriers which exist to student advocacy for CWC in practice.

Results: There were 3,239/11,754 (26.9%) respondents. While most students (*n* = 2,720/3,171; 85.8%) endorsed the importance of CWC, few students felt that their institution had sufficiently integrated CWC into pre-clerkship (47.0%) and clerkship (63.5%) curricula. Overall, 61.4% of students felt that it is reasonable to expect physicians to apply CWC recommendations given the workplace culture in medicine. Only 35.1% students were comfortable addressing resource misuse with their preceptor. The most common barriers included the assumption that their preceptor was more knowledgeable (86.4%), concern over evaluations (66.0%), and concern for their reputation (31.2%).

Conclusions: Canadian medical students recognize the importance of CWC. However, many trainees feel that the workplace culture in medicine does not support the application of CWC recommendations. A power imbalance exists that prevents students from advocating for RS in practice.

Résumé

Contexte : Alors que les médecins continuent à surutiliser les ressources, l'investissement des étudiants en médecine dans l'intendance des ressources (IR) est essentiel, mais il n'est pas clair s'il s'agit d'un effet du curriculum caché. La présente étude examine les perceptions des étudiants en médecine concernant la campagne Choisir avec soin (CWC).

Méthodes : Des étudiants en médecine canadiens ont été invités à remplir un questionnaire bilingue. Le test du chi carré et le test de Student ont été utilisés pour analyser leurs réponses, exprimées sur une échelle de Likert, reflétant leur position sur des questions regroupées par thème, notamment l'importance de la campagne CWC, le degré d'intégration des principes de la CWC dans le programme d'études médicales de premier cycle, l'application des recommandations de la CWC en médecine et les facteurs pratiques qui peuvent freiner la promotion de la CWC par les étudiants.

Résultats : Parmi les 3 239/11 754 (26,9 %) répondants, la plupart (n=2 720/3 171 ; 85,8 %) reconnaissaient l'importance de la CWC, mais peu d'étudiants estiment que leur établissement ait suffisamment intégré la CWC au pré-externat (47,0 %) et à l'externat (63,5 %). Dans l'ensemble, 61,4 % des étudiants estiment qu'il est raisonnable d'attendre des médecins qu'ils appliquent les recommandations de la CWC compte tenu de la culture du lieu de travail en médecine. Seuls 35,1 % des étudiants sont à l'aise pour aborder la question de la mauvaise utilisation des ressources avec leur précepteur. Les obstacles les plus courants sont la supposition que leur précepteur est mieux informé qu'eux (86,4 %), la crainte des évaluations (66,0 %) et la crainte pour leur réputation (31,2 %).

Conclusions : Les étudiants en médecine canadiens reconnaissent l'importance de la CWC. Cependant, de nombreux stagiaires estiment que la culture du lieu de travail en médecine ne favorise pas l'application des recommandations de la CWC. Le rapport de pouvoir qui y existe empêche les étudiants de défendre l'IR dans la pratique.

Introduction

Over one million unnecessary medical tests and treatments are provided to Canadians annually.[1] These comprise 30% of all medical interventions.[1] Ordering tests, treatments, or procedures that are not supported by evidence may lead to patient harm.[2] To address unnecessary testing and treatments in Canadian health care, the Choosing Wisely Canada (CWC) campaign was founded in 2014.[3,4] CWC advocates for Resource Stewardship (RS) by developing recommendations to support physicians and patients in discussing unnecessary tests, treatments, and procedures.[2]

The CanMEDS Physician Competency Framework recognizes RS as a core competency.[3] However, some physicians fear that CWC initiatives have limited impact on physician behaviour and are unlikely to influence unnecessary medical care.[5] Resident and staff physicians report that the implementation of RS in practice has been interrupted by health system culture, malpractice concerns, patient expectations, and time constraints.[5–10] Most physicians work in busy practice environments and these dissuading factors are pronounced when the application of RS challenges traditional practice patterns, requiring further explanation and expectation management. Thus, it is important to train medical students in RS as good practice habits develop early in training.[11–14] As medical students train alongside residents, they are impacted by the hidden curriculum of informal teaching related to test and treatment selection.[11,12,15,16] Students are encouraged by their seniors to order many tests to demonstrate their knowledge, continuously perpetuating a culture which may be addressed early in undergraduate medical education.[15]

RS practice is innately associated with clinical reasoning.[17] Thus, the integration of RS into core undergraduate medical curriculum may be in the best interest of curriculum planners. However, medical students must be equally invested in this endeavour. Currently, there is scant literature assessing the perceptions of Canadian medical students on RS. Moreover, studies have not described the barriers which students experience to advocating for RS in practice. This study investigated the perceptions of Canadian medical students related to the CWC campaign using questions constructed based on prior studies stemming from a literature search (Appendix A).

Material and methods

Context & research team

Students are selected annually to be STARS (Students & Trainees Advocating for Resource Stewardship) representatives at each Canadian medical school. This study was initiated by the primary study team, composed of Dalhousie STARS and a physician lead. The national study team was comprised of representatives from all 17 Canadian medical schools, who aided in the design and dissemination of the questionnaire at their institution.

Study Purpose

A cross-sectional study was performed to assess Canadian medical student perceptions of CWC and its recommendations. Survey questions collected included demographic characteristics, as well as other questions pertaining to student opinions toward CWC. The primary objective of this study was to explore whether students perceive the CWC campaign as an important initiative. Another aim was to determine whether perceptions changed as students spent more time in practice through clerkship versus pre-clerkship. We hypothesized that negative attitudes toward CWC may increase as students progressed through their training due to the hidden curriculum in medicine. At the time of survey completion, pre-clerks were defined as students in the class of 2023 and 2024, as well as the class of 2025 at l'Université Laval. Students in the class of 2021 and 2022 were grouped as clerks. For pre-clerkship and clerkship comparisons, MD/PhD students as well as students that completed greater than six months of training at a medical school outside of Canada were excluded as their experiences were likely not representative of students that had completed full pre-clerkship and clerkship training without interruptions.

Secondary objectives were to identify whether students hold negative perceptions of the CWC, to determine whether students feel that there is sufficient emphasis on CWC in their curriculum, to establish whether students believe that the workplace culture in medicine permits the application of CWC recommendations, and to identify student-perceived barriers to advocating for the application of CWC recommendations in clinical practice.

STARS survey instrument design

Questions in the survey were grouped by theme (Appendix B). The questionnaire was piloted by 33 investigators in the national study team and was iteratively revised with feedback. Minor changes were made to the survey,

including changes related to phrasing, formatting, and logistical delivery of the questionnaire on the anonymous online platform *Opinio* (Object Planet, Oslo, Norway). The platform does not permit multiple survey submissions as IP addresses are recorded and duplicates are not accepted. The questionnaire was distributed in both English (Appendix C) and French (Appendix D) to all 11,754 students in Canada.[18]

Sample size

Assuming a study population of 11,754,[18] a total of 2,502 students were needed to detect a minimum difference of 5% between pre-clerkship and clerkship student ratings of the importance of the CWC campaign while maintaining 80% power with an alpha level of 0.05.

Data collection

Anonymous survey links were distributed through email to all Canadian medical students over a consecutive four-week period from March 1st, 2021 to May 31st, 2021. The timing of the four-week dissemination window was at the discretion of study investigators at their respective institutions within this timeframe. Canadian medical students were eligible to complete the questionnaire once. Members of the study team were not permitted to complete the survey. MD-PhD students and students that completed six months or more of training outside of their home institution were excluded for comparisons between pre-clerkship and clerkship students. Participation in the study was voluntary and informed consent was submitted with survey completion. Data was collected anonymously over a secure web browser. Once students completed the survey, they had the option of entering a draw to win one of two Apple Watches or a $50 gift card.

Analysis

Eighteen categorical variables were summarized as numbers and frequency percentage. Likert-type items were dichotomized as follows: Strongly Disagree/Disagree/Neutral versus Agree/Strongly Agree or Very Negatively/Negatively/Neutral versus Positively/Very positively. "Unsure" responses were grouped together with the "Disagree"/"Negatively" or "No" responses, where applicable. For individual Likert items and yes/no questions, differences between demographic groups were compared using Chi-square test of independence. For summation of multiple Likert items, differences between demographic groups were compared using Student's t-test. Demographic groups of interest included: Clerk/Pre-clerk, Gender (Women/Men), Age (<25/≥25), Upbringing (Rural/Urban), and Months in practice (0-3/≥4). Incomplete survey responses were included. Cronbach's alpha reliability coefficient was measured, with acceptable reliability set at values >0.7 a priori. A two-sided P value of < 0.05 was the threshold for statistical significance. Analyses were performed using SAS statistical software version 9.4 (SAS Institute Inc., Cary, N.C, USA).

Ethics

Email addresses submitted for the draw were stored separately from the primary data and handled by alternate study investigators to those performing data analysis to maintain anonymity. No personal identifiers were collected. This study adhered to Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.[19] Research ethics approval was obtained at applicable institutions (Appendix E).

Results

Population

A total of 3,239/11,754 (27.6%) Canadian medical students responded, with students in the pre-clerkship (n = 2,005/3,239; 61.9%) and the clerkship (1,157/3,239; 35.7%) stages of training. Population demographics are summarized in Table 1. The survey instrument met acceptable reliability for all study objectives except for student perceptions of the CWC campaign in their undergraduate curriculum (Cronbach's α 0.65). Questions pertaining to this theme were interpreted individually (Table 2).

Importance of the CWC campaign

Mean scores for each item in the questionnaire are listed in Table 3. Overall, the cohort emphasized the importance of CWC [mean = 12.4/15.0 (SD = 1.98)]. Canadian medical students reported that the CWC campaign is important (2,720/3,171; 85.8%), though fewer students felt that their classmates also believed in the importance of CWC (2,033/3,171; 64.1%). Most students felt that they should implement CWC recommendations in their future practice (2,788/3,171; 87.9%). Clerks, women, those ≥25 years of age and those that spent ≥4 months in practice rated CWC as important more often than their counterparts (Appendix F).

Table 1. Demographic characteristics of Canadian medical student survey respondents

	Total n (%)	Total n (%)	
		Pre-clerks	Clerks
		(*n* = 3,162)	
Class Year	(*n* = 3,239)	(*n* = 2005)	(*n* = 1,157)
2021	587 (18.1)	0 (0.0)	587 (50.7)
2022	570 (17.6)	0 (0.0)	570 (49.3)
2023	1024 (31.6)	1024 (51.1)	0 (0.0)
2024	883 (27.3)		0 (0.0)
Other	175 (5.4)		
School	(*n* = 3,239)	(*n* = 2005)	(*n* = 1,157)
University of Alberta	254 (7.8)	134 (6.7)	114 (9.9)
University of British Columbia	377 (11.6)	239 (7.6)	126 (10.9)
University of Calgary	153 (4.7)	67 (3.3)	83 (7.2)
Dalhousie University	193 (6.0)	103 (5.1)	89 (7.7)
Université Laval	349 (10.8)	271 (13.5)	75 (6.5)
University of Manitoba	123 (3.8)	61 (3.0)	58 (5.0)
McGill University	175 (2.2)	108 (5.4)	65 (5.6)
McMaster University	83 (2.6)	31 (1.5)	51 (5.6)
Université de Montréal	189 (5.9)	143 (7.1)	32 (2.8)
Memorial University of Newfoundland	76 (2.3)	40 (2.0)	35 (3.0)
Northern Ontario School of Medicine	71 (2.2)	40 (2.0)	30 (2.6)
University of Ottawa	240 (7.4)	158 (7.9)	68 (5.9)
Queen's University	83 (2.6)	59 2.9)	21 (1.8)
University of Saskatchewan	84 (2.6)	73 (3.6)	
Université de Sherbrooke	330 (10.2)	184 (9.2)	141 (12.2)
University of Toronto	274 (8.4)	162 (8.1)	99 (8.6)
Western University	185 (5.7)	122 (3.9)	60 (5.2)
Gender	(*n* = 3,239)	(*n* = 2005)	(*n* = 1,157)
Men	1053 (32.5)	628 (31.3)	397 (34.3)
Women	2156 (66.6)	67.8 (1359)	749 (64.7)
Age	(*n* = 3,239)	(*n* = 2005)	(*n* = 1,157)
≤24	1,749 (54.0)	1,308 (65.3)	408 (35.2)
25+	1,490 (45.4)	697 (34.7)	749 (64.8)
Upbringing	(*n* = 3,239)	(*n* = 2005)	(*n* = 1,157)
*Urban	2434 (75.1)	477 (23.7)	269 (25.0)
**Rural	775 (23.9)	1,509 (75.3)	858 (74.2)
Months in Clinical Practice	(*n* = 3,239)	(*n* = 2005)	(*n* = 1,157)
≤3	1911 (59.1)	1,806 (90.2)	65 (5.6)
4-6	293 (9.1)	62 (3.1)	224 (19.4)
7-12	443 (13.7)	80 (4.0)	347 (30.1)
>12	584 (18.1)	55 (2.7)	517 (44.8)

**Urban: Population >1000; **Rural: Population <1000*

Table 2. Performance & reliability of the survey instrument, by theme

Theme	Mean	SD	Cronbach's α*
Importance of CWC	12.4/15.0	1.98	0.82
Negative Attitudes toward CWC	12.0/25.0	3.1	0.74
CWC in Undergraduate Curriculum	N/A	N/A	0.65
Workplace Culture & CWC	20.5/30.0	3.9	0.75

**Cronbach's $\alpha > 0.7$ was considered as an acceptable threshold for reliability.*

Table 3. Perceptions of Canadian medical students toward the CWC campaign

	Agree n (%)
Importance of the CWC Campaign (*n* = 3,171)	
The CWC campaign is important to me	2720 (85.8)
The CWC campaign is important to my classmates	2033 (64.1)
It is important to implement CWC recommendations into my future practice	2788 (87.9)
Negative Perceptions Toward the CWC Campaign (*n* = 2,990)	
The CWC campaign is a trend that will pass	167 (5.6)
Applying CWC recommendations in practice could pose danger to patients	276 (9.2)
CWC recommendations are just a tool to save resources in a strapped system	541 (18.1)
I am worried that I will miss an important diagnosis by applying CWC recommendations	937 (31.3)
It is unlikely that CWC recommendations will change physician practices	259 (8.7)
CWC Campaign in Undergraduate Curriculum (*n* = 2,990)	
It is important to integrate CWC recommendations into pre-clerkship curriculum	2587 (86.5)
It is important to integrate CWC recommendations into clerkship curriculum	2503 (83.7)
My school has sufficiently integrated CWC principles into the pre-clerkship curriculum	1406 (47.0)
My school has sufficiently integrated CWC principles into the clerkship curriculum	735 *(63.5)
Workplace Culture in Medicine & the CWC Campaign (*n* = 2,990)	
The CWC recommendations are compatible with the workplace culture in medicine	1691 (56.6)
Given the workplace culture in medicine, it is reasonable to expect physicians to apply CWC recommendations in clinical practice	1837 (61.4)
The workplace culture in medicine places an ethical requirement of physicians to apply CWC recommendations in clinical practice	1620 (54.2)
I believe that I can contribute to a workplace culture that incorporates CWC recommendations into routine practice	2458 (82.2)
During home electives/placements/clerkship rotations, students can contribute to a workplace culture that upholds the core values of CWC	439 (14.7)
My preceptor makes a decision misaligned with CWC Recommendations. My preceptor will complete an evaluation of me at the end of my clinical experience. In this context, I would likely address these concerns regarding RS with my preceptor	1049 (35.1)
Student-Perceived Barriers to Addressing Misuse with Preceptors (*n* = 2,986)	
Respecting my preceptor's choices	2076 (69.5)
Assuming that my preceptor is more experienced and/or knowledgeable	2581 (86.4)
Concern over evaluations	1973 (66.0)
Won't make a difference	428 (14.3)
Concerned about my reputation	933 (31.2)
Not a priority	186 (6.2)
May cause patient harm	577 (19.3)
Legal implications	388 (13.0)
Other (*n* = 3,067)	
The inappropriate use of resources is one of the top 5 problems in medicine	2213 (72.2)
If a preceptor demonstrated disinterest in CWC recommendations, it would negatively affect my perception of their professionalism	1818 (59.3)

**Out of 1,157 clerkship students.*

Negative attitudes toward the CWC campaign

Most students did not have negative perceptions about the CWC campaign [mean = 12.0/25.00 (SD = 3.1)]. Few students (276/2,990; 9.2%) felt that applying CWC recommendations in practice would pose a danger to patients, and that CWC recommendations are unlikely to change physician practices (259/2,990; 8.7%). However, 541/2,990 (18.1%) students felt that the CWC recommendations are a tool to save resources in a strapped system, while 937/2,990 (31.3%) students were concerned about missing an important diagnosis by applying CWC recommendations. Pre-clerks, men, and urban-raised students more often reported negative perceptions of CWC than their counterparts (Appendix F).

Integration of CWC campaign into undergraduate medical curriculum

Most students felt that it is important to integrate CWC recommendations into pre-clerkship (2,587/2,990; 86.5%) and clerkship (2,503/2,990; 83.7%) curricula. However, fewer students felt that their institution had sufficiently integrated CWC principles of RS into the pre-clerkship (1,406/2,990; 47.0%) and clerkship (735/1,157; 63.5%) curricula. Women emphasized the importance of

integrating CWC into pre-clerkship and clerkship curriculum more often than men (Appendix F).

Workplace culture in medicine & CWC campaign

Students did not feel that the workplace culture in medicine was compatible with CWC recommendations [mean = 20.6/30.0 (SD = 3.9)]. Only 439/2,990 (14.7%) students felt that they could contribute to a workplace culture that applies CWC recommendations in routine practice during their undergraduate training. In total, 1,620/2,990 (54.2%) respondents felt that physicians are ethically obligated to apply CWC recommendations in practice. Only 1,837/2,990 (61.4%) students felt that it is reasonable to expect physicians to apply CWC recommendations given the workplace culture in medicine.

Only 1,049/2,990 (35.1%) students would address resource misuse with their preceptor. Of those that would act, the majority would do so through verbal communication (871/1,049; 83.0%) and fewer (528/1,049; 50.3%) would lead by example by demonstrating the application of CWC recommendations.

Student-perceived barriers to addressing misuse with preceptors

The assumption that their preceptor is more experienced and/or knowledgeable prevented many students (2,581/2,986; 86.4%) from addressing resource misuse with their preceptors. However, many students cited concern over evaluations (1,973/2,986; 66.0%) as a barrier to advocating for RS with their preceptors. A significant group cited concern for their reputations (933/2,986; 31.2%) and patient harm (577/2,986; 19.3%) as barriers to speaking up. Some students cited that speaking with their preceptor would not make a difference (428/2,986; 14.3%) and that they were concerned over legal implications of doing so (388/2,986; 13.0%).

Top five problems & professionalism

About two-thirds of students felt that the inappropriate use of resources is one of the top five problems in medicine (2,213/3,067; 72.2%), reported more often by urban students than their rural counterparts (Appendix F).

In total, 1,818/3,067 (59.3%) students reported that preceptors demonstrating disinterest in CWC recommendations would negatively affect their perception of their preceptor's professionalism, reported less often by clerks and those that spent ≥4 months in practice (Appendix F).

Discussion

There is a paucity of literature identifying student opinions on resource stewardship. This national cross-sectional survey study establishes the perspectives of Canadian medical students toward Choosing Wisely Canada and its recommendations. Student belief in the importance of CWC, the presence of negative perceptions surrounding CWC recommendations, their interest in increasing the integration of CWC principles into undergraduate medical curriculum, their beliefs pertaining to the compatibility of workplace culture and CWC recommendations, and their ability to advocate for applying RS in clinical practice were identified. To our knowledge, these themes pertaining to medical student opinions toward RS in medicine have yet to be reported in the literature.

Perceptions of CWC

Most Canadian medical students in this cohort endorsed the importance of the CWC campaign, but 22% fewer students felt that their colleagues shared this view. This has yet to be reported and suggests that students may be exposed to negative views of RS from their colleagues. In contrast, it is suggested that health professions students feel that Choosing Wisely is important to their classmates, though this study was limited in sample size.[20] Another unique finding was that females were more likely to rate the importance of CWC as high compared to males. Elsewhere, there is strong literature to support that women express higher concern about environmental stewardship compared to males.[21] It is surmised that personality differences such as higher conscientiousness among females versus males account for this finding,[21] and this may apply to RS in medicine as well. Notably, students that spent more time in clinical practice were more likely to appreciate the importance of the initiative. This is another new finding which contradicts the initial hypothesis that negative perceptions would become more apparent with more clinical experience. As overuse continues despite the promotion of CWC recommendations,[2] Canadian medical students may more readily recognize the benefit of applying RS after experiencing its utility in clinical scenarios.

Canadian medical students are not devoid of RS hesitance. About one-third of the cohort was worried about missing an important diagnosis by applying CWC recommendations. There are anecdotal reports that

students learn to be good trainees by ordering many tests to demonstrate their ability to generate a thorough differential and are rewarded for doing so.[22] However, this study contributes primary data supporting this hypothesis. While it is advantageous for learning purposes that academic clinicians challenge students to expand their differential diagnoses, for the sake of patient care it may be prudent for these physicians to further encourage students to critically consider the utility of ordering certain tests. Otherwise, these represent missed opportunities to convey to students that ordering unnecessary tests exposes patients to avoidable harm.[1]

CWC & workplace culture

One study suggested that physician behaviour toward unnecessary care is not influenced by CWC.[5] This may be due to an incompatibility with medical culture, as almost half of students in our survey felt that it is unreasonable to expect physicians to apply CWC recommendations given the workplace culture in medicine. A hidden curriculum appears to abut student beliefs that CWC recommendations are important, which perpetuates a culture of inappropriate care and overuse.[23] Students exposed to this environment may be persuaded to make decisions which align more with perceived staff expectations than with the RS principles underlying the CWC recommendations. This is the first study to contribute primary data to support that medical students perceive that there a pressure to please the staff and "order first and ask questions later," as reported anecdotally.[22]

A significant portion of students reported that addressing resource misuse with their preceptor would not make a difference. This is a unique finding from this study, and it is unclear whether these preceptors were influenced by system pressures, prior clinical experiences, or personal beliefs. Physicians report that apprehensiveness to apply CWC recommendations may stem from system issues including a lack of time, malpractice concerns as well as patient requests for services.[6] However, our cohort of medical students voiced that they felt restricted from addressing resource misuse with even their preceptors. To our knowledge, no prior literature has identified barriers which prevent medical students from advocating for RS in clinical practice. Reported barriers included concern over evaluations and concern over their reputation. It is well documented that medical trainees feel restricted from questioning decisions in care made by their seniors,[24] due to the fear of being wrong, jeopardizing an ongoing relationship, concern for their reputation, and concern for evaluations. Furthermore, a significant power imbalance exists between students and their supervisors, as preceptors may influence student evaluations, reference letters, and residency program success.[24] This power imbalance may largely contribute to student-perceived inability to advocate for RS, as trainees fear that preceptors might in turn hinder their career efforts. This further supports the presence of a "hidden curriculum" due to medical hierarchy which prevents students from advocating for RS in practice. This perpetuation of resource misuse is a major challenge to ensuring improvement in RS uptake by future physicians, and a top-down approach at the institutional level may be necessary to overcome this barrier.

Great progress has been made through medical institutions and organizations such as CWC using a "bottom-up" approach. However, medical students may be "learning" that applying RS is clinically impractical. One recent study at a Canadian centre found that 60% of tests ordered at their institution did not have clinical utility.[26] With student-perceived barriers including concern over evaluations and reputations, it is apparent that a "top-down" approach at the institutional level is needed to initiate substantive change. Medical schools can aim to foster a culture of RS by tracking trainee-reported encounters of resource misuse in practice which are de-identified to help inform focused plans to reduce resource misuse. Additionally, medical institutions can develop an annual RS teaching award for physicians to further foster this culture. Moreover, it is crucial that Canadian medical institutions partner with relevant department heads at their affiliated care centres to combat a hidden curriculum that hinders the practise of RS. Without full physician buy-in, the culture of misuse will continue to perpetuate itself while students miss chances to learn to apply RS as they progress through their training. More sophisticated measures are necessary to track resource misuse in practice, establish its prevalence, inform strategies to improve resource usage, and track improvement.

Limitations

This study assessed student attitudes toward CWC, though it is possible that student opinions of the CWC campaign differ from their feelings toward RS. Moreover, although a national sample was obtained, the cross-sectional nature of this study may have allowed for volunteer bias such that the perceptions of this cohort do not fully represent those of all Canadian medical students. Additionally, due to the

nature of 5-point Likert scales, "neutral" and "unsure" responses were grouped with "no" responses and the data must be interpreted accordingly. Furthermore, qualitative methods may have better uncovered why students felt unable to advocate for RS in practice. To address these limitations, focus groups should be conducted at each institution to uncover why students feel that the workplace culture in medicine is not conducive to applying CWC recommendations for physicians. Future work should also aim to identify student understanding of the CWC campaign and attempt to quantify how often students see CWC recommendations applied when applicable based on the clinical scenario.

Conclusions

Medical students feel that the CWC campaign is an important initiative, and that there should be more RS teaching in undergraduate medical curriculum. However, students also feel that the workplace culture in medicine is not conducive to the application of CWC recommendations in practice. Student-perceived barriers to addressing resource misuse with preceptors include concern over evaluations, concern over reputations, assuming a preceptor is more experienced, and anticipating that it will not make a difference. Canadian medical institutions should partner with affiliate care centres to break down the hidden curriculum in medicine which perpetuates resource misuse. This top-down approach may consist of Canadian medical schools encouraging trainees to report de-identified instances of resource misuse to identify areas for growth.

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Appendices

Appendix A: Survey construction

The primary study team conducted a literature search on October 4th, 2020. The following terms were included in our literature search: “medical student”, “medical students”, “medical student”, “resource stewardship”, “high-value care”, “choosing wisely”, “cost-conscious care”, "Medical Overuse/prevention and control”, and "Clinical Decision-Making”. The primary study team screened 215 articles by title and abstract to yield 12 articles. Studies written in a non-English language or assessing perceptions of postgraduate medical trainees, physicians, or other healthcare providers were excluded. Studies were included if they examined undergraduate medical student perceptions of RS. The primary study team then completed a second round of screening by full text. The supervising investigator resolved conflicts at both stages. Similar inclusion and exclusion criteria were applied, yielding a total of two articles. The results of the literature search were used to build an evidence-based survey. Survey questions were developed and grouped together by theme. All study investigators participated in the development of the survey instrument, delivered in both English and French.

Appendix B: Survey themes & sample survey questions

Theme	Sample Survey Items
Is the CWC* campaign important to students?	Do you agree that "is it important to implement CWC recommendations into my future practice as a physician"
Do students have negative Attitudes toward the CWC campaign?	Please indicate whether you agree that the CWC campaign is a trend that will pass
Do students feel that the CWC campaign is sufficiently integrated into their undergraduate curriculum?	Please indicate whether your school has sufficiently integrated CWC's principles of RS into the pre-clerkship (and clerkship) curriculum.
Do students believe that the workplace culture in medicine permits the application of CWC recommendations?	Please indicate whether you agree that it is reasonable to expect physicians to apply CWC recommendations in clinical practice.

** CWC = Choosing Wisely Canada; **RS = Resource Stewardship*

Appendix C: Survey instruments (English)

Demographics:

Please indicate your school

- Dalhousie University - NS
- Dalhousie University - NB
- McGill University - Montreal
- McGill University - Gatineau
- McMaster University - Hamilton
- McMaster University - Niagara
- McMaster University - Waterloo
- Memorial University of Newfoundland
- Northern Ontario School of Medicine - Sudbury
- Northern Ontario School of Medicine - Thunder Bay
- Queen's University
- Université de Montréal - Montréal
- Université de Montréal - Trois-Rivières
- Université de Sherbrooke - Sherbrooke
- Université de Sherbrooke - Saguenay
- Université de Sherbrooke - Moncton
- Université de Laval
- University of Alberta
- University of British Columbia - Vancouver
- University of British Columbia - Victoria
- University of British Columbia - Prince George
- University of British Columbia - Kelowna
- University of Calgary
- University of Manitoba
- University of Ottawa
- University of Saskatchewan
- University of Toronto - Toronto
- University of Toronto - Mississauga
- Western University - London
- Western University - Windsor

Please indicate your class year

- 2025 (Laval)
- 2024
- 2023
- 2022
- 2021
- MD/PhD
- Other

What gender do you most closely identify with?

- Man
- Woman
- I prefer to self-describe as [free text]
- Prefer not to answer

What is your current age?

- <21
- 22-24
- 25-29
- 30-34
- 35+
- Prefer not to answer

What is your highest level of education received prior to entering medicine?

- Bachelor's

- Masters
- PhD
- Healthcare professional [free text]
- CÉGEP
- High School
- Prefer not to answer

Do you consider yourself as an individual raised in an urban or rural community?

- Rural
- Urban
- Prefer not to answer

Please indicate the number of months you have spent in practice (rotations, electives, placements, etc.)

- [Free Text]

Perceptions:

1. **Please indicate how much you agree with the following:**

(1 = Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5 = Strongly Agree, Unsure)

- The Choosing Wisely Canada™ campaign is important to me
- The Choosing Wisely Canada™ campaign is important to my classmates
- It is important to implement Choosing Wisely Canada™ recommendations into my future practice as a physician

2. **Do you think that the inappropriate use of resources (underuse defined as withholding resources despite proven benefit, overuse defined as use of resources in the absence of evidence) is one of the top 5 problems in medicine today?**
   a. Yes
   b. No
   c. Unsure

   i. **Please select the main reason(s) why you consider the inappropriate use of resources to be a problem:**
      a. Waste of limited resources prevents some facets of care to be provided
      b. Harms or risks to patients from unnecessary tests or treatments
      c. Overuse makes wait lists longer
      d. Underuse may lead to missed or delayed diagnosis
      e. Unnecessary spending in healthcare
      f. Other: [Free Text]

3. **If a preceptor demonstrated disinterest in Choosing Wisely Canada™ recommendations, how would this affect your perception of their professionalism**

(1 = Very Negatively, 2 = Negatively, 3 = Neutral, 4 = Positively, 5 = Very Positively, Unsure)?

4. **Please indicate how much you agree with the following statements**

(1 = Strongly Disagree, 2= Disagree 3= Neutral, 4= Agree, 5 = Strongly Agree, Unsure):

- The Choosing Wisely campaign is a trend that will pass
- Applying Choosing Wisely recommendations in practice could pose danger to patients as they will not receive the right tests or enough treatment
- Choosing Wisely recommendations are just a tool to save resources in a strapped system
- I am worried that I will miss doing an important diagnosis by applying Choosing Wisely recommendations
- It is unlikely that Choosing Wisely recommendations will change physician practices

5. **Please indicate how much you agree with the following statements**

(1 = Strongly Disagree, 2= Disagree 3= Neutral, 4= Agree, 5 = Strongly Agree, Unsure, Not applicable):

- It is important to integrate Choosing Wisely Canada™ recommendations into pre-clerkship curriculum
- It is important to integrate Choosing Wisely Canada™ recommendations into clerkship curriculum
- My school has sufficiently integrated Choosing Wisely Canada™'s principles of resource stewardship into the pre-clerkship curriculum
- My school has sufficiently integrated Choosing Wisely Canada™'s principles of resource stewardship into the clerkship curriculum

6. **Please indicate how much you agree with the following statements**

(1 = Strongly Disagree, 2= Disagree 3= Neutral, 4= Agree, 5 = Strongly Agree, Unsure):

- The Choosing Wisely recommendations are compatible with the workplace culture of medicine

- Given the workplace culture in medicine, it is reasonable to expect physicians to apply Choosing Wisely recommendations in clinical practice
- The workplace culture in medicine places an ethical requirement of physicians to apply Choosing Wisely recommendations in clinical practice

7. **What are some potential workplace barriers that physicians experience when attempting to apply Choosing Wisely Canada™ recommendations? (Select all that apply)**
    a. Time constraints
    b. Malpractice concerns
    c. Patient requests for services
    d. Specialist recommendations
    e. Habit/Traditional practice
    f. Other [Free Text]

8. **Please indicate how much you agree with the following statements (1 = Strongly Disagree, 2= Disagree 3= Neutral, 4= Agree, 5 = Strongly Agree, Unsure):**
    - I believe that I can contribute to a workplace culture that incorporates Choosing Wisely recommendations into routine practice
    - During electives/placements/clerkship rotations, students can contribute to a workplace culture that upholds the core values of Choosing Wisely Canada™

9. **Imagine you are a <u>student</u> on rotation/elective/placement, etc. You notice your preceptor making a decision which you believe does not align with Choosing Wisely recommendations. Your preceptor will complete an evaluation of you at the end of your clinical experience.**
    a. How likely is it that you would address this with your preceptor?

(1 = Very Unlikely, 2 = Unlikely, 3 = Neutral, 4 = Likely, 5 = Very Likely, Unsure)

b. If you did intervene, please select how you would do so:
    i. Would not act
    ii. Unsure
    iii. Verbally communicate to your preceptor
    iv. Non-verbal communication (displaying disapproval by body language)
    v. Lead by example by demonstrating the implementation of Choosing Wisely recommendations
    vi. Other: please list [Free Text]

c. Indicate potential barriers to you addressing this with your preceptor? (Select all that apply. Answer this question regardless of your answer to the previous question)
    i. Respecting your preceptor's choices
    ii. Assuming that your preceptor is more experienced and/or knowledgeable in this clinical scenario
    iii. Concern over evaluations
    iv. Won't make a difference
    v. Concerned about your own reputation
    vi. It's not a priority
    vii. May cause patient harm
    viii. Legal implications
    ix. Other [Free Text]
    x. Unsure

Appendix D: Survey Instrument (French)

Démographie :

Indiquez votre université

- Dalhousie University - NS
- Dalhousie University - NB
- McGill University - Montreal
- McGill University - Gatineau
- McMaster University - Hamilton
- McMaster University - Niagara
- McMaster University - Waterloo
- Memorial University of Newfoundland
- Northern Ontario School of Medicine - Sudbury
- Northern Ontario School of Medicine - Thunder Bay
- Queen's University
- Université de Montréal - Montréal
- Université de Montréal - Trois-Rivières
- Université de Sherbrooke - Sherbrooke
- Université de Sherbrooke - Saguenay
- Université de Sherbrooke - Moncton
- Université de Laval
- University of Alberta
- University of British Columbia - Vancouver
- University of British Columbia - Victoria
- University of British Columbia - Prince George
- University of British Columbia - Kelowna
- University of Calgary
- University of Manitoba
- University of Ottawa
- University of Saskatchewan
- University of Toronto - Toronto
- University of Toronto - Mississauga
- Western University - London
- Western University - Windsor

Veuillez indiquer l'année d'obtention de votre diplôme

- 2025 (Laval)
- 2024
- 2023
- 2022
- 2021
- MD/PhD
- Autre

À quel genre vous identifiez-vous le plus?

- Homme
- Femme
- Je préfère me décrire comme [free text]
- Je préfère ne pas répondre

Quel âge avez-vous?

- <21
- 22-24
- 25-29
- 30-34
- 35+

- Je préfère ne pas répondre

Quel est votre niveau d'éducation le plus élevé reçu avant d'entrer en médecine?

- Baccalauréat
- Maîtrise
- Doctorat
- Professionnel de la santé [free text]
- CÉGEP
- Je préfère ne pas répondre

Venez-vous d'une communauté urbaine ou rurale

- Rurale
- Urbaine
- Je préfère ne pas répondre
-

Veuillez indiquer le nombre de mois que vous avez passé en stage (rotations, placements, stages optionnels etc.)

- [Free Text]

Perceptions:

1. À votre avis, veuillez indiquer dans quelle mesure vous êtes d'accord avec ce qui suit

(1 = Pas du tout d'accord, 2 = Pas d'accord 3 = Neutre, 4 = D'accord, 5 = Tout à fait d'accord, Incertain(e):

• La campagne *Choisir avec soin Canada™* est importante pour moi
• Je pense que la campagne *Choisir avec soin* est importante pour mes camarades de classe
• Il est important d'appliquer les recommandations de *Choisir avec soin Canada™* dans ma future pratique en tant que médecin

2. Pensez-vous que l'utilisation inappropriée des ressources (sous-utilisation définie comme la rétention de ressources malgré un bénéfice prouvé, la surutilisation définie comme l'utilisation des ressources en l'absence de preuves) est l'un des 5 principaux problèmes de la médecine aujourd'hui ?

a. Oui
b. Non
c. Incertaine

3. Veuillez sélectionner la ou les principale.s raison.s pour laquelle/ lesquelles vous considérez l'utilisation inappropriée des ressources comme un problème:

1. Le gaspillage de ressources limitées empêche que certaines facettes de soins soient fournies
2. Des dommages ou risques pour les patients de tests ou de traitements inutiles
3. La surutilisation allonge les listes d'attente
4. Autre: [Texte libre]

4. Si un précepteur démontre un désintérêt pour les recommandations du *Choisir avec soin Canada™* CASC, comment cela affecterait-il votre perception de son professionnalisme

(1 = Très négativement, 2 = Négativement, 3 = Neutre, 4 = Positivement, 5 = Très positivement, Incertain(e)?

5. Veuillez indiquer dans quelle mesure vous êtes d'accord avec les affirmations suivantes

(1 = Pas du tout d'accord, 2 = Pas d'accord 3 = Neutre, 4 = D'accord, 5 = Tout à fait d'accord, Incertain(e):

• La campagne *Choisir avec soin* est une tendance qui ne durera pas
• L'application des recommandations de *Choisir avec soin* dans la pratique pourrait présenter un danger pour les patients, car ils ne recevront pas les bons tests ou le traitement suffisant
• Les recommandations de *Choisir avec soin* ne sont qu'un outil permettant d'économiser des ressources dans un système à court terme
• Je crains de manquer de mener un sondage médicale importante en appliquant les recommandations *Choisir avec soin*
• Il est peu probable que les recommandations *Choisir avec soin* changent les pratiques des médecins

6. Veuillez indiquer dans quelle mesure vous êtes d'accord avec les affirmations suivantes

(1 = Pas du tout d'accord, 2 = Pas d'accord 3 = Neutre, 4 = D'accord, 5 = Tout à fait d'accord, Incertain(e), Sans objet):

• Il est important d'intégrer les recommandations de Choisir avec soin Canada™ dans le programme pré-clinique.
• Il est important d'intégrer les recommandations de Choisir avec soin Canada™ lors de l'externat

• Mon université a suffisamment intégré les principes d'intendance des ressources de *Choisir avec soin Canada™* dans le programme d'études préalables à l'externat
• Mon université a suffisamment intégré les principes d'intendance des ressources de *Choisir avec soin Canada™* dans le programme d'externat

7. Veuillez indiquer dans quelle mesure vous êtes d'accord avec les affirmations suivantes

(1 = Pas du tout d'accord, 2 = Pas d'accord 3 = Neutre, 4 = D'accord, 5 = Tout à fait d'accord, Incertain(e)):
• Les recommandations *Choisir avec soin* sont compatibles avec la culture de la médecine en nos milieus de travail
• Compte tenu de la culture du milieu de travail en médecine, il est raisonnable de s'attendre à ce que les médecins appliquent les recommandations *Choisir avec soin* dans la pratique clinique
• La culture du milieu de travail en médecine impose aux médecins une obligation éthique d'appliquer les recommandations *Choisir avec soin* dans la pratique clinique

8. Quels sont les obstacles potentiels auxquels les médecins font face au travail lorsqu'ils tentent d'appliquer d'utiliser les recommandations de *Choisir avec soin Canada™* ? (Sélectionnez tout ce qui s'y rapporte)

a. Contraintes de temps
b. Craintes de faute professionnelle
c. Demandes de services des patients
d. Recommandations de spécialistes
e. Autre [Texte libre]

9. Veuillez indiquer dans quelle mesure vous êtes d'accord avec les affirmations suivantes (1 = Pas du tout d'accord, 2 = Pas d'accord 3 = Neutre, 4 = D'accord, 5 = Tout à fait d'accord, Incertain-e):

• Je peux contribuer à une culture de travail qui intègre les recommandations *Choisir avec soin* dans la pratique courante
• Pendant les stages au choix / Placement, les étudiants peuvent contribuer à une culture de travail qui respecte les valeurs fondamentales de *Choisir avec soin Canada™*

10. Imaginez un scénario où vous êtes **un(e) étudiant(e)** à l'externat/ en stage à option, etc. Vous remarquez que votre précepteur prend une décision qui, selon-vous, ne correspond pas aux recommandations de *Choisir avec soin*. Votre précepteur effectuera une évaluation de vous à la fin de votre expérience clinique.
    a. Quelle est la probabilité que vous abordiez cette question avec votre précepteur?

(1 = Très improbable, 2 = Improbable, 3 = Neutre, 4 = Probable, 5 = Très probable, Incertain(e))

b. Si vous souhaitez agir, veuillez sélectionner comment vous le feriez:
    i. N'agirait pas
    ii. Ne serait pas certain(e)
    iii. Communiquez verbalement à votre précepteur
    iv. Communication non verbale (affichage de la désapprobation par le langage corporel)
    v. Changer sa propre pratique (démontrer la mise en œuvre des recommandations *Choisir avec soin* par exemple)
    vi. Autre: Veuillez indiquer [Texte libre]

c. Quels sont les obstacles potentiels qui pourraient vous empêchent de résoudre ce problème avec votre précepteur ? (Sélectionnez tout ce qui s'applique. Répondez à cette question quelle que soit votre réponse à la question précédente)

i. Respecter les choix de votre précepteur
ii. Préoccupation concernant les évaluations
iii. Cela ne fera aucune différence
iv. Soucieux de votre propre réputation
v. Ce n'est pas une priorité
vi. Peut nuire au patient
vii. Implications légales
viii. Autre [Texte libre]
ix. Incertain(e)

Appendix E: Research ethics approval at Canadian medical institutions

#	School	Research Ethics Board/Access	Approval & Application No.	Approval Date
1	University of Alberta	University of Alberta Research Ethics Board 2	Pro00110612	May 3rd, 2021
2	University of British Columbia	Learner Access Advisory Council Accepted Dalhousie REB Approval	*N/A	*N/A
3	University of Calgary	Conjoint Health Research Ethics Board	REB21-0233	February 10th, 2021
4	Dalhousie University	Dalhousie Health Sciences Research Ethics Board	2020-5262	Sept 16th, 2020
5	Université Laval	Accepted Dalhousie REB Approval	*N/A	*N/A
6	University of Manitoba	Accepted Dalhousie REB Approval	*N/A	*N/A
7	McGill University	McGill Institutional Review Board	A03-B27-21B (21-03-044)	March 19th, 2021
8	McMaster University	Accepted Dalhousie REB Approval	*N/A	*N/A
9	Université de Montréal	Université de montreal Comité d'éthique de la recherche en sciences et en santé (CERSES)	CERSES-21-024-D	February 25th, 2021
10	Memorial University of Newfoundland	Newfoundland and Labrador Health Research Ethics Board	20211515	March 9th, 2021
11	Northern Ontario School of Medicine	Lakehead University Research Ethics Board Laurentian University Research Ethics Board	1468539 6020955	April 6th, 2021 March 22nd, 2021
12	University of Ottawa	Accepted Dalhousie REB Approval	*N/A	*N/A
13	Queen's University	Queen's University Health Sciences & Affiliated Teaching Hospitals Research Ethics Board (HSREB)	6031921	March 16th, 2021
14	University of Saskatchewan	University of Saskatchewan Research Ethics Board (REB)	*N/A	*N/A
15	Université de Sherbrooke	Université de Sherbrooke Comité d'éthique de la recherche – Éducation et sciences sociales	2021-2879/Huo	February 9th, 2021
16	University of Toronto	University of Toronto Research Ethics Boards (REBs)	00040621	April 6th, 2021
17	Western University	Accepted Dalhousie REB Approval	*N/A	*N/A

*Dalhousie REB approval was accepted at these institutions as per their respective ethics boards.

Appendix F. Demographic comparisons of medical student perceptions toward CWC

	Mean (SD/%)	*p*-value
Importance of the CWC Campaign (*n* = 3,171)		
Training Stage		0.001
Pre-clerks	12.3 (2.0)	
Clerks	12.5 (1.8)	
Gender		0.001
Women	12.5 (1.9)	
Men	12.2 (2.1)	
Age		0.027
≥25 years of age	12.5 (2.0)	
≤24 years of age	12.3 (2.0)	
Time in Practice		<0.001
≥4 months in practice	12.6 (1.9)	
≤3 months in practice	12.3 (2.0)	
Negative Perceptions Toward the CWC Campaign (*n* = 2,990)		
Training Stage		0.037
Pre-clerks	12.1 (3.0)	
Clerks	11.9 (3.3)	
Gender		0.001
Women	11.8 (3.0)	
Men	12.3 (3.3)	
Upbringing		0.001
Urban	12.1 (3.1)	
Rural	11.6 (3.2)	
CWC Recommendations in Pre-Clerkship Curriculum (*n* = 2,990)		
Gender		<0.001
Women	1,764/1,976 (89.2%)	
Men	801/983 (81.5%)	
CWC Recommendations in Clerkship Curriculum (*n* = 2,990)		
Gender		<0.001
Women	1,702/1,976 (86.1%)	
Men	779/983 (79.3%)	
Time in Practice		<0.001
≥4 months in practice	1,103/1,239 (89.0%)	
≤3 months in practice	1,395/1,744 (80.0%)	
Workplace Culture in Medicine & the CWC Campaign (*n* =2,990)		
Upbringing		0.042
Urban	20.6 (3.9)	
Rural	20.9 (4.1)	
Time in Practice		0.018
≥4 months in practice	20.8 (3.7)	
≤3 months in practice	20.5 (4.1)	
Resource Stewardship & Top Five Problems in Medicine (*n* = 3,067)		
Upbringing		0.001
Urban	1,629/2,384 (68.3%)	
Rural	566/759 (74.6%)	
Disinterest in CWC & Preceptor's Professionalism (*n* = 3,067)		
Training Stage		<0.001
Pre-clerks	1,756/1,843 (95.3%)	
Clerks	987/1,078 (91.2%)	
Time in Practice		0.001
≥4 months in practice	1,141/1,239 (92.1%)	
≤3 months in practice	1,660/1,745 (95.1%)	