

# Awareness of and Interest in Green Initiatives and Practices in Hospital Pharmacy: A Canada-Wide Survey

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## ABSTRACT

**Background:** Climate change poses significant risks to both the environment and public health. The Canadian health care system accounts for an estimated 4.6% of national carbon emissions, and hospital pharmacy contributes substantially to these emissions.

**Objectives:** To evaluate the awareness of green initiatives and green practices in hospital pharmacy and to explore the overall interest of pharmacy staff in improving on sustainable and climate-resilient pharmacy practices.

**Methods:** A cross-sectional survey was administered securely online to Canadian hospital pharmacy staff, between February 15 and April 30, 2023. The survey contained 38 questions with specified themes related to sustainability and climate resilience.

**Results:** A total of 214 participants responded to the survey. Of these, 84% (141/167) were motivated or highly motivated to engage in sustainable pharmacy practices. When asked about specific green initiatives planned by their hospital, 53% (109/206) reported not being aware of any initiatives, and 10% (20/206) indicated that no plans existed. The green practices that were at least partially implemented were “reduced paper use” (27% of responses), “improved recycling programs” (18%), and “raised awareness” (11%). The top 3 areas of pharmacy waste were identified as “single-use plastic” (28% of responses), “excessive paper use” (18%), and “improper recycling” (17%). The top 3 barriers to implementing eco-friendly practices were identified as “cost” (50% [83/166]), “time consumption” (50% [83/166]), and “added complexity” (30% [49/166]).

**Conclusions:** Hospital pharmacy staff participating in this survey study shared a willingness and strong motivation to engage in more sustainable and climate-resilient pharmacy practices, but they reported significant barriers, such as time consumption and perceived complexity, that must be addressed in implementing these changes.

**Keywords:** hospital pharmacy, climate resilience, Canada, sustainability, health care

## RÉSUMÉ

**Contexte :** Le changement climatique pose des risques importants pour l’environnement et la santé publique. Le système de santé canadien est responsable d’environ 4,6 % des émissions nationales de carbone, et les pharmacies d’hôpitaux y contribuent largement.

**Objectifs :** Évaluer la sensibilisation aux initiatives et aux pratiques écologiques dans les pharmacies d’hôpitaux et examiner l’intérêt général de leur personnel pour améliorer ses pratiques pharmaceutiques durables et résilientes face au climat.

**Méthodologie :** Une enquête transversale a été menée de manière sécurisée en ligne auprès du personnel des pharmacies d’hôpitaux canadiens, entre le 15 février et le 30 avril 2023. L’enquête comportait 38 questions portant sur des thèmes précis liés à la durabilité et à la résilience face au climat.

**Résultats :** Au total, 214 participants ont répondu à l’enquête. Parmi ceux, 84 % (141/167) étaient motivés ou très motivés à adopter des pratiques pharmaceutiques durables. Lorsqu’on leur a demandé quelles étaient les initiatives écologiques particulières prévues par leur hôpital, 53 % des répondants (109/206) ont déclaré ne pas être au courant de telles initiatives et 10 % (20/206) ont indiqué qu’aucun plan n’existait. Les pratiques écologiques ayant au moins été partiellement mises en œuvre étaient « la réduction de l’utilisation de papier » (27 % des réponses), « l’amélioration des programmes de recyclage » (18 %) et « une plus grande sensibilisation » (11 %). Les 3 principaux types de déchets pharmaceutiques indiqués étaient « le plastique à usage unique » (28 % des réponses), « l’utilisation excessive de papier » (18 %) et « le recyclage inapproprié » (17 %). Les 3 principaux obstacles à la mise en œuvre de pratiques écologiques étaient « le coût » (50 % [83/166]), « le temps nécessaire » (50 % [83/166]) et « la plus grande complexité » 30 % [49/166].

**Conclusions :** Le personnel des pharmacies d’hôpitaux participant à cette étude a fait part d’une volonté et d’une forte motivation à s’engager dans des pratiques pharmaceutiques plus durables et plus résilientes face au climat, mais a aussi signalé des obstacles importants, tels que le temps nécessaire et la complexité perçue : des obstacles qui doivent être abordés dans la mise en œuvre de ces changements.

**Mots-clés :** pharmacie hospitalière, résilience face au climat, Canada, durabilité, soins de santé

## INTRODUCTION

Climate change poses significant risks to both the environment and public health. Determining the carbon footprint—the total direct and indirect emissions of greenhouse gases (GHGs) from an activity, a product, or an organization—is one way to measure impact on climate change.<sup>1</sup> The carbon footprint is usually expressed in terms of carbon dioxide equivalents (also known as CO<sub>2</sub> eq), a metric used to compare emissions from different GHGs based on their global-warming potential.<sup>2</sup> The Canadian health care system is responsible for an estimated 4.6% of national carbon emissions, along with more than 200 000 tonnes of other pollutants annually, with pharmaceutical products representing 25% of these GHGs.<sup>3,4</sup>

Enacted in 2021, the *Canadian Net-Zero Emissions Accountability Act* (<https://laws-lois.justice.gc.ca/eng/acts/c-19.3/fulltext.html>) provided the framework to achieve net zero GHG emissions by 2050 through obligatory 5-year emission-reduction targets and science-based emission-reduction plans, such as the federal government's *2030 Emissions Reduction Plan*.<sup>5</sup> Several similar pledges were made at the 2021 United Nations Climate Change Conference (COP26). These ambitious goals are key to planetary health, considering that the Canadian health care system is the second highest per-capita emitter of GHGs among health systems worldwide<sup>6</sup> and that GHGs emitted from health care in Canada have been linked to 23 000 years of life lost annually because of disability or early death.<sup>3</sup>

Health care professionals are well positioned to facilitate changes to promote the sustainability of their practices and of the organizations within which they work.<sup>7</sup> Despite mounting evidence documenting the impact of climate on health,<sup>8</sup> there is still a paucity of information about the role of health care professionals in climate and health communication and advocacy, their awareness of the connections between climate and health, and their willingness to engage with the topic.<sup>9</sup>

A recent literature review by McGain and Naylor<sup>10</sup> regarding green initiatives implemented by hospitals identified several sustainability themes, such as decreasing energy consumption, reducing water usage, reducing travel, engaging in sustainable procurement, establishing waste reduction and recycling programs, and generating energy on site. Several of these entail large-scale implementation that would be unrealistic for a hospital pharmacy to undertake alone. However, improved recycling and waste reduction practices, increased awareness about sustainability efforts, greener commuting, and wise usage of medications have been described as means by which hospital pharmacies can improve on sustainable and climate-resilient pharmacy practices and reduce their GHG emissions.<sup>11,12</sup>

Numerous qualitative studies have described various climate initiatives conducted by individual pharmacies.<sup>11,12</sup>

However, an updated assessment of what, if anything, hospital pharmacies in Canada are doing to reduce the overall carbon footprint of their activities by improving on sustainable and climate-resilient pharmacy practices has been lacking. The current cross-sectional survey study aimed to fill this knowledge gap by evaluating awareness of and interest in green initiatives in pharmacy and identifying which sustainable and climate-resilient pharmacy practices are currently being employed to reduce the carbon footprint of hospital pharmacies across Canada.

## METHODS

A pharmacy research team developed a cross-sectional quantitative survey that was administered online, from February 15 to April 30, 2023, through REDCap,<sup>13</sup> a secure, web-based software platform designed to support data capture for research. Recruitment was initiated at the 2023 Together conference of the Canadian Society of Hospital Pharmacists (now the Canadian Society of Healthcare-Systems Pharmacy [CSHP]) in Alberta, by advertising to conference attendees through a QR code on the study poster and in the conference's Pheedloop platform chat. Recruitment was also accomplished by sharing, through organizational networking platforms, the electronic version of the study poster with members of the CSHP, the Association des pharmaciens des établissements de santé du Québec, and the Ontario Hospital Directors of Pharmacy Forum. The study poster was also shared online through social media outlets (e.g., LinkedIn, Facebook) in a snowball recruitment manner. The survey was distributed to employees of Canadian hospital pharmacies through email distribution lists and by a snowball method through hospital pharmacy associations' media platforms and during the 2023 CSHP Together conference. The survey was administered only in English, with participation limited to pharmacy directors and managers, pharmacists, and pharmacy technicians; the invitation letter in the email served as the consent form, and the link for the survey was embedded into the invitation letter, constituting an implied consent model.

Development of the survey occurred in a 2-step pilot process, with the methodology being formalized on the basis of iterative feedback from pharmacy directors and managers, as well as from pharmacists and pharmacy technicians. The team first piloted a survey with 15 respondents within their own pharmacy department in 2021 to assess content validity in the understanding or awareness of green practices ongoing in this pharmacy, as well as awareness of green initiatives being proposed at the hospital and governmental levels to reduce the carbon footprint. The pilot survey was then further refined to focus on how the pharmacy's current operations matched up to the ideal and to determine what it would take for the pharmacy to "Go Green" by improving on sustainable and climate-resilient pharmacy practices. The pilot

survey was then sent to 35 hospital pharmacies in Ontario, most located in “full-service” hospitals. Data from this larger group of respondents was used to develop the questions that were included in the final survey, used for the current study.

Designed to comprehensively explore sustainable and climate-resilient pharmacy initiatives and practices, the current survey comprised 38 questions categorized into the following themes: participants’ demographic characteristics, government-level initiatives, hospital-level initiatives and practices, other emission-lowering initiatives, and pharmacy-specific initiatives and practices. Directors and managers were asked an additional 14 position-specific questions to capture their unique experiences within committees and working groups. Sustainable and climate-resilient pharmacy *initiatives* were operationalized as government- or hospital-level guidance or targets to be employed to “Go Green” and reduce overall carbon footprint, whereas sustainable and climate-resilient pharmacy *practices* were operationalized as any formal process already put into practice specifically to reduce overall carbon footprint and improve climate resilience.

The survey consisted of multiple-choice (single-answer) questions, check-box questions (where multiple responses were allowed; termed “multi-select”), 5-point Likert scale questions (based on the respondent’s “willingness” and “agreement”), and questions allowing open-text style responses. This type of survey design, consisting of both closed- and open-ended questions, allows respondents to provide more comprehensive and nuanced feedback, as well as to reveal unanticipated insights.<sup>14</sup>

This study was approved by the research ethics board of CHEO, Ottawa, Ontario (REB#22-105X). Data were summarized descriptively as frequencies and percentages.

## RESULTS

### Participants’ Demographic Characteristics

A total of 214 respondents answered some or all of the survey questions. However, for the section on demographic characteristics, complete data were available for only 159 participants.

Operational characteristics of the hospitals, such as total number of beds and total number of pharmacy employees, are presented in Table 1. Regarding the types of hospital pharmacy where respondents worked, 69% (109/159) reported working in a general hospital pharmacy, and 18% (29/159) reported working in pediatric hospital pharmacy (Table 1). Current prescription and medication administration systems were reported as computerized provider order entry by 50% (80/159) of respondents, whereas 28% (45/159) reported using a paper-based model, and 28% (44/159) indicated a hybrid model.

Regarding employment categories, nearly half of the respondents (47% [74/159]) were pharmacists, 21% (34/159)

**TABLE 1. Demographic Characteristics**

Characteristic	No. (%) of Respondents (n = 159 <sup>a</sup> )
<b>Location of hospital: province or territory</b>	
British Columbia	28 (18)
Alberta	4 (3)
Saskatchewan	23 (14)
Manitoba	7 (4)
Ontario	88 (55)
Quebec	5 (3)
New Brunswick	2 (1)
Nova Scotia	2 (1)
Prince Edward Island	0 (0)
Newfoundland and Labrador	0 (0)
Yukon	0 (0)
Northwest Territories	0 (0)
Nunavut	0 (0)
<b>Type of hospital pharmacy with which respondent is involved</b>	
General hospital pharmacy	109 (69)
Pediatric hospital pharmacy	29 (18)
Convalescent hospital / long-term care	3 (2)
Rehabilitation hospital pharmacy	2 (1)
Outpatient pharmacy	2 (1)
Psychiatric hospital pharmacy	1 (1)
Other	12 (8)
Prefer not to say	1 (1)
<b>Respondent’s role in the pharmacy</b>	
Director	9 (6)
Manager	25 (16)
Pharmacist	74 (47)
Pharmacy technician	34 (21)
Pharmacy assistant	1 (1)
Pharmacy administrator	2 (1)
Pharmacy student	1 (1)
Pharmacy resident	0 (0)
Pharmacy intern	0 (0)
Other	9 (6)
Prefer not to say	4 (3)
<b>Approximate no. of people working in pharmacy department (n = 34)<sup>b</sup></b>	
≥ 125	10 (29)
101–125	2 (6)
76–100	5 (15)
51–75	7 (21)
26–50	5 (15)
≤ 25	5 (15)
<b>Estimated no. of beds in hospital (n = 34)<sup>b</sup></b>	
≥ 1000	2 (6)
751–1000	5 (15)
501–750	6 (18)
251–500	9 (26)
101–250	8 (24)
≤ 100	4 (12)

<sup>a</sup>Except where indicated otherwise.

<sup>b</sup>Questions specific to directors and managers only.

were pharmacy technicians, 16% (25/159) were managers, and 6% (9/159) were directors. The majority of respondents (55% [88/159]) were from Ontario, with 18% (28/159) from British Columbia and 3% (5/159) from Quebec (Table 1).

### **Awareness of Sustainable and Climate-Resilient Pharmacy Initiatives and Practices**

Nearly half (47% [101/214]) of respondents were not aware of the federal government's *2030 Emissions Reduction Plan*. The eco-friendly initiatives that respondents thought would have the greatest impact on reducing GHG emissions were "reduced drug waste" (21%), "improved recycling program" (20%), and "reduced paper usage" (15%) (Table 2).

In terms of respondents' awareness of GHG emission reduction goals set by their hospital, 67% (137/206) of respondents were not aware of any goals, and 17% (35/206) indicated that no plans existed. When asked about specific green practices in place at their hospital aimed at reducing carbon footprint or maintaining environmental sustainability, 53% (109/206) of respondents were not aware of any, whereas 10% (20/206) indicated that no plans existed.

### **Sustainable and Climate-Resilient Pharmacy Practices**

Among respondents who indicated that their institutions had implemented sustainable and climate-resilient practices, the practices that were at least partially implemented were "reduced paper use" (27%), "improved recycling programs" (18%), and "raised awareness" (11%) (Table 2).

The top 3 areas of pharmacy waste were identified as "single-use plastics" (28%), "excessive paper use" (18%), and "improper recycling" (17%). Most respondents were motivated or very motivated to engage in more sustainable practices (84% [141/167]).

The top 3 barriers preventing initiatives to lower pharmacy-specific emissions were reported as cost (50% [83/166]), time consumption (50% [83/166]), and added complexity (30% [49/166]).

### **Sustainable and Climate-Resilient Pharmacy Initiatives**

Regarding plans for specific emissions-lowering initiatives, the respondents indicated a lack of engagement, whereby 55% (99/181) indicated that their organizations had no plans and no engagement related to reductions in use of metered dose inhalers (MDIs), 56% (100/180) indicated no plans and no engagement related to deprescribing initiatives, and 53% (96/180) indicated no plans and no engagement related to implementation of a green committee, stewardship, or working group (Table 3).

### **Directors and Managers: Challenges Implementing Climate-Resilient Pharmacy Practices**

Among the 34 directors and managers who responded to the survey, the top 3 barriers viewed as posing the greatest challenges to implementing sustainable and climate-resilient

pharmacy practices were time consumption (68% [23/34]), cost (62% [21/34]), and additional complexity (50% [17/34]).

Initiatives that had at least been discussed in these respondents' pharmacies but were not yet implemented were reducing medical waste (56% [19/34]), improving recycling programs (38% [13/34]), and raising awareness of green or sustainable practices (38% [13/34]). The absence of relevant evaluation at this time (56% [19/34]) and the lack of capacity to change (50% [17/34]) were the main factors identified as preventing implementation of these plans.

When asked how they would raise awareness of a new initiative and get their coworkers (staff) on board, 76% (26/34) indicated they would form a green team, 41% (14/34) said they would use word of mouth, 44% (15/34) would offer a speaker series on green and sustainable practices, and 41% (14/34) would use signage or a poster.

## **DISCUSSION**

The findings of this cross-sectional survey shed light on the current state of awareness of and interest in sustainable and climate-resilient pharmacy initiatives and practices in hospital pharmacies in Canada. Nearly half of the respondents were completely unaware of the federal government's *2030 Emissions Reduction Plan*, signifying a need to improve communication channels for disseminating government initiatives to health care institutions, to ensure emission-reduction targets are met. Furthermore, despite our finding that more than three-quarters of respondents were motivated or very motivated to engage in more sustainable pharmacy practices, we found significant gaps in awareness of sustainable and climate-resilient initiatives, as well as barriers to implementation of more sustainable practices in hospital pharmacy.

Front-line health care staff, such as those employed in hospital pharmacy, play a pivotal role in the successful implementation of sustainability initiatives, and the lack of awareness observed here highlights a potential communication gap that needs to be addressed.<sup>15</sup> With the global push to achieve net-zero carbon emissions and accompanying campaigns of activism,<sup>3</sup> it was surprising that 81% of respondents indicated there was no green committee at their hospital (Table 3), and only 11% (20/181) of respondents agreed that their pharmacy was adequately engaged and represented in their hospital's green committees and working groups. Taken together, these findings highlight the need to promote awareness and to find ways to better align individual hospitals' goals with national climate-related objectives, as well as the need to develop guidance documents and education materials for hospitals seeking to integrate sustainability and carbon-reduction models into their organizational strategies.

It was interesting to notice the overlap between the top 3 areas of pharmacy waste and the top 3 waste areas identified

**TABLE 2. Breakdown of Survey Responses for Entire Sample and by Province for Questions Concerning Sustainable Pharmacy Initiatives and Practices<sup>a</sup>**

Option <sup>b</sup>	Province; % of Responses								
	All Combined	Alberta	British Columbia	Manitoba	New Brunswick	Nova Scotia	Ontario	Quebec	Saskatchewan
<b>Initiatives that respondent feels would have most impact on reducing GHGs produced directly or indirectly by the pharmacy</b>									
Reduced drug waste	21	20	24	25	9	18	21	16	17
Improved recycling program	20	20	20	23	18	18	19	12	19
Reduced paper usage (e.g., paperless system)	15	13	11	15	9	18	16	16	18
Reduced power usage (e.g., energy efficient computers, lighting, and climate control)	12	13	11	15	18	9	12	8	12
Increased sustainability in purchasing contracts	11	20	14	8	9	18	11	16	12
Carpooling initiative	7	0	4	8	18	9	7	12	8
Choosing Wisely	7	13	9	4	0	0	6	8	7
Reduced frequency of orders/deliveries	7	0	8	4	18	9	7	12	7
<b>Areas of waste that respondent believes have greatest opportunity for improvement (i.e., most actionable)</b>									
Single-use plastic	38	75	25	71	50	0	40	0	30
Excessive paper use (e.g., TPN orders, purchase orders)	20	25	11	0	0	0	20	40	43
Medical waste	16	0	36	0	0	0	15	0	9
Improper recycling (e.g., not being sorted, paper/carboard being put in garbage)	14	0	14	14	0	100	15	40	4
Limited awareness of green practices	3	0	4	0	0	0	3	20	0
Lights left on in empty rooms	2	0	4	0	0	0	2	0	4
Organic waste not being composted	2	0	0	14	0	0	2	0	0
Frequency of deliveries	1	0	0	0	50	0	0	0	4
Other	2	0	7	0	0	0	2	0	0
Prefer not to say	1	0	0	0	0	0	0	0	4
<b>Initiatives that respondent's department has at least partially implemented<sup>c</sup></b>									
Reduced paper usage (e.g., paperless system)	27	22	25	13	50	50	37	30	10
Improved recycling program	18	22	19	50	0	0	17	20	10
Raise awareness of green or sustainable practices	11	22	6	0	0	50	10	0	10
Reduced power usage (e.g., energy efficient computers, lighting, and climate control)	10	0	13	13	0	0	10	10	7
Reduced medical waste	5	0	10	13	0	0	4	0	0
Increased sustainability in purchasing contracts	4	0	6	0	0	0	3	10	7
Reduced frequency of orders/deliveries	3	0	2	0	0	0	4	10	0
Carpooling initiative	3	11	5	0	0	0	3	20	0
Reduced water usage	1	0	2	0	0	0	0	0	3
Other	11	22	11	0	50	0	9	0	31
Prefer not to say	7	0	2	13	0	0	18	0	21

GHG = greenhouse gas, TPN = total parenteral nutrition.

<sup>a</sup>The total number of survey respondents was 214, of whom 159 provided location information by province, as follows: Alberta, 4; British Columbia, 28; Manitoba, 7; New Brunswick, 2; Nova Scotia, 2; Ontario, 88; Quebec, 5; and Saskatchewan, 23. Respondents were not required to answer every question, so the number of responses for a given question (for all combined or by province) might be less than these values.

<sup>b</sup>Data in this table are based on "multi-select" questions, for which respondents could select more than one option per question.

<sup>c</sup>For any initiatives not stated explicitly in the survey, respondents were instructed to categorize them as "Other(s)".

as having the greatest opportunity for actionable improvement (“single-use plastic”, “excessive paper use”, and “medical waste”) (Table 2). These findings signify a convergence in terms of the action areas where respondents have identified paths toward reducing the most important areas of waste in pharmacy. These results also highlight that sustainable and climate-resilient pharmacy practices should focus on interventions related to these 3 areas of pharmacy waste, dovetailing with the findings of a systematic review of hospital environmental sustainability, which described the extent to which hospital environmental sustainability extends to clinical practice, pharmaceuticals, and medical devices.<sup>10</sup> Furthermore, the overlap noted above aligns very neatly with respondents’ perceptions of the largest contributors

to GHG production in pharmacy, whereby the pharmacy practices thought to have the most impact on reducing GHG emissions were “reduced drug waste”, “improved recycling programs”, and “reduced paper usage” (Table 2). These 3 key areas of pharmacy waste should be considered as action targets for policy, practice, and research.

The current findings have illuminated noteworthy challenges in implementing sustainable pharmacy practices. The top 3 barriers to implementing sustainable and climate-resilient pharmacy practices were reported to be “cost”, “time consumption”, and “added complexity”. Considering that waste was identified as a main area for improvement, the 2-way relationship between cost and waste could be further explored for the purposes of generating overall cost

**TABLE 3. Breakdown of Survey Responses for Entire Sample and by Province for Questions Concerning Current or Future Plans to Improve Sustainable and Climate-Resilient Pharmacy Practices**

Survey Question and Response	Province; No. (%) of Responses								
	All Combined <sup>a</sup>	Alberta	British Columbia	Manitoba	New Brunswick	Nova Scotia	Ontario	Quebec	Saskatchewan
<b>Have you implemented or are you planning to implement the reduction of MDI use to lower the impact of emissions?</b>									
No. of responses	<i>n</i> = 181	<i>n</i> = 4	<i>n</i> = 28	<i>n</i> = 7	<i>n</i> = 2	<i>n</i> = 2	<i>n</i> = 88	<i>n</i> = 5	<i>n</i> = 23
No plans, no engagement	99 (55)	2 (50)	12 (43)	2 (29)	2 (100)	0 (0)	54 (61)	0 (0)	15 (65)
No plans, some engagement	52 (29)	1 (25)	11 (39)	3 (43)	0 (0)	1 (50)	22 (25)	3 (60)	4 (17)
Planning to implement	16 (9)	0 (0)	2 (7)	0 (0)	0 (0)	1 (50)	8 (9)	1 (20)	3 (13)
Partially implemented	10 (6)	1 (25)	3 (11)	1 (14)	0 (0)	0 (0)	3 (3)	0 (0)	1 (4)
Fully implemented	4 (2)	0 (0)	0 (0)	1 (14)	0 (0)	0 (0)	1 (1)	1 (20)	0 (0)
<b>Have you implemented or are you planning to implement deprescribing initiatives to reduce the impact of medication usage on the environment?</b>									
No. of responses	<i>n</i> = 180	<i>n</i> = 4	<i>n</i> = 28	<i>n</i> = 7	<i>n</i> = 2	<i>n</i> = 2	<i>n</i> = 88	<i>n</i> = 5	<i>n</i> = 23
No plans, no engagement	100 (56)	1 (25)	12 (43)	4 (57)	2 (100)	0 (0)	51 (58)	4 (80)	16 (70)
No plans, some engagement	40 (22)	2 (50)	8 (29)	1 (14)	0 (0)	0 (0)	19 (22)	0 (0)	4 (17)
Planning to implement	13 (7)	0 (0)	0 (0)	1 (14)	0 (0)	1 (50)	6 (7)	1 (20)	2 (9)
Partially implemented	25 (14)	1 (25)	8 (29)	1 (14)	0 (0)	1 (50)	11 (13)	0 (0)	1 (4)
Fully implemented	2 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	0 (0)	0 (0)
<b>Is your pharmacy department planning to implement or has it implemented a green committee, stewardship, or working group?</b>									
No. of responses	<i>n</i> = 180	<i>n</i> = 4	<i>n</i> = 28	<i>n</i> = 7	<i>n</i> = 2	<i>n</i> = 2	<i>n</i> = 88	<i>n</i> = 5	<i>n</i> = 23
No plans, no engagement	96 (53)	1 (25)	14 (50)	4 (57)	2 (100)	1 (50)	48 (55)	1 (20)	12 (52)
No plans, some engagement	51 (28)	2 (50)	11 (39)	1 (14)	0 (0)	0 (0)	26 (30)	1 (20)	6 (26)
Planning to implement	21 (12)	0 (0)	0 (0)	2 (29)	0 (0)	0 (0)	12 (14)	1 (20)	3 (13)
Partially implemented	8 (4)	1 (25)	3 (11)	0 (0)	0 (0)	1 (50)	1 (1)	1 (20)	0 (0)
Fully implemented	4 (2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1)	1 (20)	2 (9)

MDI = metered dose inhaler.

<sup>a</sup>Includes data for respondents who did not specify their province.

savings for hospital pharmacies. There is growing reason for optimism regarding cost as a barrier, as there are many large funding programs across Canada at both the federal and the provincial levels, including for climate-related initiatives.<sup>16-18</sup> However, funding specific to green initiatives in hospital pharmacy is limited to niche opportunities, such as institutional grant competitions or programs offered by organizations such as CASCADES Canada<sup>19</sup> (an initiative funded by Environment and Climate Change Canada and supported by the University of Toronto, Dalhousie University, the University of British Columbia, the Canadian Coalition for Green Health Care, and the Réseau d'action pour la santé durable du Québec).

Time-related barriers could be overcome by integrating sustainability practices into routine workflows and providing adequate training to streamline processes. The Lean Six Sigma (LSS) method has been shown to simplify the time and complexity associated with adopting green practices.<sup>20</sup> In general, LSS methods have become increasingly integrated in pharmacy settings over the past 2 decades, where employing such methods has reduced pharmacy wait times<sup>21</sup> and improved medication synchronization processes.<sup>22</sup>

Although there are examples of “sustainable medicine” in health care professional education, many existing pharmacy education programs may not provide the necessary training and knowledge to allow trainees to understand and implement sustainable practices while ensuring the safe and effective use of medication.<sup>11</sup> Some medical schools have already begun to teach how to prescribe more carefully and to avoid medication waste; as more universities and colleges add similar educational content to their pharmacy programs, this barrier will slowly disappear. Local, organizational, and government-funded initiatives and alliances, such as the CSHP Sustainability Task Force, the Canadian Association of Pharmacy for the Environment, CASCADES Canada,<sup>19</sup> and Choosing Wisely Canada,<sup>23</sup> are pushing forward sustainable and climate-resilient pharmacy initiatives.

The concept of environmental pharmacists and the importance of their role as front-line health care workers in patient counselling about environmental health have been described,<sup>12</sup> and this counselling role is evolving within a budding carbon stewardship model. Much like the reductions in prescribing of opioids that have flowed from pharmacists' efforts in opioid stewardship, pharmacists have the ability to counsel patients on the environmental consequences of their use of pharmaceutical products and the environmental issues specific to their medications. The fact that approximately half of all respondents to the current survey reported no green initiatives at their hospital aimed at deprescribing or reducing MDI use is indicative of areas where hospitals can target for improvements in sustainability (Table 3).

Regarding current programs or initiatives, 15% of respondents indicated that their organizations had already fully or partially implemented deprescribing initiatives to

reduce the impact of medication usage on the environment. Furthermore, of the respondents who indicated that sustainable and climate-resilient pharmacy practices were currently being employed, 8% indicated partial or full implementation of initiatives aimed at switching to MDIs with a smaller carbon footprint. These findings signify that hospital pharmacy is beginning to change practice, but they also indicate that it is still important to provide education and clear communication to staff about the importance of reducing the carbon footprint and about the specific actions they can take to contribute to this goal, such as switching from MDIs to more sustainable dry-powder inhalers.<sup>24</sup> Several other interventions were identified that can improve on sustainable practices, including provision of training about recycling unused medications, green procurement, and energy conservation.<sup>11,25</sup> At the moment, although university and college curricula are constantly evolving,<sup>10</sup> we are unaware of any mandatory requirement in Canadian pharmacy schools with respect to teaching sustainability practices in pharmacy.

A lack of awareness and understanding of evaluation criteria concerning sustainability and carbon neutrality in pharmacy operations is an important barrier to implementing sustainable and climate-resilient pharmacy practices. Previous research has demonstrated that pharmacy staff may not have the necessary knowledge or understanding of the environmental impacts of their actions and the potential benefits of sustainability initiatives,<sup>25</sup> which represents a target area for actionable change.<sup>26</sup> Furthermore, successful pharmacist-led interventions related to the quality of medication use and reducing inappropriate use of medications<sup>16,17</sup> have proven that hospital pharmacy can be a fulcrum for change by employing more sustainable practices in medication management.

## Limitations

The cross-sectional nature of the survey means that it captured a snapshot in time, which limits our ability to discern longitudinal trends or causality. The reliance on self-reported data introduces the potential for response bias, as participants may have provided socially desirable answers or may have overemphasized their environmentally conscious practices. The nature of the survey distribution and use of the snowball method of recruitment could introduce the chance of “multiple participation” and prevents us from knowing how many potential respondents were approached. Given the geographic distribution of the sample, with the majority from Ontario, these findings do not fully represent the diversity of sustainable initiatives across all Canadian provinces.

## CONCLUSION

The respondents to the current survey represented diverse roles in pharmacy, and the findings are timely, underscoring a significant gap in awareness and engagement across

key initiatives and practices, respectively. Our findings indicated that 47% of respondents were not aware of the federal government's *2030 Emissions Reduction Plan*, and 67% were not aware of any goals set by their respective hospitals to reduce the institutions' carbon footprint through GHG reduction. Directors and managers play a pivotal role in driving sustainable practices, and the current findings identified important barriers preventing implementation of sustainable and climate-resilient pharmacy practices, the most important being a lack of evaluation criteria, time, and capacity to make changes. This situation underscores the need for targeted interventions and education programs aimed at empowering leadership to champion sustainability efforts within their organizations, with the goal of the physical implementation of sustainable and climate-resilient pharmacy practices. With demonstrably high motivation to improve on sustainable and climate-resilient pharmacy practices, the path forward should focus on fostering awareness of sustainable pharmacy initiatives, while at the same time breaking down barriers that prevent pharmacies from implementing sustainable changes to pharmacy practice, all with a view toward a greener future for hospital pharmacy.

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