

Editor's key points

▶ Family physicians are front-line providers in addressing sources of environmental exposure and environmental-related illnesses, and training is required to effectively assess and manage these concerns. The goal of this study was to determine family medicine residents' learning needs in and knowledge of environmental health (EH).

▶ This study found that although EH is considered important by family physicians in training, there is a gap between its perceived value and the knowledge, effective teaching, and clinical practices necessary for diagnosing exposure-related conditions. Taking an exposure history is a key clinical skill that should be addressed in resident and faculty education, and respondents reported a lack of training and negative attitudes toward this skill.

▶ The results indicate a need for educational measures to enhance EH knowledge and practice skills among family medicine residents and their preceptors. Given that no difference was observed between first-year residents and second- and third-year residents in these measures, it is important to determine where and when current knowledge, attitudes, and clinical skills are being learned. Notably, although residents rated their supervisors' knowledge of EH as low, they continued to use supervisors as their second most frequent source of information when confronted with a clinical problem.

Family medicine residents' knowledge of, attitudes toward, and clinical practices related to environmental health

Multi-program survey

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Abstract

Objective To assess family medicine residents' knowledge of, attitudes toward, and clinical practices related to environmental health (EH).

Design Two-part study with questionnaire construction using a modified Delphi method, and a Web-based questionnaire administered to family medicine residents between November 2015 and January 2016.

Setting All Canadian family medicine programs (for questionnaire construction) and 4 Ontario family medicine training programs (for questionnaire administration).

Participants First- to third-year family medicine residents (for questionnaire administration).

Main outcome measures Responses to 93 survey items that measured family medicine residents' knowledge of, attitudes toward, and clinical practices related to EH.

Results For the final administered questionnaire, 203 of 887 (22.9%) family medicine residents responded. Although 92.0% of respondents somewhat or strongly believed that taking an environmental exposure history was important, only 18.1% of them had specific training in taking environmental exposure history, and 48.4% believed that taking an exposure history takes up too much time in office practice. While 82.9% of residents correctly identified recreational water use as a cause of gastroenteritis, only 60.2% correctly identified radon as a cause of lung cancer and 37.6% knew that elevated ground-level ozone is associated with asthma. Only 10.8% believed their supervisors had a good understanding of environmental exposures. Residents who believed their supervisors understood environmental exposures were more likely to take exposure histories for patients with uncontrolled asthma ($P < .05$), and those who discussed EH exposure with supervisors frequently, or thought environmental exposure histories were very important, were more likely to provide patients with EH education materials ($P < .01$).

Conclusion Although family medicine residents are aware of the importance of assessing patients' environmental exposures, they lack training and mentorship in EH. As a health determinant of critical importance, EH should be a high priority for inclusion in postgraduate family medicine education.



Les connaissances, les attitudes et les pratiques cliniques des résidents en médecine familiale en matière de santé environnementale

Sondage auprès de multiples programmes

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Résumé

Objectif Évaluer les connaissances, les attitudes et les pratiques cliniques des résidents en médecine familiale en matière de santé environnementale (SE).

Type d'étude Étude en 2 étapes, notamment la formulation du questionnaire au moyen d'une méthode Delphi modifiée, et un questionnaire sur le Web, administré entre novembre 2015 et janvier 2016.

Contexte Tous les programmes canadiens en médecine familiale (pour la conception du questionnaire) et 4 programmes de formation en médecine familiale en Ontario (pour l'administration du questionnaire).

Participants Des résidents de première, deuxième et troisième années en médecine familiale (pour l'administration du questionnaire).

Principaux paramètres à l'étude Les réponses aux 93 éléments du sondage qui mesuraient les connaissances, les attitudes et les pratiques cliniques des résidents en médecine familiale en matière de SE.

Résultats Lors de l'administration du questionnaire final, 203 des 887 (22,9 %) résidents en médecine familiale ont répondu. Même si 92,0 % des répondants estimaient qu'un bilan des expositions environnementales était assez ou très important, seulement 18,1 % d'entre eux reçu une formation précise en anamnèse des expositions environnementales, et 48,4 % croyaient qu'un bilan des expositions prenait trop de temps en clinique. Si 82,9 % des résidents ont correctement identifié que l'eau à des fins récréatives était une cause de gastroentérite, seulement 60,2 % savaient à juste titre que le radon pouvait causer le cancer du poumon, et 37,6 % connaissaient l'association entre des concentrations élevées d'ozone au niveau du sol et l'asthme. Seulement 10,8 % étaient d'avis que leurs superviseurs connaissaient bien les expositions environnementales. Les résidents qui croyaient que leurs superviseurs comprenaient bien les expositions environnementales étaient plus enclins à procéder à une anamnèse des expositions si leurs patients souffraient d'asthme non contrôlé ($p < ,05$), et ceux qui discutaient souvent avec leurs superviseurs d'expositions en SE ou qui jugeaient les bilans des expositions environnementales très importants étaient plus enclins à fournir du matériel d'information sur la SE à leurs patients ($p < ,01$).

Conclusion Même si les résidents en médecine familiale sont conscients de l'importance d'évaluer les expositions environnementales des patients, ils manquent de formation et de mentorat en SE. Étant donné son importance critique en tant que déterminant de la santé, il faudrait accorder une grande priorité à l'inclusion de la SE dans la formation médicale postdoctorale en médecine familiale.

Points de repère du rédacteur

▸ Les médecins de famille sont en première ligne quand il s'agit de cerner les sources d'exposition environnementale et les maladies qui leur sont liées, et ils doivent recevoir la formation nécessaire pour évaluer et prendre en charge efficacement ces préoccupations. Cette étude avait pour but de déterminer les besoins des résidents en médecine familiale en matière d'apprentissage et de connaissances en santé environnementale (SE).

▸ On a constaté dans cette étude que, même si les médecins de famille en formation considèrent la SE importante, il existe des lacunes entre la valeur qu'ils lui accordent, et les connaissances, l'enseignement efficace et les pratiques cliniques nécessaires pour diagnostiquer les problèmes associés aux expositions. Faire l'anamnèse des expositions est une compétence clinique essentielle qu'il faudrait perfectionner dans l'éducation des résidents et du corps professoral, et les répondants ont signalé un manque de formation et des attitudes négatives face à cette compétence.

▸ Les résultats pointent vers la nécessité de prendre les mesures pédagogiques voulues pour améliorer les connaissances et les compétences professionnelles en SE chez les résidents en médecine familiale et leurs précepteurs. Étant donné l'absence de différences observées dans ces résultats entre les résidents, qu'ils soient en première, deuxième ou troisième année, il importe de déterminer où et quand les connaissances récentes, les attitudes et les compétences cliniques sont apprises. Fait à remarquer, même si les résidents ont accordé une faible cote aux connaissances de leurs superviseurs en SE, ils continuaient à les consulter comme leur deuxième source la plus fréquente d'information lorsqu'ils étaient confrontés à un problème clinique.

In Canada, deaths from modifiable environmental risks account for 9% to 14% of all mortality.¹ Articles highlighting the need for improvement of physician education in environmental health (EH) have been present in literature since 1972.² Calls for this improvement have been made twice by the Institute of Medicine^{3,4} and have echoed through the training of pediatricians,⁵⁻⁷ obstetricians and gynecologists,^{8,9} and family physicians.¹⁰⁻¹² However, articles as recent as 2013 in the United States¹³ and 2009 in Canada¹⁴ have shown that training in EH is still largely absent.

Family physicians are front-line providers in addressing sources of environmental exposure and environmental-related illnesses, and training is required to effectively assess and manage these concerns. Several studies have assessed the EH concerns and learning needs of practising physicians. A survey of rural, small-urban, and large-urban community family physicians in Ontario found that all groups had high concern about the respiratory, carcinogenic, and teratogenic effects of environmental exposures.¹¹ In this study, more than half of the physicians recalled receiving questions from patients pertaining to sunlight, food additives, radiation, and lead.¹¹ A survey conducted with health care providers and parents attending public health clinics in Edmonton, Alta,¹⁵ found high concern about children's environmental exposures among both groups. In Italy, a cross-sectional mail survey of primary care physicians found that 84% thought that evaluating sources of exposure by taking an environmental history was very important.¹⁶

Studies directly investigating clinical competence in EH have mainly focused on occupational asthma. These studies consistently found problems of delayed diagnosis, underdiagnosis, and undermanagement,¹⁷⁻¹⁹ with 41% of patients believing that lack of inquiry by their primary care physician about the work-relatedness of symptoms was the main factor in diagnosis delay, which averaged 4.9 years.¹⁸ An audit of primary care practices found that only 14% of patients with adult-onset asthma had their occupation recorded.¹⁹ A mail survey of family physicians in Texas reported that 86% of family physicians had no specific training in EH, while almost 92% wanted to learn more about EH hazards. Patients initiated questions about drinking water, herbicides, and indoor and outdoor pollution more frequently than physicians did.¹²

Assessments of family medicine residents' learning needs in and knowledge of EH are very limited. A pilot study of family medicine residents at an Ontario university in 2001 found that, compared with practising physicians, their self-reported knowledge was similarly low and EH concerns similarly high, when measured using the same survey tool (Sanborn MD, Scott EA, Cole D, unpublished data, 2001). A national survey of US family medicine training programs in 2008 found that only 68% of them had any occupational or environmental medicine content; however, almost 92% of responding

residency directors thought training in occupational medicine was important.²⁰

This study of family medicine residents was undertaken to investigate the combination of high interest in EH with low self-reported knowledge found in studies of practising physicians, and to generate information to identify family medicine EH curriculum gaps, improve EH training in family medicine, and graduate family physicians who are better prepared to diagnose and treat environmental exposure-related illnesses.

— Methods —

The study was conducted in 2 parts: questionnaire construction using the modified Delphi method, and questionnaire administration to family practice residents.

Questionnaire construction

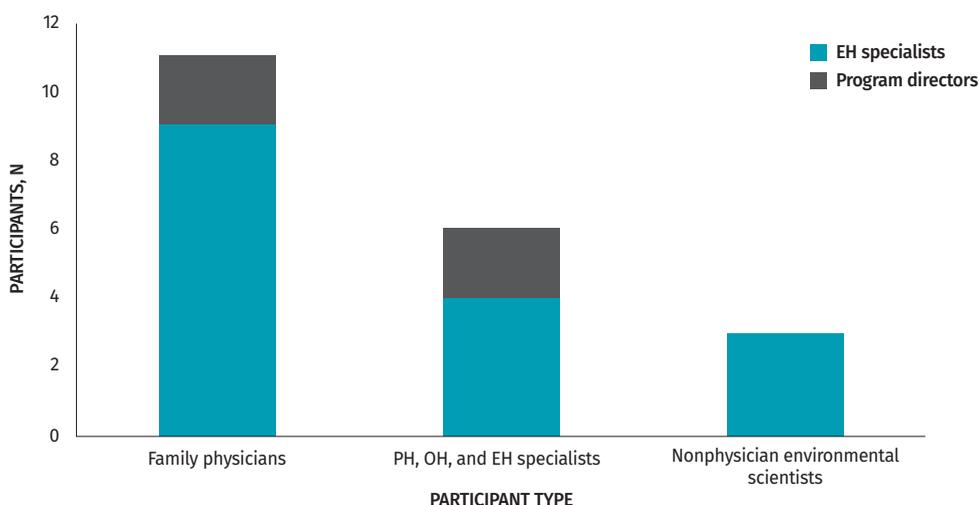
Developing a questionnaire for a previously unstudied target group requires a reliable method to ensure the content validity of the survey tool. The Delphi method has been extensively used in health care research, including in curriculum development,²¹⁻²³ providing independent expert opinions on content areas and questions to be included in surveys, guidelines, and health priorities.^{24,25} The modified method is implemented by iteratively asking participants, by e-mail, to identify priority questions to include in the survey, questions not to include, and their own ideas regarding important questions.²⁵

Forty invitees, including EH experts and all Canadian family medicine program directors, were asked to participate in the Delphi process; the composition of respondents is shown in **Figure 1**. Questions for the initial round were taken from previous surveys or developed through research group discussions. There were 19 participants in the first Delphi round, and 15 of them also participated in the second round. Questions were included in the final survey if they were approved (a rating of 4 or 5 on a 5-point Likert scale) by more than 74% of the Delphi respondents. The full survey is available at <https://fammedmcmaster.ca/research/survey-of-environmental-health-concerns>.

Survey of family medicine residents

After ethics approval of the final questionnaire by all institutions included in the survey, all first- to third-year family medicine residents in 4 Ontario training programs were invited to participate in the online survey between November 2015 and January 2016. Each resident received 3 reminders over a 6-week period.

Response proportion varied according to the contact method (for invitation to participate and reminders) approved by each department of family medicine. In the 3 programs that contacted residents individually, response rates were 27.7% to 37.4%, and in 1 program that included the survey invitation as an item in the departmental

Figure 1. Participants in the Delphi process: N = 19.

EH—environmental health, OH—occupational health, PH—public health.

e-newsletter, 11.5% of residents responded. The overall response proportion was 22.9% (203 of 887 residents).

Analyses

We expressed continuous data as means and standard deviations, or as medians and interquartile ranges when data were skewed. For categorical data, we presented the proportion endorsing each category as well as those not responding. Demographic characteristics were used to compare residents with a substantial amount of missing data ($\geq 25\%$) to those with sufficiently complete responses. Associations were assessed among a subset of the questions determined a priori by the research team. Specifically, the association between ordinal variables assessing the frequency of discussing exposure history domains and asking about specific sources of environmental exposure with confidence or answering patient questions about those exposures was assessed using the Spearman ρ . Generalized logistic models with a probit link function were used to identify factors associated with a correct answer to each of the knowledge questions. Independent variables included previous EH education or experience, satisfaction with training, perceived level of supervisor understanding, and frequency of discussions with supervisor. Multicollinearity of independent variables was assessed using bivariate Spearman correlation coefficients, and model fit was assessed using the Akaike information criterion.

— Results —

Initial analyses were conducted to test for clustering effects at the program and year levels to determine

whether there were differences among the 4 programs surveyed, as well as between first-year residents and second- and third-year residents. There were no statistically significant differences in EH attitudes, knowledge, or clinical practices found among the 4 programs. There were also no differences in EH knowledge or the frequency of performing relevant clinical practices between first-year residents and second- and third-year residents. Therefore, all subsequent analyses were conducted using the pooled responses from all 4 programs and all years.

Population

Table 1 presents respondent characteristics. Of 203 participants, 45 (22.2%) either did not finish the survey or did not answer a substantial portion of the questions (ie, $\geq 25\%$ of questions). Of 13 characteristics, only 1—intention to practice in an urban area—was associated with more missing data ($P=.03$).

Exposure history taking

As environmental exposure history taking is considered a key EH skill,²⁶ several questions examined this skill. Although 92.0% of respondents somewhat or strongly agreed that taking an exposure history is important, only 18.1% had specific training in taking one. Two clinical scenarios were presented, asking how often the resident would take an exposure history in the setting of A) a patient with poorly controlled asthma or frequent asthma exacerbations and B) a patient with recurrent miscarriage. While 75.3% would take an exposure history for the asthma patient half the time or more often, only 20.2% of residents would take an exposure history for the miscarriage patient half the time or more often. The statement

Table 1. Family medicine respondent characteristics: N = 181.*

CHARACTERISTICS	RESPONDENTS, %
Female sex	76.2
Age ≥ 30 y	29.3
Year of training	
• First-year resident	50.8
• Second- or third-year resident	49.2
Had pre-residency environmental health training	17.1
Have children aged < 18 y	13.8
Location of MD training	
• Ontario	70.7
• Other province	13.8
• IMG	15.5

IMG—international medical graduate, MD—medical doctor.

*Not all 203 respondents finished the survey.

“taking an exposure history takes up too much time in office practice” was endorsed by 48.4% of respondents.

A further line of questioning asked how often the CH2OPD2 (Community, Home and Hobbies, Occupation, Personal habits, Diet and Drugs)²⁷ exposure domains were assessed during exposure history taking. As shown in **Table 2**, the exposure domains of community, home and hobbies, occupation (for adults), and school (for children) were asked about less than half the time.

Table 3 shows results for the 8 most clinically relevant exposures. For example, 89.6% of respondents had never discussed radon exposure with their patients. **Table 4** presents respondents' confidence levels in answering patient questions about sources of exposure. For example, 63.5% felt not at all confident answering patient questions about radon. Frequency of asking about specific environmental exposures was moderately correlated with confidence in answering patients' questions about these exposures (Spearman ρ range of 0.34 to 0.54, all $P < .001$, data not shown).

Knowledge of EH

Knowledge was assessed by asking respondents to match sources of exposure with diseases. These were grouped in sets of 4, providing a 25% possibility of a correct answer by chance. **Figure 2** shows the wide range of correct answers for 7 exposure-disease pairs. While 82.9% of residents correctly identified recreational water use as a cause of gastroenteritis, only 60.2% correctly identified radon as a cause of lung cancer and 37.6% knew that elevated ground-level ozone is associated with asthma. Correctly answering 2 air-quality questions (ie, matching air pollution with cardiac events and ground-level ozone with asthma) was highly correlated ($P < .001$).

An open-ended knowledge question asked respondents to list a few exposures that are important to discuss with prospective parents. There was a 75.9% response rate, with residents who intended to provide future prenatal or well-baby care being more likely to respond ($P < .025$). The top 10 responses are presented in **Figure 3**.

Regression analyses of various factors

Factors associated with knowledge of exposure-disease pairs. For the knowledge questions about the radon exposure association with lung cancer and the ground-level ozone exposure associated with asthma, none of the following factors was statistically significantly associated with a correct answer: previous environmental exposure education, satisfaction with environmental exposure training, perceived supervisors' knowledge of environmental exposure, or frequency of discussions with supervisors regarding environmental exposure.

Factors associated with clinical practices. Residents who perceived their supervisors' understanding of environmental exposures as moderate to very good were more likely to take exposure histories for patients with uncontrolled asthma ($P < .05$, odds ratio [95% CI] of 1.85 [1.02 to 3.34]). For spontaneous abortion, the perception that supervisors' EH knowledge was poor was associated with not taking an exposure history ($P < .01$, odds ratio [95% CI] of 1.85 [1.16 to 2.97]). Only 10.8% of residents surveyed thought their supervisors understood environmental exposures quite well or very well.

Factors associated with educational material. Most respondents (52.3%) never provided patient education materials about environmental exposures to patients. Providing patients with such materials was positively associated with the belief that taking an exposure history is very important ($P < .01$) and with discussing exposure-disease links with a supervisor at least once a month ($P < .01$).

Sources of EH information

The most commonly reported resource used to answer a clinical EH question was the Internet, followed by the clinical supervisor and clinical practice guidelines (**Figure 4**). The most commonly used Web resource was the subscription site UpToDate, mentioned by 48 respondents. Fourteen government or academic websites and 8 commercial websites were each named between 1 and 5 times.

— Discussion —

This study confirms previous findings that, although EH is considered important by concerned family physicians in training, there is a gap between its perceived value and the knowledge, effective teaching, and clinical practices necessary for diagnosing exposure-related conditions.

Table 2. Frequency of assessing environmental health exposure during history taking, by exposure domain

EXPOSURE DOMAIN (CH2OPD2)*	TOTAL ANSWERS, N (%)	MISSING ANSWERS, N (%)	ANSWERS, N (%)				
			NEVER	OCCASIONALLY	HALF THE TIME	USUALLY	ALWAYS
Community or neighbourhood (C)	159 (78.3)	44 (21.7)	80 (50.3)	58 (36.5)	11 (6.9)	10 (6.3)	0 (0.0)
Housing or home (H)	162 (79.8)	41 (20.2)	21 (13.0)	69 (42.6)	32 (19.8)	38 (23.5)	2 (1.2)
Hobbies (H)	160 (78.8)	43 (21.2)	46 (28.8)	72 (45.0)	21 (13.1)	19 (11.9)	2 (1.3)
Occupation (for adults) (O)	163 (80.3)	40 (19.7)	16 (9.8)	72 (44.2)	31 (19.0)	38 (23.3)	6 (3.7)
School (for children) (O)	162 (79.8)	41 (20.2)	67 (41.4)	58 (35.8)	13 (8.0)	18 (11.1)	6 (3.7)
Diet or food (D)	164 (80.8)	39 (19.2)	14 (8.5)	48 (29.3)	38 (23.2)	42 (25.6)	22 (13.4)
Drugs (including alternative medications and supplements) (D)	163 (80.3)	40 (19.7)	18 (11.0)	46 (28.2)	26 (16.0)	43 (26.4)	30 (18.4)
Personal habits (P)	164 (80.8)	39 (19.2)	1 (0.6)	7 (4.3)	7 (4.3)	59 (36.0)	90 (54.9)

*CH2OPD2 (Community, Home and Hobbies, Occupation, Personal habits, Diet and Drugs) is an exposure-history mnemonic tool.

Table 3. Frequency of asking patients about several clinically relevant sources of exposure

EXPOSURE SOURCE	TOTAL ANSWERS, N (%)	MISSING ANSWERS, N (%)	ANSWERS, N (%)				
			NEVER	OCCASIONALLY	HALF THE TIME	USUALLY	ALWAYS
Sun	162 (79.8)	41 (20.2)	0 (0.0)	26 (16.0)	35 (21.6)	74 (45.7)	27 (16.7)
Outdoor air pollution	163 (80.3)	40 (19.7)	71 (43.6)	72 (44.2)	12 (7.4)	6 (3.7)	2 (1.2)
Radon	163 (80.3)	40 (19.7)	146 (89.6)	12 (7.4)	2 (1.2)	2 (1.2)	1 (0.6)
Pesticides	162 (79.8)	41 (20.2)	105 (64.8)	47 (29.0)	4 (2.5)	5 (3.1)	1 (0.6)
Heavy metals	162 (79.8)	41 (20.2)	77 (47.5)	69 (42.6)	10 (6.2)	5 (3.1)	1 (0.6)
Carbon monoxide indoors	163 (80.3)	40 (19.7)	29 (17.8)	63 (38.7)	35 (21.5)	32 (19.6)	4 (2.5)
Recreational water	161 (79.3)	42 (20.7)	71 (44.1)	65 (40.4)	16 (9.9)	8 (5.0)	1 (0.6)
Mold	159 (78.3)	44 (21.7)	61 (38.4)	73 (45.9)	13 (8.2)	11 (6.9)	1 (0.6)

Table 4. Respondents' confidence levels in answering patients' questions about sources of exposure

EXPOSURE SOURCE	TOTAL ANSWERS, N (%)	MISSING ANSWERS, N (%)	ANSWERS, N (%)				
			NOT AT ALL	SOMEWHAT	MODERATELY	QUITE	VERY
Sun	155 (76.4)	48 (23.6)	0 (0.0)	6 (3.9)	26 (16.8)	62 (40.0)	61 (39.4)
Outdoor air pollution	156 (76.8)	47 (23.2)	40 (25.6)	50 (32.1)	41 (26.3)	20 (12.8)	5 (3.2)
Radon	156 (76.8)	47 (23.2)	99 (63.5)	34 (21.8)	14 (9.0)	8 (5.1)	1 (0.6)
Pesticides	156 (76.8)	47 (23.2)	70 (44.9)	55 (35.3)	22 (14.1)	8 (5.1)	1 (0.6)
Heavy metals	156 (76.8)	47 (23.2)	51 (32.7)	64 (41.0)	31 (19.9)	10 (6.4)	0 (0.0)
Carbon monoxide indoors	155 (76.4)	48 (23.6)	23 (14.8)	42 (27.1)	37 (23.9)	39 (25.2)	14 (9.0)
Recreational water	155 (76.4)	48 (23.6)	45 (29.0)	49 (31.6)	38 (24.5)	20 (12.9)	3 (1.9)
Mold	153 (75.4)	50 (24.6)	35 (22.9)	66 (43.1)	36 (23.5)	15 (9.8)	1 (0.7)

Figure 2. Percentage of respondents who correctly identified exposure-disease pairs

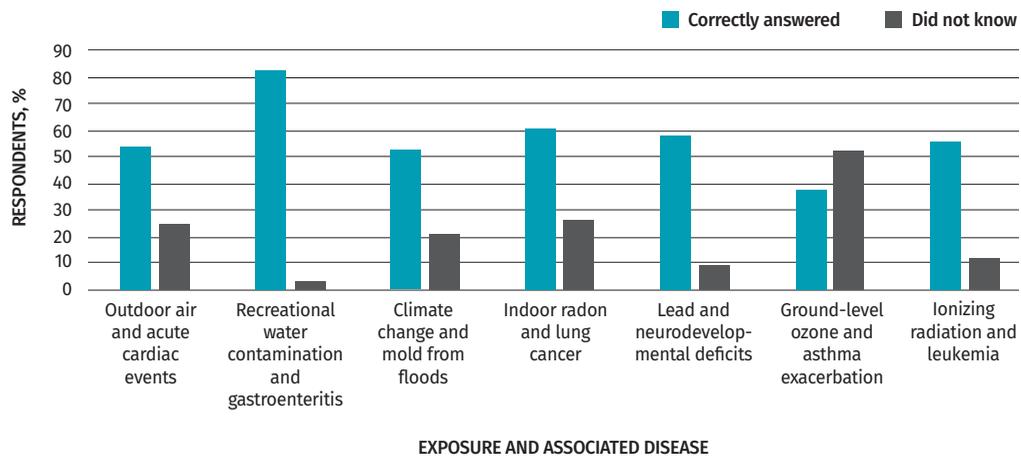
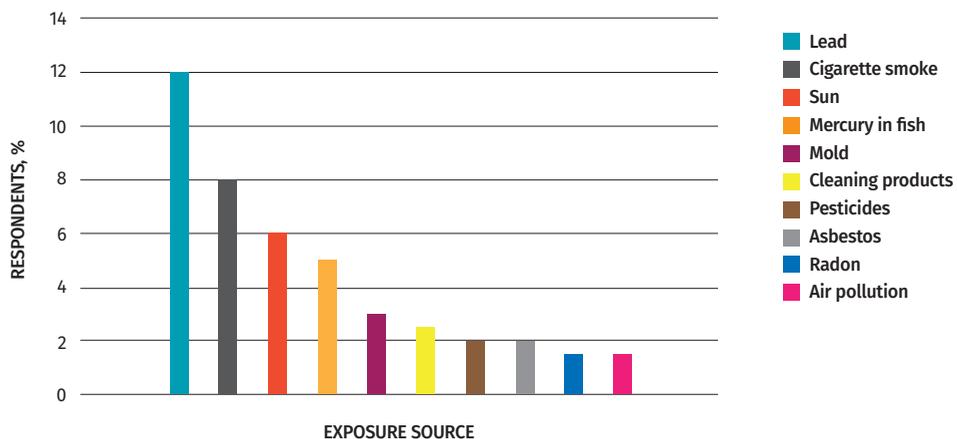


Figure 3. Top 10 sources of exposure that respondents would discuss with prospective parents

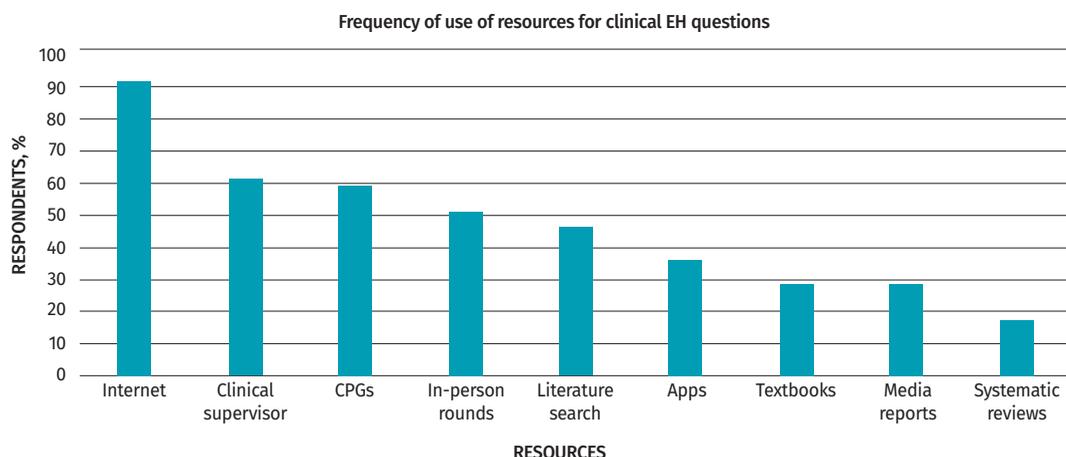


Taking an exposure history is a key clinical skill that should be addressed in resident and faculty education, and respondents reported a lack of training and negative attitudes toward this skill, which is considered the fundamental clinical practice for diagnosing exposure-related illness.³ Half of residents thought taking an exposure history took too much time in office practice, similar to the 52% of Italian family physicians who thought taking an EH history “takes too much time.” Although Health Canada recommends asking all patients to test their homes for radon, 89.6% of residents had never discussed radon with a patient. So that taking an exposure history “requires only a few minutes of the clinician’s time,”³ the process has been refined using

the clinical mnemonic CH2OPD2,²⁷ which can be applied clinically in diagnosing many different exposures.⁴

The results indicate a need for educational measures to enhance EH knowledge and practice skills among family medicine residents and their preceptors. Given that no difference was observed between first-year residents and second- and third-year residents in these measures, it is important to determine where and when current knowledge, attitudes, and clinical skills are being learned. Notably, although residents rated their supervisors’ knowledge of EH as low, they continued to use supervisors as their second most frequent source of information when confronted with a clinical problem.

Figure 4. Use of EH resources



CPGs—clinical practice guidelines, EH—environmental health.

Strengths and limitations

The survey tool development was a strength of this study, with good agreement on the important questions achieved through a Delphi process. The study was also strengthened by sampling residents from 4 programs and finding no differences among the programs in the survey measures. However, the response rate, although typical of provider surveys, was low. This study did not survey clinical supervisors, and this group might provide additional information to improve EH in family medicine education.

Conclusion and future directions

Given public and patient concern, proposed strategies to incorporate EH education in physician training need to be implemented. Basic competencies recommended for both medical students³ and primary care physicians⁴ could be modified for family medicine residents. The importance of stressing the central role of the exposure history as a core skill is reiterated in many articles.^{14,26,27} Environmental health can be integrated into current training rather than being taught in a specially created curriculum.²⁶ Cited barriers to incorporating EH into medical training include lack of time,⁶ expert faculty,^{6,28} and sufficient space in the curriculum.^{6,28} Faculty champions and institutional leadership are essential for overcoming these barriers, as exemplified in the literature.^{14,29,30} As a health determinant of critical importance,¹ EH should be a high priority for inclusion in postgraduate family medicine education. 

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Contributors

Drs Sanborn, Grierson, Upshur, Marshall, Vakil, Griffith, Scott, and **Cole** were involved in research design, contributed to development of the survey tool, and participated in discussion of results and analyses. **Drs Vakil, Marshall, Upshur, Sanborn,** and **Scott** were site coordinators responsible for obtaining ethics reviews, departmental permissions, and resident champions at their respective universities. **Dr Grierson** facilitated data collection and data security for the Delphi surveys and the resident survey through the Program for Education Research and Development at McMaster University. **Dr Griffith** provided expert consultation and mentoring for research assistants during the statistical analyses. **Dr Benusic** was a resident champion for one site and provided a literature review. All authors contributed to writing and editing the paper and have approved its final version.

Competing interests

None declared

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