

Scientific Article

International Survey on the Use of Complementary and Alternative Medicines for Common Toxicities of Radiation Therapy

Anna Lee MD, MPH ^{a,1}, Aleksandra Kuczmarska-Haas MD ^{b,1},
Meghan W. Macomber MD ^c, Kaitlin Woo MS ^d, Chris Freese MD ^e,
Zachary S. Morris MD, PhD ^{b,*}

^aDepartment of Radiation Oncology, State University of New York, Downstate Medical Center, Brooklyn, New York; ^bDepartment of Human Oncology, University of Wisconsin School of Medicine and Public Health, Madison, Wisconsin; ^cDepartment of Radiation Oncology, University of Washington Medical Center, Seattle, Washington; ^dDepartment of Biostatistics and Medical Informatics, University of Wisconsin, Madison, Wisconsin; and ^eDepartment of Radiation Oncology, University of Cincinnati College of Medicine, Cincinnati, Ohio

Received 4 June 2018; revised 25 September 2018; accepted 26 September 2018

Abstract

Purpose: Complementary and alternative medicines (CAMs) are widely used by patients with cancer. However, little is known about the extent to which these potential remedies are used internationally to treat the most common toxicities of radiation therapy. We report on the results of an international survey that assessed the use of CAMs.

Methods and Materials: Surveys were distributed to 1174 practicing radiation oncologists. Questions evaluated the perceptions of CAMs and specific practice patterns for the use of CAM remedies in the treatment of common radiation-induced toxicities (eg, skin, fatigue, nausea, diarrhea, and mucositis/xerostomia). The responses were compared between the groups using the χ^2 test and stratified on the basis of provider location, number of years in practice, and perception of CAMs.

Results: A total of 114 radiation oncologists from 29 different countries completed the survey, with a balanced distribution between North American (n = 56) and non-North American (n = 58) providers. Among the responding clinicians, 63% recommended CAMs in their practice. The proportion of clinicians who recommend CAMs for radiation toxicities did not significantly vary when stratified by provider's number of years in practice ($P = .23$) or location (United States/Canada vs other; $P = .74$). Overall, providers reported that 29.4% of their patients use CAMs,

Sources of support: This study was supported with the UW Carbone Cancer Center Core Grant P30 CA014520.

Conflicts of interest: Dr. Zachary S. Morris has a research Agreement with AstraZeneca, holds a patent for molecular-targeted radiation therapy for immunomodulation, and is on the scientific advisory board of Archeus Technologies LTD.

* Corresponding author. Department of Human Oncology, University of Wisconsin, School of Medicine and Public Health, 1111 Highland Ave., WIMR Tower I, Room 3131, Madison, WI 53705.

E-mail address: zmorris@humonc.wisc.edu (Z.S. Morris).

¹ A.L. and A.K.H. contributed equally to this work.

<https://doi.org/10.1016/j.adro.2018.09.012>

2452-1094/© 2018 The Authors. Published by Elsevier Inc. on behalf of American Society for Radiation Oncology. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



and 87.7% reported that their practice encouraged or was neutral on CAM use, whereas 12.3% recommended stopping CAMs. The most common sources of patient information on CAMs were the Internet (75.4%), friends (60.5%), and family (58.8%). Clinicians reported the highest use of CAMs for radiation skin toxicity at 66.7%, followed by 48.2% for fatigue, 40.4% for nausea, and 36.8% for mucositis/xerostomia.

Conclusions: Nearly two-thirds of the surveyed radiation oncologists recommend CAMs for radiation-related toxicities; however, they estimated that less than one third of patients use CAMs for this purpose. This suggests a need for further investigation and perhaps greater patient education on the roles of CAMs in treating radiation toxicities.

© 2018 The Authors. Published by Elsevier Inc. on behalf of American Society for Radiation Oncology. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Radiation therapy (RT) is an important component in the treatment of many malignancies, and its use is anticipated to increase globally as the incidence of cancer continues to rise.¹ RT can improve local tumor control and even patient survival in many settings, but its use is also associated with side effects including fatigue, pain, nausea, diarrhea, mucositis, and skin changes.

Low-grade toxicities can occur frequently with RT. For example, radiation-related fatigue has been reported to occur acutely in 80% of patients and 30% chronically.² Prior studies suggest that many patients will use complementary and alternative medicines (CAMs) to address such side effects during and after their course of RT.^{3–5} A meta-analysis on the use of CAMs in cancer care in Western countries has shown a marked increase in its use from an estimated 25% in the 1970s to 49% after 2000.⁶ Yet, little is known about the use of CAMs for the treatment of RT toxicities, the types of CAMs employed in this capacity, physician attitudes toward this application of CAMs, or global variation in these practices and perspectives.

The management of toxicity associated with RT is an integral part of a patient's cancer treatment course. However, studies have shown that 47% to 71% of patients do not discuss CAMs with their physicians.^{7–9} Qualitative studies have reported a variety of CAM practices among patients who receive RT, including the use of oral supplements, mind-body techniques, and cognitive-behavioral therapies. A discussion on the safety, efficacy, or interaction with RT for any given CAMs are often difficult owing to a broad lack of evidence pertaining to the potential risks and benefits of these approaches.

In this study, we developed and administered a survey to obtain information from radiation oncology providers internationally with regard to the use of CAMs among their patients and their own perceptions regarding the use of CAMs for RT toxicities.

Methods and Materials

We created a cross-sectional, descriptive survey using a combination of dichotomous, scalar, multiple-choice, and free-response questions (Appendix). The study design and survey questions were evaluated by the University of Wisconsin-Madison Institutional Review Board and were determined to be exempt under category 45 CFR 46.101(b)(2) (UW16-1342). The survey respondents were anonymous, and the survey began with a statement of informed consent.

CAMs were defined per the National Cancer Institute guidelines as approaches referring to practices that are used together with or in place of conventional treatments or medicines.¹⁰ Demographic information gathered included only the provider's practice location, location of training, and number of years in practice. Respondents were asked about their practice of recommending CAMs for RT toxicity, perceptions of the efficacy of CAMs for RT toxicity, the percentage of their patients estimated to use CAMs for RT toxicities, and sources/barriers to information on CAMs. Finally, 5 toxicity-specific sections (ie, skin, fatigue, nausea, diarrhea, and mucositis/dry mouth) evaluated specific applications of CAMs for RT toxicity and collected information on the specific types of CAM employed.

Surveys were distributed to 1174 practicing radiation oncologists, including trainees in residency. The survey was administered electronically via e-mail using the SurveyMonkey web application. Three reminder emails were sent, and the electronic survey was closed 6 months after the initial e-mail. To increase response from providers outside of North America, a cohort of printed surveys were distributed and collected anonymously (n = 100) at the 2017 American Society for Radiation Oncology (ASTRO) annual meeting international breakfast.

The distribution of survey responses was tabulated, and demographic data regarding the duration of practice and location were compared between those who would

and would not recommend CAMs using the χ^2 test. Statistical tests were 2-sided, and 5% ($P < .05$) was set as the level of significance. The analysis was done using the statistical software R package, version 3.4.2. The responses with regard to practice patterns and perceptions were further tabulated based on region of practice and duration of practice. The specific CAM remedies used were tabulated by location to evaluate whether the use of specific remedies were regionalized.

Results

A total of 125 responses (11.0%) were obtained from the 1174 surveys. A total of 47 paper surveys (37.6%) were collected at the ASTRO Annual Meeting international breakfast, and the remainder were received through SurveyMonkey. Eleven physician respondents did not give consent to participate in the study, which left 114 completed surveys (10.0%) to be analyzed from 29 different countries. There was a balanced distribution between North American ($n = 56$) and non-North American ($n = 58$) providers. Five surveys (4.4%) were collected from providers practicing in Africa, 22 (19.3%) in Asia/Australia, 6 (5.3%) in Europe, 63 (55.3%) in North America, and 18 (15.8%) in South America (Table 1). Among the responding clinicians, 63.0% recommended CAMs in their practice.

Overall, providers reported that 29.4% of their patients use CAMs, and 87.7% encouraged or were neutral on CAM use, but 12.3% recommended stopping CAMs. The most common sources of patient information on CAMs were the Internet (75.4%), friends (60.5%), and family (58.8%). Clinicians reported the highest use of CAMs for RT skin toxicity at 66.7%, with reported CAM use rates of 48.2% for fatigue, 40.4% for nausea, 36.8% for mucositis/xerostomia, and 21.9% for diarrhea.

These responses were further stratified based on region of practice. The average percent use of CAMs was 21.3% in Africa, 25.0% in Asia/Australia, 17.0% in Europe, 28.8% in North America, and 41.9% in South America (Table 2). The region that encouraged the use of CAMs the most was North America at 53.3%, and the region that encouraged patients to stop the use of CAMs the most was Asia/Australia at 35.7%. Taken altogether, providers felt neutral about the effectiveness of CAMs (36.8%).

The reasons why physicians felt that patients would approach them about CAM use were well distributed, with 43.9% indicating a concern about drug interactions, 49.1% wanting physicians to be fully informed of their health, 54.4% wanting to know more about CAMs, and 44.7% wanting to take CAMs only with their doctor's approval. The most common reason physicians cited for why a patient would not approach them was that the doctor's response would be negative (83.3%; Table 2).

Table 1 Participant characteristics

	Country of practice	Country of training
Africa, n (%)	5 (4.4)	4 (3.5)
Egypt	1	1
Ghana	1	1
Nigeria	2	2
Zambia	1	-
Asia/Australia, n (%)	22 (19.3)	20 (17.6)
Bangladesh	1	1
China	6	6
India	3	4
Japan	1	1
Malaysia	1	-
Philippines	1	1
Saudi Arabia	1	-
South Korea	2	2
Taiwan	3	3
Turkey	2	1
Europe, n (%)	6 (5.3)	11 (7.9)
France	-	1
Netherlands	1	1
Poland	1	1
Spain	1	3
Sweden	3	3
United Kingdom	-	2
North America, n (%)	63 (55.3)	61 (53.5)
Canada	3	4
Mexico	5	3
United States of America	55	54
South America, n (%)	18 (15.8)	14 (12.3)
Argentina	3	3
Brazil	10	7
Chile	2	2
Colombia	1	-
Venezuela	2	2
Unknown/missing, n (%)	-	4 (3.5)
Total	114	114

The proportion of clinicians who recommend CAMs for RT toxicities did not vary significantly when stratified by provider's number of years in practice ($P = .23$) or location (United States/Canada vs other; $P = .74$; Table 3). Among physicians who recommended CAMs, 30.6% were <5 years in practice, 19.4% had 5 to 10 years of experience, 29.2% were 10 to 20 in practice, and 20.8% had >20 years of experience ($P = .23$). When stratified by years of provider experience, the responses did not appear to differ between the cohorts (Table 4).

Among providers who believed CAMs were not effective on the Likert scale, the highest percentage was with those with the most experience (>20 years; 16%), and among providers who believed CAMs were the most effective, the highest percentage was among those with the least experience (<10 years; 12.5%). The reasons for why physicians felt that patients would approach them

Table 2 Distribution of responses from CAM survey by region of practice

	Total N (%)	Africa, n (%)	Asia/ Australia, n (%)	Europe, n (%)	North America, n (%)	South America, n (%)
How effective are CAM remedies for your patients for the treatment of radiation toxicities?						
1 (not effective)	12 (10.5)	0 (0)	4 (33.3)	2 (16.7)	4 (33.3)	2 (16.7)
2	20 (17.5)	1 (5.0)	6 (30.0)	2 (10.0)	10 (50.0)	1 (5.0)
3	42 (36.8)	2 (4.8)	9 (21.4)	2 (4.8)	24 (57.1)	5 (11.9)
4	19 (16.7)	0 (0)	1 (5.3)	0 (0)	11 (57.9)	7 (36.8)
5 (very effective)	5 (4.4)	0 (0)	0 (0)	0 (0)	3 (60.0)	2 (40.0)
No response	16 (14.0)	-	-	-	-	-
Average percent use of CAM by patients	29.4%	21.3%	25.0%	17.0%	28.8%	41.9%
What is your practice's general perception of CAM?						
We encourage patients to continue using CAM	30 (26.3)	0 (0)	5 (16.7)	1 (3.3)	16 (53.3)	8 (26.7)
We are neutral about patient's use of CAM	70 (61.4)	2 (2.9)	12 (17.1)	3 (4.3)	43 (61.4)	10 (14.3)
We encourage patients to stop using CAM	14 (12.3)	3 (21.4)	5 (35.7)	2 (14.3)	4 (28.6)	0 (0)
What are the sources of patient's information regarding CAM?						
Magazines/print media	38 (33.3)	2 (5.3)	8 (21.1)	3 (7.9)	24 (63.2)	1 (2.6)
Internet	86 (75.4)	4 (4.7)	17 (19.8)	5 (5.8)	50 (58.1)	10 (11.6)
Medical professionals	38 (33.3)	0 (0)	7 (18.4)	1 (2.6)	20 (52.6)	10 (26.3)
Practitioners of alternative medicine	56 (49.1)	3 (5.4)	5 (8.9)	5 (8.9)	37 (66.1)	6 (10.7)
Religious influences	23 (20.2)	4 (17.4)	6 (26.1)	0 (0)	13 (56.5)	0 (0)
Friends	69 (60.5)	3 (4.3)	10 (14.5)	5 (7.2)	45 (65.2)	6 (8.7)
Family	67 (58.8)	5 (7.5)	13 (19.4)	4 (6.0)	41 (61.2)	4 (6.0)
Other cancer patients	59 (51.8)	4 (6.8)	10 (16.9)	3 (5.1)	32 (54.2)	10 (16.9)
What are some reasons that patients approach you about their use of CAM?						
They are concerned about drug interactions	50 (43.9)	3 (6.0)	12 (24.0)	5 (10.0)	25 (50.0)	5 (10.0)
They want their doctor to be fully informed about their health	56 (49.1)	2 (3.6)	4 (7.1)	5 (8.9)	39 (69.6)	6 (10.7)
They want to know more about CAM	62 (54.4)	2 (3.2)	10 (16.1)	3 (4.8)	41 (66.1)	6 (9.7)
They would only take it with doctor's approval	51 (44.7)	4 (7.8)	9 (17.6)	4 (7.8)	24 (47.1)	10 (19.6)
What are some reasons that you believe patients may not approach physicians about CAM treatments?						
Doctor's response would be negative	95 (83.3)	5 (5.3)	15 (15.8)	5 (5.3)	55 (57.9)	15 (15.8)
Doctor would not know sufficient information about CAM	51 (44.7)	3 (5.9)	8 (15.7)	0 (0)	33 (64.7)	7 (13.7)
Not important for doctor to know	21 (18.4)	0 (0)	2 (9.5)	1 (4.8)	17 (81.0)	1 (4.8)
My doctor never asks me about CAM	31 (27.2)	0 (0)	1 (3.2)	2 (6.5)	24 (77.4)	4 (12.9)
Do your patients use CAM remedies for the following effects of radiation therapy?						
Skin toxicity	76 (66.7)	1 (1.8)	12 (21.8)	2 (2.6)	48 (63.2)	13 (17.1)
Fatigue	55 (48.2)	1 (1.8)	12 (21.8)	3 (5.5)	32 (58.2)	7 (12.7)
Nausea	46 (40.4)	2 (4.3)	6 (13.0)	1 (2.2)	31 (67.4)	6 (13.0)
Diarrhea	25 (21.9)	1 (4.0)	3 (12.0)	1 (4.0)	17 (68.0)	3 (12.0)
Mucositis/dry mouth	42 (36.8)	1 (2.4)	12 (28.6)	1 (2.4)	21 (50.0)	7 (16.7)
None	9 (7.9)	1 (11.1)	1 (11.1)	0 (0)	5 (55.6)	2 (22.2)

Abbreviation: CAM = Complementary and alternative medicines.

about CAM use were distributed similarly between the groups when physicians were stratified by experience (Table 4).

CAM remedies for RT toxicities were reported by free response and further classified by region of practice. The most common CAM remedies reported were aloe vera ($n = 20$) and Chinese traditional medicine ($n = 4$) in Asia/Australia; aloe vera ($n = 20$) and exercise/yoga ($n = 14$) in North America; and aloe vera ($n = 7$) and chamomile ($n = 9$) in South America (Table 5). Regions with limited responses were not included.

Discussion

In this cross-sectional descriptive study of international radiation oncology providers, we found that nearly two-thirds of radiation oncologists recommended CAMs for RT-related toxicities. However, these providers estimated that less than one-third of patients use CAMs for this purpose, which is slightly lower than in previous reports. Few prior studies have reported on the use of CAMs among patients receiving RT.^{4,5,7,11} One study of patients

Table 3 Participant characteristics and CAM recommendations

Variable	Does not recommend CAM, n (%); (n = 42)	Recommends CAM, n (%); (n = 72)	P-value
Duration of Practice, n (%)			.23
<5 y	14 (38.9)	22 (61.1)	
5-10 y	7 (33.3)	14 (66.7)	
10-20 y	9 (30.0)	21 (70.0)	
>20 y	12 (44.4)	15 (55.6)	
American/Canadian radiation oncologist			.74
Yes	20 (34.5)	38 (65.5)	
No	22 (39.3)	34 (60.7)	

Abbreviation: CAM = Complementary and alternative medicines.

from Asia undergoing RT for various malignancies found that 86% were using CAMs.⁷

A multicenter, prospective study of patients with breast cancer who received RT in the United States found that 54% reported CAM usage.⁵ On the other hand, international studies have been published citing widely varying rates (32%-98%) of CAM use among patients with cancer.¹²⁻¹⁴ This wide variation in reported CAM usage may result from differences in study design, phrasing of survey questions, the surveyed population, and the definition of CAMs used. For example, patient reports could differ from physician reports of perceived patient CAM use, and definitions of CAMs may vary depending on the context of the study and the population of interest. In the current analysis, the definition by the National Cancer Institute was used. The relatively limited variation in our study in the reported usage of CAMs across regions and by provider experience could suggest that these factors may have a limited, if any, role in contributing to the variability of CAM usage reported in prior studies.

Although the incidence of cancer has been increasing in the developing world, very little data are available on the management of RT-related toxicities in developing countries and the potential discrepancy between treatment approaches in resource-poor and resource-rich practice environments. Our study suggests that CAMs are used at comparable rates across a wide range of practice settings internationally. This prevalence may be due to a long-standing history of CAM use among patients with cancer, which may translate into a greater awareness among oncologists. Still, the remedies used for the specific toxicities vary, and this may be attributed to different sociocultural and medical systems.

A limited number of studies have evaluated the efficacy or safety of CAM remedies for RT toxicities. In a phase 3 trial, patients undergoing concurrent chemoradiotherapy for head and neck cancer were randomized

to prophylactic trolamine emulsion (active ingredient in sunscreen) every 8 hours, 4 hours apart from the RT session or best supportive care. Grade 3 skin reactions occurred in 20% of the treatment group and 53.3% of the control group ($P < .01$), demonstrating a significant benefit in the prevention of skin RT toxicity.¹¹ A phase 3, randomized clinical trial found improved breast tissue compliance in patients who received pentoxifylline and vitamin E versus placebo after breast RT.¹⁵ A recent study examined the effect of topical vitamin D compared with standard aqua cream in patients with breast cancer who received daily RT. Vitamin D was well tolerated with no increased side effects, and radiation dermatitis was not significantly different between both treatment arms.¹⁶

Other reports have suggested that CAMs can have a detrimental effect when used with RT. A case report published in 2002 discussed a patient who was scheduled to receive magnetic resonance imaging–guided prostate brachytherapy. Before the procedure, the prothrombin time was found to be elevated, and the procedure was canceled. The patient had been self-administering supraphysiologic doses of niacin, which caused his increased prothrombin time and could have led to a life-threatening intraoperative hemorrhage.¹⁷ Combining these limited studies on the efficacy of CAMs together with the results of our current survey and in the absence of evidence-based data, most surveyed radiation oncologists appear to view CAMs favorably with regard to the treatment of RT toxicities. This could suggest a broad need for further prospective evaluations of the safety and efficacy of CAMs because the most commonly used CAMs have not been well studied together with RT.

Although CAM remedies can have beneficial or deleterious effects on patients when used in combination with traditional therapies, prior studies have found that the majority of patients do not mention the use of CAMs to their doctors. This was mostly because their doctors did not ask about the use of CAMs.^{14,18} In our study, providers most often thought that patients did not approach them because their response would be negative (83.3%) or that they would not know sufficient information about CAMs (44.7%). Prior survey studies of patients with cancer have found that these are common sentiments, and 2 studies showed that less than half of patients knew a physician with competence in CAMs.^{19,20}

Interestingly, the present analysis found that approximately two-thirds of radiation oncologists recommended CAMs with only 12.3% of providers discouraging their use. This trend did not significantly vary when stratified by provider's number of years in practice or by location. Nevertheless, the surveyed radiation oncologists estimated that 29% of their patients use CAMs, a low estimate compared with other studies. The findings from the present study could highlight a need for a more open discussion because radiation oncologists are more aware of and open to the utilization of CAMs than patients may realize.

Table 4 Distribution of responses from CAM survey by duration of practice

	Total N (%)	<5 y, n (%)	5-10 y, n (%)	10-20 y, n (%)	>20 y, n (%)
How effective are CAM remedies for your patients for the treatment of radiation toxicities?					
1 (not effective)	12 (10.5)	4 (12.5)	2 (12.5)	2 (8)	4 (16)
2	20 (17.5)	10 (31.2)	0 (0)	6 (24)	4 (16)
3	42 (36.8)	14 (43.8)	9 (56.25)	9 (36)	10 (40)
4	19 (16.7)	2 (6.25)	4 (25)	7 (28)	6 (24)
5 (very effective)	5 (4.4)	2 (6.25)	1 (6.25)	1 (4)	1 (4)
No response	16 (14.0)	-	-	-	-
Average percent use of CAM by patients	29.4%	29.3%	28.3%	29.3%	30.3%
What is your practice's general perception of CAM?					
We encourage patients to continue using CAM	30 (26.3)	9 (30.0)	6 (20.0)	8 (26.7)	7 (23.3)
We are neutral about patient's use of CAM	70 (61.4)	23 (32.9)	12 (17.1)	19 (27.1)	16 (22.9)
We encourage patients to stop using CAM	14 (12.3)	4 (28.6)	3 (21.4)	3 (21.4)	4 (28.6)
What are the sources of patient's information regarding CAM?					
Magazines/print media	38 (33.3)	13 (34.2)	9 (23.7)	9 (23.7)	7 (18.4)
Internet	86 (75.4)	30 (34.9)	17 (19.8)	20 (23.3)	19 (22.1)
Medical professionals	38 (33.3)	12 (31.6)	9 (23.7)	10 (26.3)	7 (18.4)
Practitioners of alternative medicine	56 (49.1)	18 (32.1)	12 (21.4)	12 (21.4)	14 (25.0)
Religious influences	23 (20.2)	13 (56.5)	3 (13.0)	3 (13.0)	4 (17.4)
Friends	69 (60.5)	27 (39.1)	9 (13.0)	19 (27.5)	14 (20.3)
Family	67 (58.8)	25 (37.3)	10 (14.9)	18 (26.9)	14 (20.9)
Other cancer patients	59 (51.8)	19 (32.2)	13 (22.0)	14 (23.7)	13 (22.0)
What are some reasons that patients approach you about their use of CAM?					
They are concerned about drug interactions	50 (43.9)	16 (32.0)	12 (24.0)	10 (20.0)	12 (24.0)
They want their doctor to be fully informed about their health	56 (49.1)	18 (32.1)	12 (21.4)	12 (21.4)	14 (25.0)
They want to know more about CAM	62 (54.4)	24 (38.7)	13 (21.0)	14 (22.6)	11 (17.7)
They would only take it with doctor's approval	51 (44.7)	18 (35.3)	11 (21.6)	12 (23.5)	10 (19.6)
What are some reasons that you believe patients may not approach physicians about CAM treatments?					
Doctor's response would be negative	95 (83.3)	31 (32.6)	16 (16.8)	25 (26.3)	23 (24.2)
Doctor would not know sufficient information about CAM	51 (44.7)	18 (35.3)	10 (19.6)	13 (25.5)	10 (19.6)
Not important for doctor to know	21 (18.4)	5 (23.8)	6 (28.6)	5 (23.8)	5 (23.8)
My doctor never asks me about CAM	31 (27.2)	10 (32.3)	4 (12.9)	8 (25.8)	9 (29.0)
Do your patients use CAM remedies for the following effects of radiation therapy?					
Skin toxicity	76 (66.7)	25 (32.9)	12 (15.8)	20 (26.3)	19 (25.0)
Fatigue	55 (48.2)	16 (29.1)	11 (20.0)	12 (21.8)	16 (29.1)
Nausea	46 (40.4)	13 (28.3)	11 (23.9)	12 (26.1)	10 (21.7)
Diarrhea	25 (21.9)	10 (40.0)	4 (16.0)	8 (32.0)	3 (12.0)
Mucositis/dry mouth	42 (36.8)	17 (40.5)	3 (7.1)	13 (31.0)	9 (21.4)
None	9 (7.9)	3 (33.3)	3 (33.3)	1 (11.1)	2 (22.2)

Abbreviation: CAM = Complementary and alternative medicines.

In our study, the most commonly reported CAM remedies were aloe vera products ($n = 45$) for skin toxicity, exercise ($n = 14$) for fatigue, ginger ($n = 11$) for nausea, probiotics ($n = 11$) for diarrhea, and acupuncture ($n = 8$) for mucositis/xerostomia. Intriguingly, the rates of CAM recommendation did not markedly vary by region, but the specific types of CAMs used for RT toxicities varied widely between regions. Such differences may be related to CAM availability as well as cultural, social, and economic influences.

In other studies, the most commonly cited CAMs used by patients with cancer included exercise therapy, ingestion of vitamins and minerals, and herbal therapies.^{21,22}

Given the potential interactions that could occur with the use of oral supplements, the findings of our study suggest that the highest usage of topical or activity-based CAMs together with RT may offer some reassurance about the relative safety of current practices. However, further evaluation is needed.

Our study has several limitations, and perhaps the most notable is the low response rate. Several factors may have contributed to this. First, we surveyed a diverse group of responders from 29 different countries. Survey questions were written in English and may have been more difficult for nonnative English speakers to understand. In addition, recipient contact information was not verified, and we are

Table 5 Remedies for specific toxicities by region

	Asia/Australia (n)	North America (n)	South America (n)
Skin	Aloe vera (20)	Aloe vera (18)	Aloe vera (7)
	Chinese traditional medicine (2)	Essential oils (9)	Chamomile (6)
		Vitamin E (8)	
		Calendula cream (6)	
Fatigue	Chinese traditional medicine (3)	Exercise/yoga (14)	Fruit (2)
	Supplements (2)	Supplements (8)	Acupuncture (2)
		Ginseng (3)	Herbs (2)
Nausea	Ginger (2)	Ginger (9)	Acupuncture (2)
	Acupuncture (1)	Marijuana (9)	Tea (2)
		Acupuncture (7)	
Diarrhea	-	Probiotics (11)	Nutmeg (2)
Mucositis	Honey (2)	Acupuncture (7)	Chamomile (3)
		Salt/baking soda (3)	Acupuncture (1)
		Aloe vera (2)	

not able to determine how many survey emails were actually received, opened, or read. To increase the response rate from non-North American providers, paper surveys were collected at the ASTRO Annual Meeting international breakfast; thus, there may be differences related to the distribution of surveys at 2 different time points with 2 different formats (paper and online), which may be unaccounted for in our analysis. Because of the low response rate, there is potential for selection bias in this study among the responding practitioners who completed this survey. However, other physician survey studies have observed similarly low response rates and have suggested that the response rate in this population may not be a reliable proxy for response bias.²³⁻²⁵

Despite these limitations, this study provides initial insights on a poorly understood topic that may influence the care of a majority of patients with cancer globally, and highlights a need for further research. A recent study conducted using the National Cancer Database illustrates this need and reports that patients who received CAMs are more likely to refuse conventional treatments, which is associated with a higher risk of death.²⁶ Our findings are hypothesis-generating and may guide subsequent investigations into the use of CAMs among patients who receive radiation, especially in developing countries.

Knowledge often transfers from developed countries that perform clinical studies to less affluent settings, but the understanding of local and regional CAM applications for RT toxicities may enable a critical transfer of knowledge from resource-poor settings to developed nations for the collective benefit of patients with cancer. Such knowledge will be critical given that a minority of patients discuss CAMs with their doctors, despite the potential positive or negative impact on the overall cancer care. Future work could include interventional studies in which radiation oncologists initiate a discussion of CAMs with their patients.

Conclusions

The use of CAMs to treat common RT toxicities is prevalent globally, with nearly two-thirds of radiation oncologists recommending CAMs for RT-related toxicities. There appears to be broad awareness of and support for CAM usage among radiation oncology providers; however, patients may not perceive this. Open discussions of CAMs before or during the course of RT may maximize the potential benefits of CAMs in the treatment of RT toxicities.

Supplementary data

Supplementary material for this article can be found at <https://doi.org/10.1016/j.adro.2018.09.012>.

References

1. Stewart BW, Wild CP. *World Cancer Report 2014*. Lyon, France: World Health Organization; 2014.
2. Jereczek-Fossa BA, Marsiglia HR, Orecchia R. Radiotherapy-related fatigue. *Crit Rev Oncol Hematol*. 2002;41:317-325.
3. Ernst E, Cassileth BR. The prevalence of complementary/alternative medicine in cancer: A systematic review. *Cancer*. 1998;83:777-782.
4. Yarney J, Donkor A, Opoku SY, et al. Characteristics of users and implications for the use of complementary and alternative medicine in Ghanaian cancer patients undergoing radiotherapy and chemotherapy: A cross-sectional study. *BMC Complement Altern Med*. 2013;13:16.
5. Moran MS, Ma S, Jagsi R, et al. A prospective, multicenter study of complementary/alternative medicine (CAM) utilization during definitive radiation for breast cancer. *Int J Radiat Oncol Biol Phys*. 2013;85:40-46.
6. Horneber M, Bueschel G, Dennert G, Less D, Ritter E, Zwahlen M. How many cancer patients use complementary and alternative medicine: A systematic review and metaanalysis. *Integr Cancer Ther*. 2012;11:187-203.

7. Wong LC, Chan E, Tay S, Lee KM, Back M. Complementary and alternative medicine practices among Asian radiotherapy patients. *Asia Pac J Clin Oncol*. 2010;6:357-363.
8. Puataweepong P, Sutheecheet N, Ratanamongkol P. A survey of complementary and alternative medicine use in cancer patients treated with radiotherapy in Thailand. *Evid Based Complement Alternat Med*. 2012;2012:670408.
9. Rausch SM, Winegardner F, Kruk KM, et al. Complementary and alternative medicine: use and disclosure in radiation oncology community practice. *Support Care Cancer*. 2011;19:521-529.
10. National Cancer Institute. Complementary and Alternative Medicine. In: (NIH) NIOH, ed. <https://nccih.nih.gov/health/integrative-health>. Accessed January 15, 2018.
11. Abbas H, Bensadoun RJ. Trolamine emulsion for the prevention of radiation dermatitis in patients with squamous cell carcinoma of the head and neck. *Support Care Cancer*. 2012;20:185-190.
12. Cui Y, Shu XO, Gao Y, et al. Use of complementary and alternative medicine by chinese women with breast cancer. *Breast Cancer Res Treat*. 2004;85:263-270.
13. Pud D, Kaner E, Morag A, Ben-Ami S, Yaffe A. Use of complementary and alternative medicine among cancer patients in Israel. *Eur J Oncol Nurs*. 2005;9:124-130.
14. Ezeome ER, Anarado AN. Use of complementary and alternative medicine by cancer patients at the University of Nigeria Teaching Hospital, Enugu, Nigeria. *BMC Complement Altern Med*. 2007;7:28.
15. Jacobson G, Bhatia S, Smith BJ, Button AM, Bodeker K, Buatti J. Randomized trial of pentoxifylline and vitamin E vs standard follow-up after breast irradiation to prevent breast fibrosis, evaluated by tissue compliance meter. *Int J Radiat Oncol Biol Phys*. 2013;85:604-608.
16. Nasser NJ, Fenig S, Ravid A, et al. Vitamin D ointment for prevention of radiation dermatitis in breast cancer patients. *NPJ breast cancer*. 2017;3:10.
17. D'Amico AV, Toupless G, Lopes L, et al. Self-administration of untested medical therapy for treatment of prostate cancer can lead to clinically significant adverse events. *Int J Radiat Oncol Biol Phys*. 2002;54:1311-1313.
18. Brahmi SA, El M'rabet FZ, Benbrahim Z, et al. Complementary medicine use among Moroccan patients with cancer: A descriptive study. *Pan Afr Med J*. 2011;10:36.
19. Wortmann JK, Bremer A, Eich HT, et al. Use of complementary and alternative medicine by patients with cancer: A cross-sectional study at different points of cancer care. *Med Oncol*. 2016;33:78.
20. Huebner J, Prott FJ, Micke O, et al. Online survey of cancer patients on complementary and alternative medicine. *Oncol Res Treat*. 2014;37:304-308.
21. Kang E, Yang EJ, Kim SM, et al. Complementary and alternative medicine use and assessment of quality of life in Korean breast cancer patients: A descriptive study. *Support Care Cancer*. 2012;20:461-473.
22. Er O, Mistik S, Ozkan M, Ozturk A, Altinbas M. Factors related to complementary/alternative medicine use among cancer patients in central Anatolia. *Tumori*. 2008;94:833-837.
23. Wiebe ER, Kaczorowski J, MacKay J. Why are response rates in clinician surveys declining? *Can Fam Physician*. 2012;58:e225-e228.
24. Cunningham CT, Quan H, Hemmelgarn B, et al. Exploring physician specialist response rates to web-based surveys. *BMC Med Res Methodol*. 2015;15:32.
25. Cull WL, O'Connor KG, Sharp S, Tang SF. Response rates and response bias for 50 surveys of pediatricians. *Health Serv Res*. 2005;40:213-226.
26. Johnson SB, Park HS, Gross CP, Yu JB. Complementary medicine, refusal of conventional cancer therapy, and survival among patients with curable cancers. *JAMA Oncol*. 2018;4:1375-1381.