

Complementary and alternative medicine use among cancer survivors: a population-based study

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Abstract

Introduction The use of complementary and alternative medicine (CAM) among cancer survivors is high, yet less is known about reasons behind such use or the communication of CAM with conventional medical providers.

Methods Cross-sectional, multivariate logistic regression models were developed to evaluate the similarities and differences between cancer survivors and non-cancer controls in the 2007 National Health Interview Survey with 23,393 participants, including 1,471 cancer survivors.

Results Among cancer survivors, 66.5% reported ever using CAM and 43.3% having used CAM in the past year. When compared with the general population, cancer survivors used CAM more often for general disease prevention, immune enhancement, and for pain (Adjusted Odds Ratio [AOR] 1.27,

95% Confidence Interval [CI] 1.10–1.48; AOR 1.32, 95% CI 1.05–1.62; AOR 1.42, 95% CI 1.05–1.92, respectively). Cancer survivors were more likely to use CAM because of recommendations from their provider (AOR 1.54, 95% CI 1.26–1.88) and were more likely to disclose their CAM use to their provider (AOR 1.45, 95% CI 1.22–1.72).

Discussions/Conclusions When compared to the general population, cancer survivors were more likely to use CAM and communicate this use with providers, indicating a growing integration of CAM in conventional medical care. **Implications for Cancer Survivors** Cancer survivors are more likely than the general population to communicate CAM use with providers, suggesting greater integration of CAM use in conventional care. However, the majority of CAM use is still not being communicated to providers, indicating an important area for improvement in patient-centered care.

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Introduction

There are 12 million cancer survivors in the U.S. and this number will continue to expand because of early screening, effective cancer treatments, and population aging [1]. The use of complementary and alternative medicine (CAM) use among cancer survivors is high [2–4], and has appeared to be increasing in specific populations such as breast cancer survivors [5]. Population-based studies have demonstrated that cancer survivors are more likely to use CAM than the general population without cancer [6, 7].

Many cancer survivors turn to CAM therapies in addition to their conventional treatment to deal with health

issues such as recurring pain, insomnia, and ongoing psychological distress [8–12], Cancer survivors report that they seek CAM in order to gain a sense of control [13, 14], to manage symptoms, to improve quality of life [15], and to boost the immune system [16, 17]. Cancer survivors may also seek CAM because they desire non-pharmacologic therapies to treat their symptoms [18] or deal with needs are unmet by conventional medical care [19, 20].

Despite the high prevalence of CAM use, research suggests that patients often do not discuss CAM use with their conventional health care provider (from here on referred to as “provider”) [11, 21, 22]. While several types of CAM therapies may provide benefits to cancer patients [23–26], many have not been rigorously studied for safety or efficacy. Some CAM treatments may interact with conventional cancer therapies [27] or contain substances (e.g. heavy metals) that are harmful for prolonged use [28]. Because internet and other media contain unsubstantiated claims about untested therapies that patients often turn to for health information [29, 30], discussing CAM use with patients in clinical context may help maximize benefits, minimize risk, and facilitate integration of safe and effective CAM use into conventional cancer care.

Despite emerging knowledge about CAM use in cancer, existing literature lacks the population-based approach to evaluate the motivations behind CAM use among cancer survivors and the extent of communication about such use between patients and providers. Further, studies often lack appropriate non-cancer comparator group, which makes it difficult to interpret whether cancer survivors are using CAM to address issues that are unique to them. A better examination of these topics is critical to develop better integration of CAM with conventional medical system and support patient-centered communication in cancer survivorship care. In this paper, we analyze a nationally representative sample to evaluate both use and communication of CAM in the cancer population compared to the general population. We specifically investigated: 1) Rates of past and recent CAM use, 2) Reasons for use, 3) Motivations behind use, and 4) Communication of CAM use with providers.

Materials and methods

The study population includes all of the adults who participated in the 2007 National Health Interview Survey (NHIS), an annual multistage survey conducted in a nationally representative sample of the civilian non-institutionalized population of the United States. The NHIS survey was conducted through confidential in-person interviews by the Centers for Disease Control and Prevention’s National Center for Health Statistics [31]. The data for this

study was extracted from the Sample Adult Core component and the Complementary and Alternative Medicine supplement of the 2007 NHIS. Details on the survey design and content can be found at <http://www.cdc.gov/nchs/nhis.htm> (last accessed: July 26, 2010). This study was approved by the Institutional Review Board at the University of Pennsylvania.

Cancer survivorship status

Cancer survivorship status was determined by a subject’s response to the item “Have you ever been told by a doctor or other health professional that you had cancer or a malignancy of any kind?” Individuals who responded “yes” were then asked about the type(s) of cancer and their age at each cancer diagnosis. Those individuals with only non-melanoma skin cancer were classified as controls rather than cancer survivors [6]. We created seven non-overlapping cancer types: breast, prostate, colorectal (included colon and rectal), gynecological (included cervical, ovarian, and uterine), melanoma, multiple cancers, and other. Time since cancer diagnosis was calculated by subtracting age at diagnosis from age at the time of the survey. We created 4 categories of time since diagnosis (within the past year, 2–5 years, 6–10 years, ≥ 11 years) [31–33]. When the subtraction yielded inconsistent results (e.g. negative numbers), we used the methods described by Yabroff et al. [32] to recode this variable.

CAM use

The National Center for Complementary and Alternative Medicine (NCCAM) defines CAM as a group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medical care [34]. The 2007 NHIS supplemental questionnaire included questions on 38 CAM therapies commonly used in the United States. Individuals were asked whether they had used particular CAM therapies ever, and if they responded “yes,” they were then asked whether they used specific therapies over the past 12 months [33]. Consistent with NCCAM’s definition, we classified CAM into the following five areas: whole medical systems (i.e. Ayurveda, homeopathy, naturopathy), mind-body medicine (i.e. meditation, prayer, yoga), biologically based therapies (i.e. herbs, special diets), manipulative and body-based (i.e. chiropractic, osteopathy, massage), and energy healing (i.e. reiki) [34–36]. Because stress management and support groups may be particularly relevant to cancer survivors, we also included these under mind-body based CAM.

We created the overall and specific categories of CAM use, looking both at past use (past use is referred to as “ever” in this paper) and recent use (recent use is referred to

as “12 months” in this paper). For each specific CAM therapy used in the past 12 months, participants were asked questions regarding their motivation behind and use of CAM therapies, the source of information about CAM (i.e. health care provider, family, friends, or co-workers), and their communication about CAM with their provider. We calculated proportions of responses over the overall CAM therapies used in the past 12 months.

Covariates

We used the racial/ethnic groups defined in the NHIS survey: Hispanic, non-Hispanic white, non-Hispanic black, and then combined non-Hispanic Asian and non-Hispanic other to form our own non-Hispanic other. Geographic locations were based on US census regions: West, Midwest, South, and Northeast. For analysis purposes, we created three age categories: <50, 50–64, and ≥ 65 . We classified education as high school graduate or less, some college or technical school, and college or more advanced degree.

Statistical analyses

We first described the prevalence of individual and composite categories of CAM past and recent use among cancer survivors. To compare the differences in CAM use between cancer survivors and non-cancer controls, we first used chi square test. Multivariate logistic regression models were then developed to determine the association between CAM use and cancer survivorship status while adjusting for age, sex, race/ethnicity, education, and census region. We used the survey analysis package from STATA version 10 (Stata Corp, College Station, Texas) for all statistical analyses, and population estimates were generated to take into account the multistage sampling, clustering, and stratification design of the NHIS [37]. All statistical tests were two-sided with $p < 0.05$ indicating significance.

Results

Study population characteristics

In 2007, 23,393 non-institutionalized individuals aged 18 years or older participated in the survey with an overall response rate of 67.8% [38], 1,785 reported having been diagnosed with cancer. Among these, 314 had been diagnosed with non-melanoma skin cancer and were classified as non-cancer controls rather than cancer survivors [32]. Our final sample consisted of 1,471 cancer survivors and 21,922 non-cancer controls.

The socio-demographic and clinical characteristics of this population are presented in Table 1. Among this

sample of cancer survivors, 17.3% had breast cancer, 14.0% had prostate cancer, 6.6% had colorectal cancer, 14.0% had gynecologic cancer, 7.2% had melanoma, 30.4% had other types of cancer, and 10.5% had multiple types of cancer. Stratified by time since cancer diagnosis, 17.9% of individuals were diagnosed with cancer in the past year, 28.8% between 2 and 5 years ago, 19.4% between 6 and 10 years, and 32.5% greater than 10 years previously.

CAM use in cancer survivors

Overall, cancer survivors were significantly more likely to have ever used CAM in their lifetime than non-cancer controls (65.0% vs. 52.5%, $p < 0.001$), see Table 2. Similarly, cancer survivors were likely to report CAM use than non-cancer controls in specific domains: Alternative medical system (15.5% vs. 11.2%, $p < 0.001$), biologically based (36.8% vs. 29.2%, $p < 0.001$), manipulative and body based (41.8% vs. 31.4%, $p < 0.001$), mind-body (32.0% vs. 25.5%, $p < 0.001$), and energy healing (2.9% vs. 1.6%, $p = 0.002$).

Cancer survivors were also significantly more likely to use CAM in the past 12 months (43.3% vs. 37.3%, $p < 0.001$), specifically biologically based (26.0% vs. 19.6%, $p < 0.001$), mind-body (21.7% vs. 19.2%, $p = 0.046$), and energy healing (1.1% vs. 0.5%, $p = 0.027$), while rates were comparable for alternative medical systems and manipulative/body-based therapies.

In multivariate analysis adjusting for socio-demographic factors, cancer survivors were found to have both increased past use of CAM (AOR 1.61, 95% CI 1.39–1.86, $p < 0.001$) and recent use of CAM (AOR 1.28, 95% CI 1.11–1.49, $p = 0.001$).

Reasons for CAM use

Cancer survivors report using CAM for a variety of reasons (see Fig. 1). Among the reported uses of CAM, 28.9% were for wellness or general disease prevention, 11.3% were to enhance energy, 11.5% were to enhance immune function, 6.7% were to treat pain-related symptoms (including joint pain/aching, neck pain, back pain, other musculoskeletal, regular headaches, severe headaches/migraines), 2.1% were to treat psychological distress (including stress, anxiety, or depression), and 1.1% were to treat insomnia.

When compared with non-cancer controls (see Table 3), CAM use in cancer survivors was more likely to be for wellness and general disease prevention (OR 1.33, 95% CI 1.17–1.52), which remained significant after adjusting for socio-demographic variables (AOR 1.27, 95% CI 1.10–1.48). CAM was also more likely to be used by survivors for enhancing immune function (OR 1.31, 95% CI 1.10–1.57) and for treating pain related symptoms (OR 1.44,

Table 1 Characteristics of cancer survivors ($n=1,471$) vs. non-cancer controls ($n=21,922$)

Characteristics	Cancer survivors		Non-cancer controls		<i>p</i> -value
	%	SE	%	SE	
Sex					<0.001
Female	58.5	1.5	51.3	0.4	
Male	41.5	1.5	48.7	0.4	
Age					<0.001
<50	21.2	1.3	62.2	0.5	
50–64	29.1	1.4	23.6	0.4	
>65	49.8	1.6	14.1	0.3	
Education attainment					0.19
High school or less	48.7	1.6	44.3	0.5	
Some college or technical school	23.8	1.3	28.8	0.4	
College or more advanced	27.6	1.5	26.9	0.5	
Race/ethnicity					0.026
Non-Hispanic White	84.4	1	68.4	0.5	
Non-Hispanic Black	7.5	0.7	12.0	0.4	
Hispanic	5.8	0.6	13.9	0.4	
Other (non-Hispanic)	2.4	0.4	5.8	0.3	
Census Region					0.047
Northeast	18.7	1.4	17.0	0.5	
Midwest	24.3	1.5	24.1	0.8	
South	37.8	1.8	36.6	0.7	
West	19.2	1.4	22.3	0.6	
Time since cancer diagnosis					
Past year	17.9	1.1			
2–5 years	28.8	1.4			
6–10 years	19.4	1.2			
11 or more years	32.5	1.5			
Type of cancer					
Breast	17.3	1.1			
Prostate	14.0	1.1			
Colorectal	6.6	0.7			
Gynecological	14.0	1.0			
Melanoma	7.2	0.8			
Other	30.4	1.3			

95% CI 1.09–1.91), which remained significant after adjusting for socio-demographic variables (AOR 1.32, 95% CI 1.05–1.62 and AOR 1.42, 95% CI 1.05–1.92, respectively).

Motivations behind CAM use

Among all CAM therapies used by cancer survivors, 5.2% were cited because medical treatments did not help, 2.2% because medical treatments were too expensive, 13.3% because recommended by a provider, and 14.9% because recommended by a family member, friend, or coworker

(14.9%) (see Fig. 2). Compared to non-cancer controls (see Table 3), CAM use among cancer survivors was more likely because medical treatments did not help (OR 1.68, CI 1.22–2.31) or because recommended by a provider (OR 1.92, 95% CI 1.61–2.30). After adjusting for socio-demographic variables, the motivations that were significant were because medical treatment did not help (AOR 1.67, 95% CI 1.19–2.36), because medical treatments were too expensive (AOR 1.44, 95% CI 0.93–2.23), because recommended by a provider (AOR 1.54, 95% CI 1.26–1.88), and because recommended by lay persons (AOR 1.21, 95% CI 1.02–1.44).

Table 2 Prevalence of CAM use: ever and in past 12 months

Therapies	Ever used				<i>p</i> -value	Used in 12 months				<i>p</i> -value
	Cancer survivors		Non-cancer controls			Cancer survivors		Non-cancer controls		
	%	SE	%	SE		%	SE	(%)	SE	
Total										
Any CAM therapy	65.0	1.5	52.5	0.6	<0.001	43.3	1.6	37.3	0.5	<0.001
Alternative medical systems	15.5	1.2	11.2	0.3	<0.001	3.2	0.6	3.5	0.2	0.70
Acupuncture	10.2	1.0	6.2	0.2	<0.001	1.6	0.5	1.4	0.1	0.68
Ayurveda	0.6	0.3 ^d	0.6	0.1	–	0.1	0.1 ^d	0.1	0 ^d	–
Homeopathy	4.0	0.6	3.7	0.2	0.56	1.5	0.4	1.8	0.1	0.43
Naturopathy	1.7	0.4	1.5	0.1	0.69	0.2	0.1 ^d	0.3	0 ^d	–
Traditional healers ^a	2.4	0.5	2.2	0.2	0.69	0.3	0.2 ^d	0.4	0.1	–
Biologically based	36.8	1.5	29.2	0.5	<0.001	26.0	1.4	19.6	0.4	<0.001
Chelation therapy	0.4	0.2 ^d	0.4	0.1	–	0.0	0 ^d	0.1	0 ^d	–
Herbs	32.5	1.4	24.8	0.5	<0.001	23.2	1.2	17.5	0.4	<0.001
Special diets ^b	11.5	1.1	8.6	0.3	0.004	5.2	0.8	3.5	0.2	0.008
Manipulative and body based	41.8	1.6	31.4	0.5	<0.001	16.5	1.2	15.1	0.4	0.24
Chiropractic/osteopathic	34.6	1.6	22.9	0.5	<0.001	9.8	0.1	8.5	0.3	0.19
Massage	19.4	1.4	16.6	0.4	0.033	9.0	0.9	8.2	0.3	0.39
Movement based ^c	2.4	0.5	3.5	0.2	0.068	0.7	0.3 ^d	1.5	0.1	–
Mind-body	32.0	1.6	25.5	0.4	<0.001	21.7	1.2	19.2	0.4	0.046
Biofeedback	2.5	0.6	1.4	0.1	0.028	0.1	0.1 ^d	0.2	0 ^d	–
Meditation	13.2	1.1	12.1	0.3	0.28	9.8	0.9	9.4	0.3	0.64
Guided imagery	4.8	0.7	3.5	0.2	0.036	2.9	0.5	2.2	0.2	0.13
Progressive relaxation	5.8	0.7	4.2	0.2	0.011	3.2	0.6	2.9	0.2	0.61
Deep breathing	18.3	1.2	15.1	0.3	0.004	14.7	1.0	12.6	0.3	0.04
Hypnosis	5.3	0.7	2.2	0.1	<0.001	0.4	0.3 ^d	0.2	0 ^d	–
Stress management	3.7	0.6	2.1	0.1	0.001	1.3	0.3	0.8	0.1	0.05
Support groups	6.2	0.7	3.3	0.2	<0.001	2.7	0.5	1.7	0.1	0.012
Yoga	9.8	0.9	9.9	0.3	0.93	5.5	0.8	6.1	0.2	0.51
Tai chi	3.5	0.6	2.8	0.1	0.23	1.1	0.3	1.0	0.1	0.77
Qi gong	0.7	0.3 ^d	0.6	0.1	–	0.2	0.1 ^d	0.3	0 ^d	–
Energy healing/Reiki	2.9	0.6	1.6	0.1	0.002	1.1	0.4	0.5	0.1	0.027

CAM complementary and alternative medicine; SE standard error.

^a Traditional Healers include curandero, espiritista, hierbero, shaman, botanica, native american healer, and sobador.

^b Special diets include vegetarian, macrobiotic, Atkins, Priltikin, Ornish, Zone, and South Beach.

^c Movement based therapies include Feldenkreis, Alexander technique, Pilates, and Trager.

^d Relative standard error greater than 30% and should be interpreted with caution as they do not meet the standard of reliability or precision.

Communication of CAM with provider

Of the CAM used by cancer survivors, 22.7% of CAM and 14.6% of herbs used were disclosed to providers (see Fig. 3). CAM disclosure among cancer survivors was significantly higher when compared to non-cancer controls (OR 1.84, 95% CI 1.58–2.16), and this remained significant after controlling for socio-demographic variables (AOR 1.45, 95% CI 1.22–1.72) (see Table 3). The same was true for herb use (AOR 1.40, 95% CI 1.14–1.71).

Discussion

To our knowledge, this is the first study that uses a population-based approach to analyze the motivations behind CAM use among cancer survivors and the extent of communication of CAM use between patients and providers. In addition, this study compares cancer survivors to a control group, allowing issues unique to the cancer survivor population to be identified. We found that cancer survivors are more likely than the general population to

Fig. 1 Reasons for CAM use

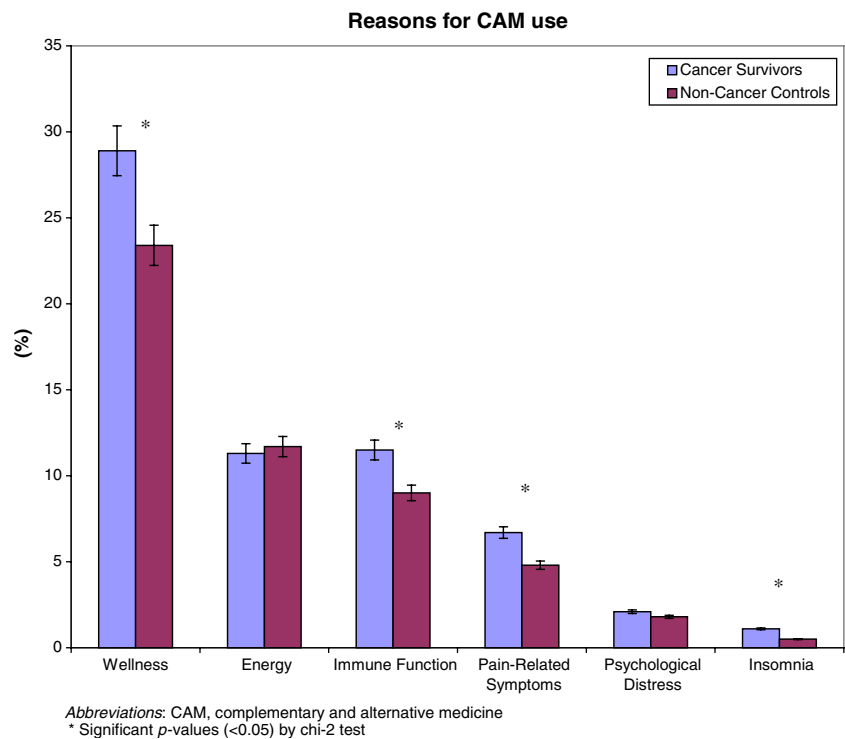


Table 3 Multivariate analysis: cancer survivors vs. non-cancer controls

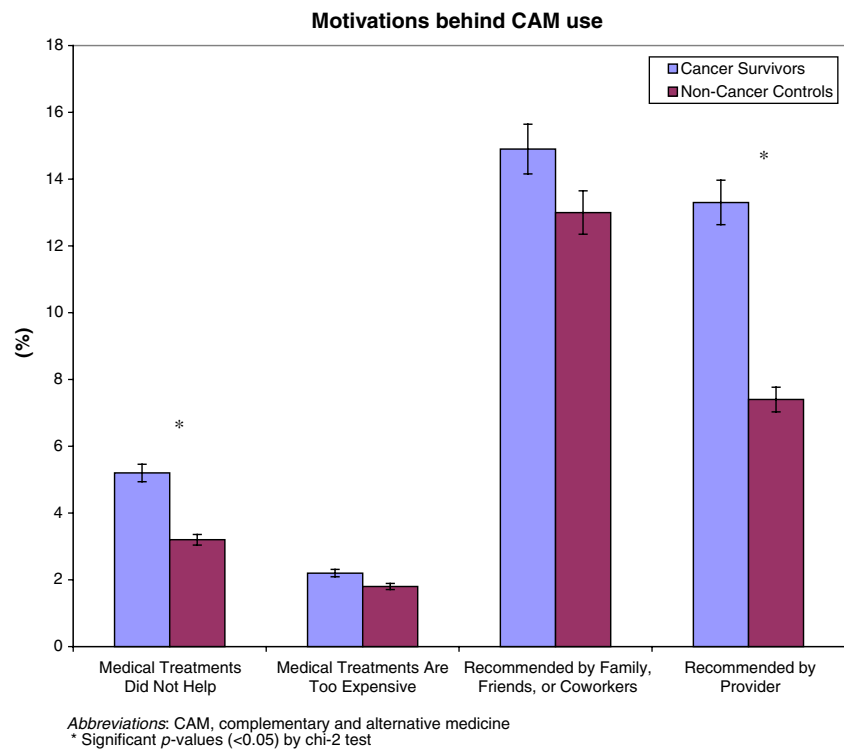
	Univariate Analysis			Multivariate Analysis ^a		
	OR	95% CI	p-value	AOR	95% CI	p-value
Prevalence of CAM use						
Ever used	1.71	(1.49–1.95)	<0.001	1.61	(1.39–1.86)	<0.001
Used in the previous 12 months	1.29	(1.13–1.47)	<0.001	1.28	(1.11–1.49)	0.001
Reasons for CAM use						
Wellness	1.33	(1.17–1.52)	<0.001	1.27	(1.10–1.48)	0.002
Energy	0.97	(0.79–1.18)	0.73	1.12	(0.89–1.40)	0.34
Immune function	1.31	(1.10–1.57)	0.003	1.32	(1.05–1.62)	0.007
Pain-related symptoms ^b	1.44	(1.09–1.91)	0.010	1.42	(1.05–1.92)	0.025
Psychological distress ^c	1.13	(0.74–1.72)	0.57	1.30	(0.82–2.05)	0.27
Insomnia	2.39	(1.14–5.00)	0.021	2.30	(0.95–5.54)	0.065
Motivations behind CAM use						
Medical treatments didn't help	1.68	(1.22–2.31)	0.001	1.67	(1.19–2.36)	0.003
Medical treatments were too expensive	1.22	(0.81–1.84)	0.34	1.44	(0.93–2.23)	0.01
Recommended by provider	1.92	(1.61–2.30)	<0.001	1.54	(1.26–1.88)	<0.001
Recommended by family/friend/coworker	1.17	(1.00–1.38)	0.055	1.21	(1.02–1.44)	0.033
Communication of CAM use						
Let provider know of CAM use	1.84	(1.58–2.16)	<0.001	1.45	(1.22–1.72)	<0.001
Let provider know of Herb use	2.06	(1.71–2.47)	<0.001	1.40	(1.14–1.71)	0.001

CAM complementary and alternative medicine; OR odds ratio; AOR adjusted odds ratio; CI confidence interval.

^a Multivariate analysis adjusts for age, sex, education, race, and census region.

^b Pain-related symptoms included joint, back, neck, headache, migraine, and other musculoskeletal pain.

^c Psychological distress included stress, depression, and anxiety.

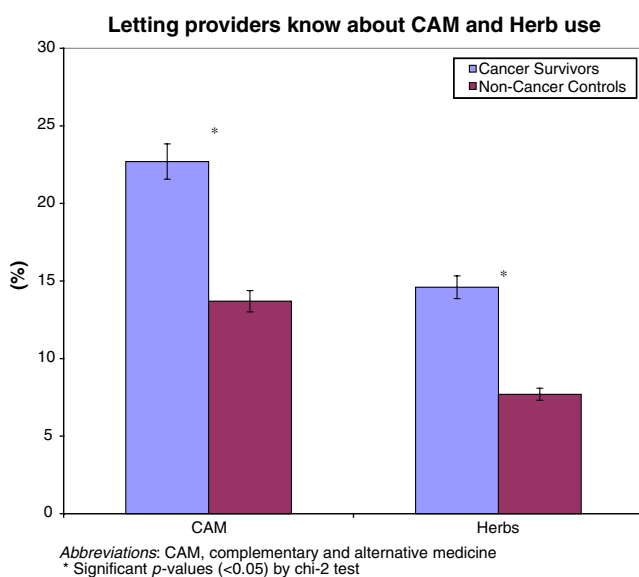
Fig. 2 Motivations behind CAM use

communicate CAM use with providers, suggesting greater integration of CAM use in conventional care. However, we also found that the majority of CAM use is not being communicated to providers. While some CAM therapies can provide benefits for symptoms such as anxiety, fatigue, or pain, other CAM therapies pose risks such as interaction with other medications or the containment of harmful substances such as heavy metals. It is important to improve

communication between patients and providers regarding CAM use to ensure that these therapies are safely integrated into cancer care.

In this study, we found that 65% of cancer survivors have used CAM in their lifetime and 43% use CAM in the previous 12 months. Cancer survivors were more likely to use CAM for general wellness and disease prevention, immune enhancement, and pain control when compared to non-cancer controls. Furthermore, cancer survivors more often use CAM because of recommendations from their provider and also more often disclosed their CAM use with their providers. These findings suggest that CAM use in cancer survivor population may be more “integrated” into the conventional medical system than that in the general population.

While echoing previous findings that cancer survivors use CAM more often than the general population, our analysis found that cancer survivors use these therapies more often for general wellness and disease prevention. As the diagnosis of cancer may represent a “teachable moment” for many individuals to engage in health promotion activities [39], our study suggested that survivors are more likely to incorporate methods from outside of conventional medical system to achieve the global sense of wellness and disease prevention. It is also quite possible that while conventional medical research and clinical practice often emphasizes treatment for a specific medical condition such as cancer, the terrain of survivorship faced by individuals with cancer often centers on how to recover,

**Fig. 3** Letting providers know about CAM and Herb use

stay well, and prevent recurrence. It is unlikely that one method of approach is adequate for the diverse physical and psychosocial issues faced by survivors; therefore, survivors may incorporate different CAM therapies to address their varying needs. More research is needed to understand how to best integrate CAM into survivorship care in order to safely and effectively improve function, promote wellness, and prevent disease.

Survivors are also more likely than the general population to report use of CAM for immune enhancement. While the important role of the immune system in cancer etiology and progression is widely studied in cancer biology, the translation of such knowledge into therapeutic interventions for cancer lags behind. The recent understanding of the immune biology of stress coupled with use of many CAM approaches for stress reduction (e.g. mindfulness based stress reduction and yoga) may be why survivors were more likely to use CAM for immune enhancement. More rigorous and appropriate incorporation of immune markers into CAM intervention research is needed to provide evidence to guide such use.

Our study found that survivors were more likely than the general population to use CAM as recommended by providers and to disclose their CAM use to providers. These findings suggest a greater degree of integration appears to happen in the context of cancer care than in the rest of the medical system. There are many reasons underlying this, and it is likely patient-driven. However, in recent years, some of the top cancer centers have developed prototype integrative oncology programs to bring CAM and conventional medical care and research together [40]. Additionally, more than 50% of designated *National Cancer Center* comprehensive cancer centers in the U.S. currently provide CAM programming and information via their websites [41]. Furthermore, the development of professional societies such as the *Society for Integrative Oncology* brings clinicians and researchers from both conventional and CAM fields together to engage in meaningful discourse on the integration of CAM into cancer care [42]. As a result of this growing integration, the term CAM may need to be replaced by integrative medicine (IM) in the coming years.

Despite increased disclosure of CAM in the cancer survivor population, our study supports similar findings that only a small percentage of CAM use is actually being disclosed to providers. In the general population, discussion of CAM use with providers has been reported to be around 40%, with only 20% of herb or supplement users disclosing such use [11, 21, 43]. This lack of communication about CAM use may be due to fear of a negative response [22], physicians being perceived as not supportive nor helpful [15], or physicians and patients having differing views about CAM [44]. Discussions of CAM therapies may have

additional benefits for the patient-provider relationship, as studies have shown it indicates use of participatory decision-making [45], patient-centered communication [46], and thus greater patient satisfaction [47, 48]. With that said, in the reality of the 10 to 15-minute clinical encounter, the challenge is how to effectively improve communication about CAM when there are many issues that need to be discussed. Like others, this study has focused on the quantity of CAM communicated, but perhaps the focus now needs to shift to quality. While it may not be necessary for all CAM therapies to be communicated with providers, we need to come up with practical methods for providers to effectively glean information both on potentially dangerous CAM use, as well as unmet patient needs where CAM therapies may be useful.

Our results must be considered in light of several limitations. First, cancer survivors have been found to under-report a history of cancer diagnosis in an interview compared with medical records or tumor registries [49], which could have led to a small misclassification of cancer survivors. However, we would not expect this under-reporting of a cancer diagnosis to be associated with CAM use, and such a misclassification would only bias our results towards the null. Second, as CAM is difficult to define, we used a method described by Barnes to define the overall as well as specific categories of CAM to be consistent in order for data can be compared across studies [36]. Third, we struggled with whether to analyze reasons and communication of CAM use by individual or by proportion of CAM use. Because of the way the NHIS survey was structured, we decided to calculate proportions of total CAM use rather than by individual use. We thought this would be a more accurate analysis of CAM use since one individual may use multiple CAM therapies for different reasons and may not disclose all forms with providers. Lastly, the survey only included non-institutionalized adults, and the results cannot be generalized to pediatric or institutionalized adult populations.

Despite these limitations, our study provides a population-based estimate of U.S. cancer survivors' past and recent use of CAM, including reasons for, motivations behind, and communication of CAM use. Compared with the general population, cancer survivors are much more likely to use CAM for disease prevention, immune system enhancement, and pain management. Our study also demonstrates evidence of increased patient-provider communication of CAM in the cancer survivor population, in the form of both recommendations for CAM use and patient disclosure of CAM use. While these are encouraging, the low absolute rates of communication suggests much is needed to evaluate how to best integrate CAM into survivorship care and promote patient-centered communication. Ultimately, this will help create an integrated health

care system that can effectively address the overall health and wellbeing of millions of cancer survivors.

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