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CONFLICTS OF INTEREST/FINANCIAL DISCLOSURES

Elements of Financial/Personal Conflicts	RJM	CPG	KT	WPT	SGM	CO	HDK
Employment/Affiliation	No	No	No	No	No	No	No
Grants/Funds	No	No	No	No	No	No	No
Honoraria	No	No	No	No	No	No	No
Speaker Forum	No	No	No	No	No	No	No
Consultant	No	No	No	No	No	No	No
Stocks	No	No	No	No	No	No	No
Royalties	No	No	No	No	No	No	No
Expert Testimony	No	No	No	No	No	No	No
Board Member	No	No	No	No	No	No	No
Patents	No	No	No	No	No	No	No
Personal Relationship	No	No	No	No	No	No	No

Elements of Financial/Personal Conflicts	SML	AG	RR	VK	SMK	KH	AH
Employment/Affiliation	No	No	No	No	No	No	No
Grants/Funds	No	No	No	No	No	No	Yes *
Honoraria	No	No	No	No	No	No	No
Speaker Forum	No	No	No	No	No	No	No
Consultant	No	No	No	No	No	No	Yes *
Stocks	No	No	No	No	No	No	No
Royalties	No	No	No	No	No	No	No
Expert Testimony	No	No	No	No	No	No	No
Board Member	No	No	No	No	No	No	No
Patents	No	No	No	No	No	No	No
Personal Relationship	No	No	No	No	No	No	No

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RJM, CPG, KT, WPT, SGM, CO, HDK, SML, AG, and AH were involved in the study concept and design, as well as analysis and interpretation of the data.

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All authors contributed to the preparation and finalization of the manuscript.

Use of Complementary Medications among Older Adults with Cancer

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Abstract

BACKGROUND—Little is known about complementary medication use among older adults with cancer, particularly those undergoing chemotherapy. The purpose of this study was to evaluate the prevalence of complementary medication use and to identify factors associated with its use among older adults with cancer.

METHODS—The prevalence of complementary medication use (defined as herbal agents, minerals, or other dietary supplements excluding vitamins) was evaluated in a cohort of adults aged ≥65 years who were about to start chemotherapy for their cancer. The association between complementary medication use and patient characteristics (sociodemographics; comorbidity; functional, nutritional, psychological, and cognitive status); medication use (number of medications and concurrent vitamin use); and cancer characteristics (type and stage) was analyzed.

RESULTS—The cohort included 545 patients [mean age 73 years (range 65–91); 52% female] with cancer (61% Stage IV). Seventeen percent (N=93) of these patients reported using ≥1 complementary medications [mean number of complementary medications among users was 2 (range 1–10)]. Complementary medication use was associated with: 1) earlier cancer stage, with 29% of those with stages I–II vs. 17% with III–IV (OR=2.05, 95% CI:1.21–3.49); and 2) less impairment with instrumental activities of daily living (OR=1.39, 95% CI:1.12–1.73).

CONCLUSIONS—Complementary medication use was reported by 17% of older adults with cancer and was more common among those with less advanced disease (receiving adjuvant potentially curative treatment) and higher functional status. Further studies are needed to determine the association between complementary medication use and cancer outcomes among older adults.

Keywords

Herbals; Complementary Medicine; Older Adults; Cancer; Chemotherapy

INTRODUCTION

The use of complementary medications (e.g., herbal agents, high-dose vitamins, and other health supplements) is common among adults with cancer, with a prevalence ranging from 54% to 78%.^{1–6} Prior studies in adults with cancer have consistently shown that younger patients are more likely to use complementary medications than older patients with cancer.^{2, 7–16} However, complementary medication use among community-dwelling older adults (without cancer) in the United States has been rising over the last decade,^{17–19} with a prevalence ranging from 13% to 33%.^{17, 18, 20–22} Yet little is known about the prevalence and types of complementary medication use specifically among older adults with cancer, particularly those undergoing chemotherapy.

Complementary medication use among older adults with cancer may have important and unrecognized clinical implications. Older adults are at increased risk for polypharmacy and potential drug interactions.^{19, 21} The use of complementary medications may compound this risk. Furthermore, complementary medications in addition to more traditional medications can interact with chemotherapy and thus lead to increased risk of toxicity^{5, 23, 24} or diminished efficacy.^{23, 24} Despite these potential concerns, few studies have focused on the prevalence of complementary medications in older adults with cancer or the characteristics of those individuals who are more likely to utilize complementary medications. The goal of this study was to determine the prevalence of complementary medication use among a cohort of older adults with cancer scheduled to begin a new chemotherapy regimen and to identify factors associated with complementary medication use in this setting.

METHODS

Study Design and Subject Eligibility

This study is a secondary cross-sectional analysis of data from a multi-center, longitudinal study evaluating the utility of a comprehensive geriatric assessment in predicting chemotherapy toxicity among a cohort of older adults with cancer.²⁵ Patients were eligible for the study if they were age 65 years or older; had a diagnosis of cancer (excluding non-melanoma skin cancers); were about to receive a new chemotherapy regimen; were English-speaking; and were able to provide informed consent. Informed consent had been obtained from all study participants. This study was approved by the Institutional Review Board at all seven participating sites.

Patients completed a baseline comprehensive geriatric assessment, which included an evaluation of their functional, nutritional, cognitive, and psychological status as well as their comorbid medical conditions.^{26, 27} As part of this baseline assessment prior to initiation of chemotherapy, patients were asked to provide a list of their medications (including non-prescription medications, herbs, or supplements) and number of medications taken daily. The dosages of medications were not captured.

Definition of Complementary Medication Use

Our definition of complementary medications consisted of herbal agents, dietary supplements, and minerals for which no clear clinical indication could be derived from the initial patient assessment. This definition was adapted from the National Cancer Institute definition of complementary medication use, which includes megadose vitamins, dietary supplements, and herbal preparations.²⁸ We did not classify vitamins as complementary medications since vitamin dosages were not captured as part of the original assessment; therefore, we could not determine if such vitamins constituted “megadose.” However, the

frequencies and types of vitamins were evaluated. Our operational definition of complementary medication use also excluded use of agents that might have a clinical indication: a) particular mineral salts (i.e., iron, calcium, magnesium, and bicarbonate); b) aspirin and non-steroidal anti-inflammatory agents; and c) omega-3 fatty acids/fish oil (i.e., may be available in a prescription formulation and possibly used in treatment of dyslipidemia). The determination of such agents as potentially being used for a clinical indication was made through consensus attained among the study co-authors.

Factors Associated with Complementary Medication Use

A review of prior geriatrics-based^{17, 18, 20, 29, 30} and oncology-based studies^{2, 3, 7, 8, 11–16, 31–36} was performed in order to identify factors associated with complementary medical use and to guide our analysis plan. These factors have also been utilized and evaluated in prior geriatric oncology-based studies.^{25, 27, 37} We evaluated the association between complementary medication use and the following factors:

1. Sociodemographics (age, sex, ethnicity, race, presence of a living companion, and educational status);
2. Cancer type and stage;
3. Medication use (number of prescription medications);
4. Geriatric assessment variables (Table 1):
 - a. Functional status as measured by: i) ability to perform instrumental activities of daily living (IADLs) as assessed by the Older Americans Resources and Services (OARS) subscale³⁸; ii) Karnofsky performance status (KPS) scale (both physician- and patient-rated)^{39, 40}; iii) history of falls in the 6 months prior to study.^{41–43}
 - b. Comorbidity number and type was captured by the OARS subscale³⁸
 - c. Psychological status (i.e., depression/anxiety) was assessed by the Hospital Anxiety and Depression Scale (HADS),^{44, 45}
 - d. Nutritional status was measured by percent unintentional weight loss in the 6 months prior to study
 - e. Cognitive status was assessed by the Blessed Orientation-Memory-Concentration (BOMC) scale.^{46, 47}

Statistical Considerations

Descriptive analyses were performed to determine means, medians, standard deviations (SD), and ranges for continuous variables, and frequencies and percentages for categorical variables. KPS, HADS, and BOMC scores were dichotomized at clinically meaningful thresholds: KPS <70% indicating poor functional status; HADS score ≥15 indicating anxiety/depression; and BOMC score ≤11 indicating cognitive impairment.^{43–46} Other continuous variables except for OARS IADL score and number of prescription medications were also categorized due to non-linear relationship with the logarithm of the odds.

Bivariate analysis was then conducted to assess the association between each of the variables and complementary medication use (yes or no) utilizing unconditional logistic regression models and Fisher's exact test where data were sparse. The variables reaching a *p*-value less than 0.1 in the bivariate analysis were further examined by using multivariate logistic regression models. Interactions were examined by adding an interaction term in multivariate models. Two-sided tests with a significance level of 0.05 were used. All statistical analyses were performed using SAS statistical software, version 9.2 (Cary, NC).

RESULTS

Of the 550 eligible patients, 545 (99%) had sufficient medication data evaluable for analysis, with 1 patient having missing medication data and 4 patients who had withdrawn from the original study. Baseline patient characteristics and geriatric assessment scores were examined (Table 3). Thirty-three patients (6%) had BOMC scores ≥ 11 indicating potentially clinically significant cognitive impairment; 79 patients (15%) had HADS scores ≥ 15 indicating potentially clinically significant anxiety or depression; and 75 (14%) and 27 (5%) had patient- and physician-rated KPS scores $<70\%$, respectively, indicating potentially clinically significant functional impairment. The mean number of total medications was 6.9 medications (SD: 4.2; range: 0–25), with 5.1 medications (SD: 3.6; range: 0–23) taken daily. The mean number of prescription medications per patient was 4.4 (SD: 3.1; range: 0–20).

Ninety-three patients (17%) were taking at least 1 complementary agent regularly with 37 of these (40%) taking more than 1 such agent concurrently (Table 3). Among patients who took complementary medications, the mean number of complementary medications taken was 2 (SD: 2.2; range: 1–13). The 3 most commonly encountered complementary medications were glucosamine (with or without chondroitin), flaxseed oil, and coenzyme Q10 (Table 3). In addition to complementary medication use, vitamin use was also common, with 236 (43%) patients taking any vitamin. Almost a third (31%) of vitamin users were concurrently taking complementary medications. Among the types of vitamins used, multivitamins were the most frequently encountered (37% of all patients), with Vitamins C, B complex, and E being the most common vitamin subtypes encountered (data not shown).

In the bivariate logistic regression analysis, the following factors reached a p -value <0.1 : less advanced cancer stage (stages I–II); higher scores on individual measures of functional and nutritional status (i.e., higher patient- or physician-rated KPS scores; higher OARS IADL scores; and no falls or lower unintentional weight loss in the last 6 months); and cancer type (i.e. higher use among older adults with lymphomas, genitourinary, and gynecologic cancers vs. gastrointestinal cancer as a reference group given its lower prevalence of complementary medication use) (Table 4). There was no association between HADS scores (total score or subscales measuring anxiety and depression) and complementary medication use.

In the multivariate analysis, only less advanced cancer stage (stages I–II) and higher functional status (higher OARS IADL) were significantly associated with a higher likelihood of complementary medication use ($p < 0.01$) (Table 4). The results indicate that patients with stage I or II cancer are approximately two times as likely to be using at least one complementary medication as patients with more advanced cancer stage [Odds Ratio (OR): 2.05; 95% Confidence Interval (CI): 1.21–3.49]. Moreover, the likelihood of complementary medication use increases with increasing IADL score (OR: 1.39; 95% CI: 1.12–1.73). OARS IADL scores were also evaluated categorically since there is only a 1-unit difference among scores, one for every IADL that is impaired; nevertheless, this association remained statistically significant when adjusting for co-variables (data not shown). Furthermore, adjusting for cancer type or study site did not substantially alter these estimates (data not shown). In addition, sensitivity analysis was performed by excluding patients with leukemia or lymphoma; no substantial change in the estimates was observed (data not shown).

DISCUSSION

Our reported prevalence of complementary medication use (17%) among older adults with cancer is comparable to that found in geriatrics-based studies of older patients without

cancer.^{17, 18, 20–22} This estimate is lower than that found in cancer-based studies^{2–6}; however, the majority of cancer-based studies include a relatively younger cohort of patients (i.e., mean/median age ranging 51 to 54 years). This is one of the few studies to have specifically focused on complementary medication use among older adults with cancer.

Complementary medication use in older adults with cancer raises several clinical concerns. First, there are potential interactions between complementary medications and cancer therapies. Therefore, knowing the most frequently used types of complementary medications would help risk-stratify patients in terms of their relative risk for drug interactions. Some herbal-chemotherapy combinations can give rise to well-associated adverse drug events,²⁴ with some studies in relatively younger adults with cancer suggesting that 25% to 27% of these individuals are taking an herbal or similar agent that is known to interact significantly with chemotherapy.^{5, 6} Second, older adults may be at increased risk for such interactions given the increase in age-related comorbidity and attendant polypharmacy. For example, several of the patients included in our study were utilizing some of the more “high-risk” agents, such as garlic and ginkgo, which have multiple effects on cytochrome P450- and P-glycoprotein-mediated metabolic pathways. Moreover, patients undergoing chemotherapy using such medications can have, on average, at least 3 potential herbal-chemotherapy interactions, and up to 50% can have potential interactions that have yet to be defined.²³ The majority of complementary medications encountered in our patients potentially fall into this category. The potential for drug interactions is of particular concern in our cohort, as the patients were more likely to be receiving treatment for early stage, potentially curable disease. Of potentially clinically significant drug-drug interactions identified utilizing LexiComp (<http://www.lexi.com>), herbal-related interactions represented the third most-common type of drug-drug interaction and approximately 7.5% of all potential interactions encountered (data not shown).

Although our sample was restricted to patients 65 years and older, the use of complementary agents did vary substantially within our cohort. Therefore, we sought to identify patient characteristics associated with complementary medication use. The literature to date has demonstrated that older adults and adults with cancer who utilize complementary medications may share similar characteristics: relatively younger age^{2, 11–14, 16, 18, 29}; female gender^{2, 3, 13, 16, 17, 29, 31–33}; higher income^{2, 3, 13, 16, 18, 31–33}; and higher education levels.^{7, 8, 13, 17, 18, 31, 32, 34} Among more oncology-focused studies, factors that were also associated with higher use of complementary medications included more advanced disease^{34, 36} and higher self-reported levels of cancer-related symptoms.^{11, 12, 16, 32, 35, 36} However, among our cohort of older adults, we found that the aforementioned “traditional” factors associated with complementary medication use did not appear to be associated with use in our study. Rather, we found that older adults with cancer undergoing chemotherapy were more likely to use complementary medications if they had less advanced disease and higher functional status, both markers of healthier individuals in general. Whether these findings suggest that the use of complementary medications among this group is more for “health maintenance” rather than for treatment of active symptoms related to cancer or comorbid conditions requires further study.

There are several limitations to this study. First, an accurate estimation of complementary medication use may be difficult to ascertain since many adult patients with cancer do not readily disclose the use of such agents.^{6, 18} Second, our reported prevalence was based on a working definition derived from that set forth by the National Cancer Institute and not author-generated as found in several prior studies. This definition coincides with that established by the National Committee on Complementary and Alternative Medicine, which has been used in prior studies.^{20, 31} This more stringent definition, coupled with the fact that under-reporting is a common issue in such studies,^{6, 18} might have led to our prevalence

being underestimated. However, if vitamin use were included as part of this definition, the prevalence might, in fact, be 47% (N=257) (full data not shown), which is more consistent with the results of oncology-based studies as previously discussed. Third, the rationale for utilization of complementary medications among our study cohort was not captured. Finally, we must consider these results as “hypothesis-generating” as complementary medication use was the not the primary endpoint of the original study.

CONCLUSIONS

Despite these limitations, this study addresses several knowledge gaps. Few studies currently exist that have evaluated complementary medication use specifically among older adults with cancer,^{16, 48} despite older adults representing the majority of individuals now affected by cancer in the U.S.⁴⁹ Our findings underscore that there are key differences in the prevalence of, types of, and patient factors associated with complementary medication use among older adults with cancer undergoing chemotherapy in contrast to what has been reported in either the geriatrics- or oncology-based literature. These data *in toto* suggest that this group of patients might be distinct in all these aspects of complementary medication use. More studies are needed to quantify the risks and benefits of complementary medication use among this growing yet vulnerable geriatric oncology population.

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REFERENCES

1. Ernst E, Cassileth BR. The prevalence of complementary/alternative medicine in cancer: a systematic review. *Cancer*. 1998; 83(4):777–782. [PubMed: 9708945]
2. Richardson MA, Sanders T, Palmer JL, Greisinger A, Singletary SE. Complementary/alternative medicine use in a comprehensive cancer center and the implications for oncology. *J Clin Oncol*. 2000; 18(13):2505–2514. [PubMed: 10893280]
3. Sparber A, Bauer L, Curt G, Eisenberg D, Levin T, Parks S, et al. Use of complementary medicine by adult patients participating in cancer clinical trials. *Oncol Nurs Forum*. 2000; 27(4):623–630. [PubMed: 10833691]
4. Bernstein BJ, Grasso T. Prevalence of complementary and alternative medicine use in cancer patients. *Oncology (Williston Park)*. 2001; 15(10):1267–1272. discussion 72-8, 83. [PubMed: 11702957]
5. McCune JS, Hatfield AJ, Blackburn AA, Leith PO, Livingston RB, Ellis GK. Potential of chemotherapy-herb interactions in adult cancer patients. *Support Care Cancer*. 2004; 12(6):454–462. [PubMed: 14991387]

6. Gupta D, Lis CG, Birdsall TC, Grutsch JF. The use of dietary supplements in a community hospital comprehensive cancer center: implications for conventional cancer care. *Support Care Cancer*. 2005; 13(11):912–919. [PubMed: 15856334]
7. Lee MM, Chang JS, Jacobs B, Wrensch MR. Complementary and alternative medicine use among men with prostate cancer in 4 ethnic populations. *Am J Public Health*. 2002; 92(10):1606–1609. [PubMed: 12356606]
8. Lee MM, Lin SS, Wrensch MR, Adler SR, Eisenberg D. Alternative therapies used by women with breast cancer in four ethnic populations. *J Natl Cancer Inst*. 2000; 92(1):42–47. [PubMed: 10620632]
9. Astin JA, Reilly C, Perkins C, Child WL. Breast cancer patients' perspectives on and use of complementary and alternative medicine: a study by the Susan G. Komen Breast Cancer Foundation. *J Soc Integr Oncol*. 2006; 4(4):157–169. [PubMed: 17022924]
10. Lawsin C, DuHamel K, Itzkowitz SH, Brown K, Lim H, Thelemaque L, et al. Demographic, medical, and psychosocial correlates to CAM use among survivors of colorectal cancer. *Support Care Cancer*. 2007; 15(5):557–564. [PubMed: 17205277]
11. Wells M, Sarna L, Cooley ME, Brown JK, Chercecky C, Williams RD, et al. Use of complementary and alternative medicine therapies to control symptoms in women living with lung cancer. *Cancer Nurs*. 2007; 30(1):45–55. quiz 56–7. [PubMed: 17235219]
12. Matthews AK, Sellergren SA, Huo D, List M, Fleming G. Complementary and alternative medicine use among breast cancer survivors. *J Altern Complement Med*. 2007; 13(5):555–562. [PubMed: 17604560]
13. Patterson RE, Neuhaus ML, Hedderson MM, Schwartz SM, Standish LJ, Bowen DJ, et al. Types of alternative medicine used by patients with breast, colon, or prostate cancer: predictors, motives, and costs. *J Altern Complement Med*. 2002; 8(4):477–485. [PubMed: 12230908]
14. Henderson JW, Donatelle RJ. Complementary and alternative medicine use by women after completion of allopathic treatment for breast cancer. *Altern Ther Health Med*. 2004; 10(1):52–57. [PubMed: 14727500]
15. Lippert MC, McClain R, Boyd JC, Theodorescu D. Alternative medicine use in patients with localized prostate carcinoma treated with curative intent. *Cancer*. 1999; 86(12):2642–2648. [PubMed: 10594859]
16. Wyatt GK, Friedman LL, Given CW, Given BA, Beckrow KC. Complementary therapy use among older cancer patients. *Cancer Pract*. 1999; 7(3):136–144. [PubMed: 10352076]
17. Nahin RL, Fitzpatrick AL, Williamson JD, Burke GL, Dekosky ST, Furberg C. Use of herbal medicine and other dietary supplements in community-dwelling older people: Baseline data from the ginkgo evaluation of memory study. *J Am Geriatr Soc*. 2006; 54(11):1725–1735. [PubMed: 17087700]
18. Bruno JJ, Ellis JJ. Herbal use among US elderly: 2002 National Health Interview Survey. *Ann Pharmacother*. 2005; 39(4):643–648. [PubMed: 15741417]
19. Qato DM, Alexander GC, Conti RM, Johnson M, Schumm P, Lindau ST. Use of prescription and over-the-counter medications and dietary supplements among older adults in the United States. *JAMA*. 2008; 300(24):2867–2878. [PubMed: 19109115]
20. Cheung CK, Wyman JF, Halcon LL. Use of complementary and alternative therapies in community-dwelling older adults. *J Altern Complement Med*. 2007; 13(9):997–1006. [PubMed: 18047447]
21. Elmer GW, Lafferty WE, Tyree PT, Lind BK. Potential interactions between complementary/alternative products and conventional medicines in a Medicare population. *Ann Pharmacother*. 2007; 41(10):1617–1624. [PubMed: 17785609]
22. Patterns of Medication Use in the United States: A Report of the Slone Survey. Available from URL: <http://web.bu.edu/slone/SloneSurvey/AnnualRpt/SloneSurveyWebReport2006.pdf>
23. Engdal S, Klepp O, Nilsen OG. Identification and exploration of herb-drug combinations used by cancer patients. *Integr Cancer Ther*. 2009; 8(1):29–36. [PubMed: 19174505]
24. Sparreboom A, Cox MC, Acharya MR, Figg WD. Herbal remedies in the United States: potential adverse interactions with anticancer agents. *J Clin Oncol*. 2004; 22(12):2489–2503. [PubMed: 15197212]

25. Hurria A, Mohile S, Lichtman S, Owusu C. Geriatric assessment of older adults with cancer: Baseline data from 500 patient multicenter study. *J Clin Oncol*. 2009; 27:15s. (suppl; abstr 9546).
26. Hurria A, Lichtman SM, Gardes J, Li D, Limaye S, Patil S, et al. Identifying vulnerable older adults with cancer: integrating geriatric assessment into oncology practice. *J Am Geriatr Soc*. 2007; 55(10):1604–1608. [PubMed: 17697101]
27. Hurria A, Gupta S, Zauderer M, Zuckerman EL, Cohen HJ, Muss H, et al. Developing a cancer-specific geriatric assessment: a feasibility study. *Cancer*. 2005; 104(9):1998–2005. [PubMed: 16206252]
28. National Cancer Institute Dictionary of Cancer Terms. Available from URL: <http://www.cancer.gov/dictionary/?CdrID=44384>
29. Arcury TA, Suerken CK, Grzywacz JG, Bell RA, Lang W, Quandt SA. Complementary and alternative medicine use among older adults: ethnic variation. *Ethn Dis*. 2006; 16(3):723–731. [PubMed: 16937611]
30. Grzywacz JG, Suerken CK, Quandt SA, Bell RA, Lang W, Arcury TA. Older adults' use of complementary and alternative medicine for mental health: findings from the 2002 National Health Interview Survey. *J Altern Complement Med*. 2006; 12(5):467–473. [PubMed: 16813511]
31. Yates JS, Mustian KM, Morrow GR, Gillies LJ, Padmanaban D, Atkins JN, et al. Prevalence of complementary and alternative medicine use in cancer patients during treatment. *Support Care Cancer*. 2005; 13(10):806–811. [PubMed: 15711946]
32. Shumay DM, Maskarinec G, Gotay CC, Heiby EM, Kakai H. Determinants of the degree of complementary and alternative medicine use among patients with cancer. *J Altern Complement Med*. 2002; 8(5):661–671. [PubMed: 12470448]
33. Dy GK, Bekele L, Hanson LJ, Furth A, Mandrekar S, Sloan JA, et al. Complementary and alternative medicine use by patients enrolled onto phase I clinical trials. *J Clin Oncol*. 2004; 22(23):4810–4815. [PubMed: 15570083]
34. Chan JM, Elkin EP, Silva SJ, Broering JM, Latini DM, Carroll PR. Total and specific complementary and alternative medicine use in a large cohort of men with prostate cancer. *Urology*. 2005; 66(6):1223–1228. [PubMed: 16360447]
35. Burstein HJ, Gelber S, Guadagnoli E, Weeks JC. Use of alternative medicine by women with early-stage breast cancer. *N Engl J Med*. 1999; 340(22):1733–1739. [PubMed: 10352166]
36. Bardia A, Greeno E, Bauer BA. Dietary supplement usage by patients with cancer undergoing chemotherapy: does prognosis or cancer symptoms predict usage? *J Support Oncol*. 2007; 5(4):195–198. [PubMed: 17500507]
37. Hurria A, Togawa K, Mohile SG, Owusu C, Klepin HD, Gross CP, et al. Predicting chemotherapy toxicity in older adults with cancer: a prospective multicenter study. *J Clin Oncol*. 2011; 29(25):3457–3465. [PubMed: 21810685]
38. Fillenbaum GG, Smyer MA. The development, validity, and reliability of the OARS multidimensional functional assessment questionnaire. *J Gerontol*. 1981; 36(4):428–434. [PubMed: 7252074]
39. Yates JW, Chalmer B, McKegney FP. Evaluation of patients with advanced cancer using the Karnofsky performance status. *Cancer*. 1980; 45(8):2220–2224. [PubMed: 7370963]
40. Karnofsky, D.; Burchenal, J. The clinical evaluation of chemotherapeutic agents in cancer. In: CM, M., editor. *Evaluation of chemotherapeutic agents*. New York, NY: Columbia University Press; 1948. p. 191-205.
41. Ensrud KE, Ewing SK, Cawthon PM, Fink HA, Taylor BC, Cauley JA, et al. A comparison of frailty indexes for the prediction of falls, disability, fractures, and mortality in older men. *J Am Geriatr Soc*. 2009; 57(3):492–498. [PubMed: 19245414]
42. Ensrud KE, Ewing SK, Taylor BC, Fink HA, Cawthon PM, Stone KL, et al. Comparison of 2 frailty indexes for prediction of falls, disability, fractures, and death in older women. *Arch Intern Med*. 2008; 168(4):382–389. [PubMed: 18299493]
43. Ensrud KE, Ewing SK, Taylor BC, Fink HA, Stone KL, Cauley JA, et al. Frailty and risk of falls, fracture, and mortality in older women: the study of osteoporotic fractures. *J Gerontol A Biol Sci Med Sci*. 2007; 62(7):744–751. [PubMed: 17634322]

44. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983; 67(6):361–370. [PubMed: 6880820]
45. Carroll BT, Kathol RG, Noyes R Jr, Wald TG, Clamon GH. Screening for depression and anxiety in cancer patients using the Hospital Anxiety and Depression Scale. *Gen Hosp Psychiatry*. 1993; 15(2):69–74. [PubMed: 8472942]
46. Kawa C, Karagiozis H, Resau L, Corrada M, Brookmeyer R. Reliability of the Blessed Telephone Information-Memory-Concentration Test. *J Geriatr Psychiatry Neurol*. 1995; 8(4):238–242. [PubMed: 8561839]
47. Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H. Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. *Am J Psychiatry*. 1983; 140(6): 734–739. [PubMed: 6846631]
48. Lichtman SM, Boparai MK. Geriatric medication management: Evaluation of pharmacist interventions and potentially inappropriate medication (PIM) use in older (≥ 65 years) cancer patients (abstract 9507). *J Clin Oncol*. 2009; 27(15S)
49. Ries LA, Wingo PA, Miller DS, Howe HL, Weir HK, Rosenberg HM, et al. The annual report to the nation on the status of cancer, 1973–1997, with a special section on colorectal cancer. *Cancer*. 2000; 88(10):2398–2424. [PubMed: 10820364]

Table 1

Description of Geriatric Assessment Measures

Domain	Measure	Description	Scoring
Functional Status	Instrumental Activities of Daily Living (IADL) (OARS [*] subscale)	7 items evaluating the ability to complete activities required to maintain independence in the community	Score: 0–14, with 14 indicating no impairment in the completion of IADL
	Karnofsky Performance Status (KPS)	Global evaluation of physical function as determined by patient self-report or by the physician, ranging from “normal” to “severely disabled”	Score: 0–100%, with 100% indicating normal physical function (i.e., no level of disability)
	Falls	Self-reported number of falls in the 6 months prior to study	Score: Variable depending upon the number of falls reported
Comorbidity	OARS subscale	“Yes or No” checklist of 13 comorbid conditions with a 3-point Likert scale rating impact of each condition on daily function.	Score: Number and type of comorbid illnesses
Psychological Status	Hospital Anxiety/Depression Scale (HADS)	14 items on a Likert scale with 7 evaluating for anxiety symptoms and 7 evaluating for depressive symptoms	Score: 0–42, with 15 and higher indicating having significant underlying anxiety or depression
Nutritional Status	Unintentional Weight Loss	Self-reported weight loss in the 6 months prior to study	Score: % weight loss from baseline weight 6 months prior to study
Cognitive Status	Blessed Orientation-Memory-Concentration scale (BOMC)	6 weighted items evaluating 3 components of cognitive function (i.e., orientation, memory, concentration)	Score: 0–28, with 11 and higher indicate having significant underlying cognitive impairment

^{*} **Abbreviations:** OARS, Older Americans Resources and Services.

Table 2

Baseline Patient Characteristics and Geriatric Assessment Measures

Patient Characteristic	N (% Total)	
Age (years) 65–69 70–74 75–79 80+	186 (34) 149 (27) 112 (21) 98 (18)	
Sex Female Male	282 (52) 263 (48)	
Ethnicity Hispanic Non-Hispanic Unknown	26 (5) 515 (94) 4 (1)	
Race African-American Asian Caucasian Native American/ Pacific Islander/Other	43 (8) 26 (5) 473 (87) 3 (1)	
Highest Educational Level Grade School High School College Graduate/Professional School Missing	27 (5) 195 (36) 205 (38) 117 (21) 1 (0)	
Living Situation Live Alone Live with Spouse/Partner/Children Other Missing	110 (20) 409 (75) 25 (5) 1 (0)	
Cancer Type Gastrointestinal Lung Gynecologic Breast Genitourinary Lymphoma Other	159 (29) 159 (29) 65 (12) 54 (10) 53 (10) 29 (5) 26 (5)	
Cancer Stage I II III IV + Extensive Stage SCLC Limited Stage SCLC Acute Myeloid Leukemia Chronic Lymphocytic Leukemia	24 (4) 66 (12) 117 (21) 332 (61) 1 (0) 4 (1) 1 (0)	
Geriatric Assessment Measures	Mean Value (Standard Deviation)	Median Value (Range)
Cognitive Status BOMC (Scale 0–28)	4.6 (4.0)	4 (0–28)
Comorbidity Comorbidity Number Number of Prescription Medications	2.4 (1.6) 4.4 (3.1)	2 (0–9) 4 (0–20)
Functional Status KPS, Patient-Rated (Scale 0–100) KPS, Physician-Rated (Scale 0–100) OARS IADL (Scale 0–14) Falls in past 6 months	85.9 (13.7) 84.9 (11.2) 13.0 (1.7) 0.3 (0.7)	90 (40–100) 90 (50–100) 14 (4–14) 0 (0–4)
Nutritional Status Unintentional Weight Loss (% Loss in Prior 6 Months)	4.9 (6.3)	2.2 (0–32.3)

Patient Characteristic	N (% Total)	
Psychological Status HADS (Scale 0–42)	8.2 (5.8)	7 (0–35)

Abbreviations: **SD**, Standard Deviation; **OARS**, Older Americans Resources and Services; **IADL**, Instrumental Activities of Daily Living; **KPS**, Karnofsky Performance Status; **HADS**, Hospital Anxiety and Depression Score; **BOMC**, Blessed Orientation-Memory-Concentration test; **MOS**, Medical Outcomes Study.

Abbreviations: **SD**, Standard Deviation; **OARS**, Older Adult Research and Services; **IADL**, Instrumental Activities of Daily Living; **KPS**, Karnofsky Performance Status; **HADS**, Hospital Anxiety and Depression Score; **BOMC**, Blessed Orientation-Memory-Concentration test.

Table 3

Prevalence and Patterns of Complementary Medication Use

Number of Complementary Medications	N (% Total)
1 Agent	56 (10)
2+ Agents	37 (7)
Total	93 (17)
Medication Type	N (%)
Glucosamine (alone or in combination with chondroitin)	37 (19)
Flaxseed Oil	14 (7)
Coenzyme Q10	12 (6)
Zinc	10 (5)
Garlic	7 (3.5)
Lutein	7 (3.5)
Selenium	7 (3.5)
Probiotics	6 (3)
Lecithin	5 (2.5)
Other Minerals	5 (2.5)
Saw Palmetto	5 (2.5)
Chromium	4 (2)
Cod Liver Oil	4 (2)
Mushrooms	4 (2)
Other Arthritis Supplements	4 (2)
Other Herbal Preparations	3 (1.5)
Aloe	3 (1.5)
Cinnamon	3 (1.5)
Green Tea Extract	3 (1.5)
Other Cancer Supplements	3 (1.5)
Preservation Supplements	3 (1.5)
Bilberry	2 (1)
Curcumin	2 (1)
Echinacea	2 (1)
Ginkgo Biloba	2 (1)
Grapeseed Oil	2 (1)
Melatonin	2 (1)
Milk Thistle	2 (1)
Zyflamend	2 (1)
Other Dietary Supplements (frequencies = 1 each)	33 (17)

Table 4

Associations of patient factors with complementary medication use

Categorical Variable	Total N	CAM (+) N (%)	CAM (-) N (%)	Unadjusted OR (95% CI) [†]	Adjusted OR (95% CI) [‡]
Age (years)					
65–69	186	32 (17)	154 (83)	1.00	
70–74	149	27 (18)	122 (82)	1.07 (0.61–1.87)	
75–79	112	20 (18)	92 (82)	1.05 (0.57–1.94)	
80+	98	14 (14)	84 (86)	0.80 (0.41–1.59)	
Sex					
Female	282	45 (16)	237 (84)	1.00	
Male	263	48 (18)	215 (82)	1.18 (0.75–1.84)	
Ethnicity					
Non-Hispanic	515	90 (17)	425 (83)	1.00	
Hispanic	26	3 (12)	23 (88)	0.62 (0.18–2.10)	
Race					
Non-white	72	8 (11)	64 (89)	1.00	
White	473	85 (18)	388 (82)	1.75 (0.81–3.79)	
Education					
Grade school/High School	222	32 (14)	190 (86)	1.00	
College/Graduate School	322	61 (19)	261 (81)	1.39 (0.87–2.21)	
Living situation					
Live with someone	434	76 (18)	358 (82)	1.00	
Live alone	110	17 (15)	93 (85)	0.86 (0.49–1.53)	
Cancer type					
Gastrointestinal	159	17 (11)	142 (89)	1.00	
Breast	54	10 (19)	44 (82)	1.90 (0.81–4.45)	
Genitourinary**	53	14 (26)	39 (74)	3.00 (1.36–6.61)	
Gynecologic*	65	13 (20)	52 (80)	2.09 (0.95–4.60)	
Lung	159	26 (16)	133 (84)	1.63 (0.85–3.15)	
Lymphoma**	29	8 (28)	21 (72)	3.18 (1.22–8.29)	
Other	26	5 (19)	21 (81)	1.99 (0.66–5.96)	

Categorical Variable	Total N	CAM (+) N (%)	CAM (-) N (%)	Unadjusted OR (95% CI) [†]	Adjusted OR (95% CI) [‡]
Cancer stage ^{**}					
III–IV/Extensive SCLC/AML/CLL	454	67 (15)	387 (85)	1.00	1.00
I–II/Limited SCLC	91	26 (29)	65 (71)	2.31 (1.37–3.90)	2.05 (1.21–3.49)
BOMC					
<11	510	91 (18)	419 (82)	1.00	
11+	33	2 (6)	31 (94)	0.30 (0.07–1.26)	
Number of comorbid illnesses					
0–1	177	28 (16)	149 (84)	1.00	
2	132	25 (19)	107 (81)	1.24 (0.69–2.25)	
3	111	20 (18)	91 (82)	1.17 (0.62–2.20)	
4+	124	20 (16)	104 (84)	1.02 (0.55–1.91)	
Patient-rated KPS ^{**}					
<70%	75	6 (8)	69 (92)	1.00	
70%	463	86 (19)	377 (81)	2.62 (1.10–6.24)	
Physician-rated KPS [*]					
<70%	27	1 (4)	26 (96)	1.00	
70%	510	89 (17)	421 (83)	5.50 (0.74–41.03)	
Falls in past 6 months ^{**}					
0	451	84 (19)	367 (81)	1.00	
1+	89	8 (9)	81 (91)	0.43 (0.20–0.93)	
Unintentional weight loss (% loss in prior 6 months)					
0	254	53 (21)	201 (79)	1.00	
0.01–4.99 [*]	80	10 (13)	70 (88)	0.54 (0.26–1.12)	
5–9.99	100	20 (20)	80 (80)	0.95 (0.53–1.69)	
10+ ^{**}	109	10 (9)	99 (91)	0.38 (0.19–0.79)	
HADS					
14	455	83 (18)	372 (82)	1.00	
15	79	10 (13)	69 (87)	0.65 (0.32–1.31)	

Categorical Variable	Total N	CAM (+) N (%)	CAM (-) N (%)	Unadjusted OR (95% CI) [‡]	Adjusted OR (95% CI) [‡]
Continuous variable	Total N	CAM (+) Mean (SD)	CAM (-) Mean (SD)	OR (95% CI) [‡]	Adjusted OR (95% CI) [‡]
OARS IADL **	542	13.5 (1.0)	12.9 (1.8)	1.42 (1.15–1.77)	1.39 (1.12–1.73)
Number of Rx meds	545	4.3 (3.1)	4.4 (3.1)	0.98 (0.91–1.06)	

Abbreviations: SCLC, Small Cell Lung Cancer; OARS, Older Americans Resources and Services; IADL, Instrumental Activities of Daily Living; KPS, Karnofsky Performance Status; HADS, Hospital Anxiety and Depression Score; BOMC, Blessed Orientation-Memory-Concentration test; Rx, prescription; SD, Standard Deviation.

[‡] Bivariate logistic regression/Fisher's exact test (patients with missing values were excluded from the analysis)

[‡] Multivariate logistic regression (patients with missing values were excluded from the analysis)

^{*} $p < 0.1$ in bivariate analysis

^{**} $p < 0.05$ in bivariate analysis