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PREDICTORS OF DIETARY AND HEALTH SUPPLEMENT USE IN OLDER AUSTRALIANS

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ABSTRACT

Objective:

This study aimed to identify the health conditions and symptoms that predicted dietary and health supplement use in older Australians.

Design:

Almost 2,500 Australians aged 65 years and over were randomly selected from the 2000 Australian Electoral Commission roll. All states and territories were proportionally represented in the sample. Data were obtained using a self-administered postal survey.

Subjects:

Approximately 1,200 individuals (51% males and 49% females) aged between 65-98 years completed the survey.

Results:

At the time of survey, 43% (n=548) reported using some form of supplement. Supplement use was significantly associated with gender (female) and chronic musculoskeletal ailments such as arthritis, osteoporosis and generalised back or neck problems. A diagnosis of hypertension or a heart condition were significant barriers to supplement use in this sample. The most common potential drug-supplement interaction was between calcium supplements and antihypertensives.

Conclusion:

Older supplement users may be of the opinion that supplements offer relief from the pain and suffering associated with their medical problems. If so, current supplement patterns would indicate that they are misguided. Nurses have an important role to play in encouraging older individuals to disclose their use of supplements to all health professionals involved in their continuing care.

INTRODUCTION

In the year ended 2000, Australians spent AU\$1671 million on dietary supplements, herbal medicines and natural products, which exceeded the expenditure on pharmaceutical drugs (MacLennan et al 2002). Despite widespread utilisation of these products by the community, surprisingly little is known about the extent to which older Australians specifically use dietary supplements and herbal medicines (referred to as complementary medicines by the Therapeutic Goods Administration) as forms of self care.

Several national and regional investigations have estimated the use of dietary supplements and herbal medicines in the Australian community. However, few have reported on the prevalence of supplement use in the older age group. Rates of regular supplement usage are between 16%-45% for the general adult Australian population (Allen et al 1987; Worsley and Crawford 1984), compared with 20%-40% for individuals aged 60 or 65 years and over (Baghurst 1989; Horwath and Worsley 1989).

Numerous large-scale international studies have shown that older individuals utilise vitamins, minerals and other health preparations as forms of health care in higher proportions than the general adult population (Looker et al 1988; Stewart et al 1985; Subar and Block 1990; Bender et al 1992; Slesinski et al 1995; Ervin et al 1999).

There is a paucity of data on herbal medicine use by older Australians. The Australian National Health Survey found that 12% of participants aged 65-74 years reported the use of 'herbal/natural' products (not defined), in the previous two weeks (ABS 1995). In the United States of America, several studies have shown that older individuals regularly use preparations containing Echinacea, Garlic, Gingko Biloba, Ginseng, and St John's wort (Ervin et al 1999; Leak 1999; Winslow and Kroll 1998; Brevoort 1996).

Characteristically, older dietary supplement users are female, Caucasian and well educated, with healthier lifestyle practices than non-supplement users, and are less likely to be overweight or to smoke (Looker et al 1988; Hale et al 1982; Houston et al 1998; Freeman et al 1998; Horwath and Worsley 1989). Neither income nor self-rated health status are reliable predictors of supplement use in this group (Read and Graney 1982; Houston et al 1998). In a large population survey of Americans aged 65 years and over, nutritional supplement users reported a significantly higher use of medications than non-supplement users (Gray et al 1996).

The rate of disclosure to physicians about the use of dietary and herbal preparations is not well understood. Current data suggests that underreporting this use is prevalent among the general adult population. According to Giveon (Giveon et al. 2004), 45% of general practice patients who used supplements never reported their use to their physician. Furthermore, approximately half (49%) were also taking prescription medication and the majority (56%) believed that supplements were safe and free of side effects.

One small study of elderly American veterans found that more than one-third (35%) of dietary supplement users had not informed their health care providers about the use of these products (Ly et al 2002). Of concern is the particularly high rate of non-disclosure of herbal medicines. Klepser et al (2000) found that more than 60% of general practitioner patients who used herbal medicines did not discuss this with their doctor. Distrust and lack of rapport are frequently cited reasons that herb use is not disclosed to practitioners (Eisenberg 1997).

Concurrent users of conventional medication and dietary and/or herbal preparations, who do not report this use to their doctor, may be at greater risk of an adverse drug-supplement interaction. Given the high utilisation of medications in this population and the age-related changes in drug absorption, clearance and distribution, drug interactions probably represent the greatest safety risk with the use of these preparations (Bratman and Girman 2003). Encouraging older people to disclose their use of complementary medicines to health professionals is an important step toward minimising any risk associated with the use of these products.

The aim of this paper is to identify the health determinants that predict the use of dietary and health supplements in older Australians and to evaluate the potential risks associated with this use. Thorough questioning of those most likely to use supplements can assist efforts to reduce the potential for drug-supplement interactions in this age group and will facilitate education about the appropriate use of supplements. Nurses are well positioned to facilitate appropriate assessment and evaluation of the use of these preparations by older individuals.

METHOD

The survey methodology has been reported elsewhere (Brownie and Myers 2003; Brownie and Rolfe 2004). Briefly, in January 2001 the questionnaire was posted to a proportionally random selection of 2,457 Australians aged 65 years and over, stratified by State and Territory from the 2000 Australian Electoral Commission roll. Completed surveys were received from 1,263 elderly Australians. This represents a response rate of 62% after allowing for confirmed non-deliveries. The survey instrument was designed to obtain information about health and lifestyle practices of older Australians and their utilisation of dietary supplements and health supplements.

Respondents were provided with a list of 11 different health conditions (arthritis/rheumatism, type I diabetes, type II diabetes, stroke, cataract, cancer, a heart condition, hypertension, hypercholesterolemia, glaucoma and osteoporosis) and asked if they had ever been diagnosed with any of these conditions (yes or no). They were also asked to report on their use of 26 prescription or over-the-counter medications and their experience of 23 symptoms. The results presented in this article reflect medication used daily or regularly (often, but not every day) and symptoms experienced daily or often ie. 'every day', 'every few days', or 'once a week'.

Information about dietary and health supplement use was obtained by asking participants 'Do you take any of the following types of supplements; vitamins, minerals, herbal preparations or other health products?' (collectively referred to in this study as *dietary and health supplements*). Examples of each type of supplement were included in the questionnaire.

Possible and potential drug-supplement interactions

Supplement users were classified as having the potential for an interaction if they reported the use of a prescription or over-the-counter medication for which there was evidence of an interaction in any of the following books; *Handbook of herbs and supplements and their therapeutic uses* (Bratman and Girman 2003), *Handbook of herbs and natural supplements* (Skidmore-Roth 2001), *Clinical guide to nutrition and dietary supplements in disease management* (Jamison 2003), *An Evidence-based approach to vitamin and minerals* (Higdon 2003), and *Herbs and natural supplements* (Braun and Cohen 2005). The most recent publication, *Herbs and natural supplements* (Braun and Cohen 2005), is the most comprehensive guide available on this topic and is a highly recommended resource for health professionals concerned with the management of individuals concurrently using orthodox and complementary medicines.

Table 1: The ten most commonly consumed supplements in a national sample of older Australians

Supplement			Males		Females		Sig.
	n	%	n	%	n	%	
Vitamin C (+/- bioflavonoids)	142	26	58	41	84	59	0.012*
Multivitamin/mineral	96	17	44	46	52	54	0.312
Fish oil/omega 3	93	17	39	42	54	58	0.076
Vitamin E	90	16	41	46	49	54	0.302
Calcium (+/- Vitamin D)	73	13	13	18	60	82	0.000**
Garlic (capsules or oil)	59	11	30	51	29	49	0.993
Vitamin B (single or mixed)	52	9	19	36	33	63	0.036*
Single vitamin or single mineral ¹	43	7	15	35	28	65	0.034*
Zinc	34	6	13	38	21	62	0.138
Gingko biloba	28	5	13	46	15	54	0.633

¹ other than those listed in the questionnaire

* $p < 0.05$

** $p < 0.005$

DATA ANALYSIS

The Statistical Package for the Social Sciences for Windows (SPSS Inc. Chicago, version 10.0, 1999) was used to conduct the data analysis. Descriptive statistics were used to report the general demographic and key health features of the sample and included frequencies (counts), percentages, means and standard deviations. Chi-square analyses were conducted to measure the relationship between gender and dietary and health supplement use. The dichotomous dependent variable (any supplement use versus non use) was entered into binary logistic analyses, using backward elimination (with likelihood ratio criteria), to explore the relationship between any supplement use and the independent variables (e.g. health conditions and symptoms experienced), after controlling for gender. For all statistical tests, a significance level of $p < 0.05$ was used.

RESULTS

Gender divided the sample into two almost equal groups ie. 51% males ($n=641$) and 49% females ($n=622$). Respondents were aged between 65 and 98 years. For males, ages ranged from 65-98 years with a mean age of 73 years (SD 6.21). For females, ages ranged from 65-95 years with a mean age of 74 years (SD 6.76). Males and females did not vary significantly ($\chi^2(df:3)=5.85$, $p=0.119$) in the distribution of ages across decade age groups.

General features

The general features of the sample have been reported elsewhere (Brownie and Myers 2003). Briefly, the majority of the sample was living with his or her partner only (61%), with some secondary school education

(43%), with an income prior to retirement in the range of \$20,000-\$39,000 (45%) compared with an income after retirement of less than \$19,000 (57%). Almost three quarters (73%) were born in Australia. The demographic features of the sample are consistent with that of the general population of older Australians, with the exception of the distribution of gender (ABS 1995). The proportion of males in this sample (51%) was slightly higher than in the general population of Australians aged 65 years and over (44%) (ABS 1999).

Supplement use

In total 45 different categories of supplement types were reported. Table 1 lists the 10 most commonly used supplements and shows the proportion of males and females using each supplement type. Not shown in this table are those preparations reported by fewer than 5% of supplement users, including the following herbal preparations St John's wort, Valerian, St Mary's thistle, Echinacea, Brahmi, Saw palmetto and Ginseng.

Compared with males, females were significantly more likely to report the use of vitamin C ($\chi^2(df:1)=6.34$, $p=0.012$), calcium ($\chi^2(df:1)=33.74$, $p=0.000$), B vitamins ($\chi^2(df:1)=4.41$, $p=0.036$) and single vitamins or minerals ($\chi^2(df:1)=4.51$, $p=0.034$) (other than those listed in the questionnaire).

Predictors of supplement use

Binary logistic analyses were used to identify predictors of supplement use. Table 2 shows the odds ratios for each of the significant independent variables in the model. Gender was the most predictive determinant of supplement use. The odds of taking any supplement were significantly higher for those with arthritis (OR 1.47, CI 1.16-1.85) and osteoporosis (OR 2.06, CI 1.40-3.04). Only one of the 23 listed symptoms, 'trouble with the

Table 2: Significant health conditions, symptoms experienced and any supplement use in a national sample of older Australians

Variable	Odds ratio	Sig.	95% Confidence interval
Health conditions			
Female	1.78	0.000*	1.41-2.26
Arthritis	1.47	0.001*	1.16-1.85
Osteoporosis	2.06	0.000**	1.40-3.04
Hypertension	0.78	0.042*	0.62-0.99
A heart condition	0.75	0.044*	0.56-0.99
Symptoms			
Female	2.09	0.000**	1.65-2.61
Trouble with back, neck or spine	1.64	0.005*	1.16-2.33

* p<0.05

** p<0.005

Table 3: Possible and potential supplement interactions in a national sample of older Australians

Supplement (n=)	Drug	Consequences of interactions	No. of potential (n=548)
Vitamins			
Vitamin A (n=6)	Anticoagulants	May increase anticoagulation effects of Warfarin	0
Vitamin C (n=142)	Anticoagulants	Large doses inhibit action of Warfarin	5
Vitamin E (n=90)	Anti platelet Anti coagulants	High doses potentiate the action of these types of medication and may increase clotting time	6
Minerals			
Calcium (n=73)	Antibiotics	Calcium may interfere with absorption of antibiotics in the tetracycline and fluoroquinolone classes	2
	Anti hypertensives	The action of calcium channel blockers may be affected by high dose calcium Calcium may reduce blood levels of atenolol and other beta blockers	30
Zinc (n=34)	Antibiotics	Zinc can interfere with the absorption of tetracyclines, fluoroquinolones and penicillamine	3
Nutritionals			
Fish oils (n=93)	Anti platelet Anticoagulants	High dose fish oils may increase bleeding when taken with these types of medication	2
Garlic (n=59)	Anti platelet Anticoagulants	Garlic possess anti thrombotic activity and may increase bleeding when taken with these types of medication	2 2
	Hypoglycaemics	Because of the hypoglycaemic effect of garlic, dosages of insulin and oral hypoglycaemics may need to be adjusted	5
Herbals			
Ginkgo (n=28)	Anti platelet Anticoagulants	Gingkolides inhibit platelet-activation factor and may potentiate bleeding	0
St John's wort (n=5)	Amphetamines	May cause mild serotonin syndrome	2
	Immunosuppressants	May cause decreased plasma cyclosporin concentrations and transplant rejection	
	MAO's	May reduce MAO inhibition	
	SSRI's	May cause mild serotonin syndrome and have additive effect	
Valerian (n=8)	Tricyclics	May cause mild serotonin syndrome	2
	Anticoagulants	May reduce MAO inhibition	
Total	MAO's	May reduce MAO inhibition	1
			62

(Bratman and Girman 2003; Skidmore-Roth 2001; Higdon 2003; Jamison 2003; Braun and Cohen 2005)

back, neck or spine', predicted supplement use (OR 1.28, CI 1.09-1.67). A diagnosis of hypertension (OR 0.78, CI 0.62-0.99) or having a heart problem (OR 0.75, CI 0.56-0.99) were significant barriers to supplement use.

Drug-supplement interactions

It is important to clarify that the number of potential interactions shown in Table 3 indicates the total number of supplement users who reported daily or regular use (often, but not every day) of any of the 26 different types of medications, eg. 'antibiotics', 'blood pressure tablets', 'cough medications', 'pain relievers', 'sleeping tablets and sedatives' etc. The absence of data about the specific name or class of drugs used by study participants precludes an accurate assessment of possible interactions. Data shown in Table 3 reflects the number of supplement users potentially at risk of a drug-supplement interaction and the scope and consequences of interactions associated with the use of dietary and health supplements in this sample.

DISCUSSION

This is the first national study to focus on identifying the health predictors of supplement use in older Australians. Supplement use was reported by 43% of the sample: 52% (n=324) of females and 35% (n=224) of males. The types of dietary supplements used most often by older individuals, both here and overseas, are preparations containing vitamin C, vitamin E, multivitamins/minerals and B vitamins (Horwath and Worsley 1989; Magarey et al 1993; Yu et al 1999; Hale et al 1982; Read and Graney 1982; Ervin et al 1999).

This study found that having arthritis, osteoporosis or generalised back or neck problems predicted the use of supplements by individuals in this sample. Existing evidence supports the benefit of complementary medicines in the management of these musculoskeletal disorders. For example, glucosamine sulphate is effective in relieving joint pain and may retard the progression of osteoarthritis (Blakeley and Ribeiro 2002; Bruyere et al 2003; Pavelka et al 2002; Richy et al 2003).

In therapeutic doses, fish oil exerts an anti-inflammatory action and may afford relief from the discomfort associated with these conditions (Buchbinder et al 2002; Goff and Barasi 1999; Adam et al 2003; Belch 1990). Calcium and vitamin D supplementation can protect against osteoporosis, fractures and falls, and is especially indicated in obese, inactive or housebound older individuals (Heaney 2000; Feskanich et al 2003; Maher 2000; Vieth 1999; Janssen et al 2002; Semba et al 2000).

Interestingly, these types of preparations were reported by fewer than 15% of supplement users with arthritis or osteoporosis. Since conducting this study in 2001, glucosamine supplementation has emerged as an effective treatment for arthritis. It is reasonable to expect a

higher use of this product now by current sufferers of this condition.

Some investigations have shown that individuals with chronic conditions such as heart disease, stroke, diabetes and cancer were no more likely to report the use of dietary supplements than those without these conditions (Yu et al 1999; Lyle et al 1998). In fact, Yu et al, (1999) and Houston et al, (1998) found persons with hypertension were actually less likely to take supplements than those without hypertension, which is consistent with the results of this study.

In a previous publication (Brownie and Myers 2003) we reported that 18% and 32% of subjects in the current study only 'sometimes' or 'rarely to never' (respectively) informed their doctor about the supplements they used, which raises concerns about the safety and appropriateness of this action, particularly given the already high utilisation of medication in this age group. Polypharmacy, inappropriate drug use and medication interactions are important determinants of the clinical management of older individuals (Salmond 2002).

Evaluating the risks associated with the use of supplements by the elderly is confounded by the lack of experimental evidence on the topic of drug interactions, the lack of agreement in the literature regarding the dosages at which adverse effects or interactions are most likely to occur, and in respect to nutrient preparations specifically, the uncertainty of not knowing the actual nutrient requirements appropriate for this age group. Some studies using personal interviews have shown that between 33%-50% of dietary and herbal supplement users aged 65 years and over were taking at least one combination of a health product and prescription or over-the-counter drug that could cause an interaction (Ly et al 2002; Dergal et al 2002).

LIMITATIONS

Because of the limited information obtained about medication use in this study, any estimates of the potential risk associated with supplement use need to be interpreted cautiously. Since this study used a questionnaire to obtain this information it is not possible to verify participant responses. At best this study can highlight the potential for interactions to occur, as shown in Table 3, but more rigorous methodology in future investigations is required to quantify this risk. Future investigations need to obtain data about the type and amount of all prescription and over-the-counter medications consumed (including complementary medicines) in order to accurately assess the extent of the risk of drug-supplement interactions. This is particularly relevant for studies involving older people.

CONCLUSION

The use of dietary and health preparations among this sample of older Australians was widespread. Individuals with chronic musculoskeletal problems were significantly more likely to report the use of supplements. The rate of usage of preparations that benefit these conditions was low. A significant proportion of supplement users did not inform their doctor about the products they consumed, therefore the true extent of drug-supplement interactions is unknown. In order to reduce the risk associated with this practice, and to evaluate the appropriateness of the supplements used, nurses should incorporate a thorough assessment of all complementary medicines as part of the history taking and medication review.

REFERENCES

- Adam, O., C. Beringer, T. Kless, C. Lemmen, A. Adam, M. Wiseman, P. Adam, R. Klimmek, and W. Forth. 2003. Anti-inflammatory effects of a low arachidonic acid diet and fish oil in patients with rheumatoid arthritis. *Rheumatology International* 23(1):27-36.
- Allen, J.A., D.C.K. Roberts, D. O'Connell, D. Sillove, and R. Heller. 1987. Vitamin and mineral supplement use in an Australian adult group. *Proceedings of the Nutrition Society (Australia)*. 12:163
- Australian Bureau of Statistics (ABS).1995. National Health Survey. Canberra: Commonwealth of Australia.
- Australian Bureau of Statistics (ABS).1999. Older People: a social report. Canberra: Commonwealth of Australia.
- Baghurst K.I. 1989. Who's buying the vitamins – vitamin consumption patterns in Australia. *Proceedings of the Nutrition Society (Australia)* 14:62-68.
- Belch, J. 1990. Fish oil and rheumatoid arthritis: does a herring a day keep rheumatologists away?[comment]. *Annals of the Rheumatic Diseases* 49(2):71-2.
- Bender, M.M., A.S. Levy, R.E. Schucker, and E. A. Yetley. 1992. Trends in prevalence and magnitude of vitamin and mineral supplement usage and correlation with health status. *Journal of the American Dietetic Association* 92(9):1096-1101.
- Blakeley, J.A., and V. Ribeiro. 2002. A survey of self-medication practices and perceived effectiveness of glucosamine products among older adults. *Complementary Therapies in Medicine*. 10(3):154-160.
- Bratman, S, and A.M. Girman. 2003. *Handbook of Herbs and Supplements and their Therapeutic Uses*. St. Louis: Mosby.
- Braun, L, and M. Cohen. 2005. *Herbs and Natural Supplements: An evidence-based guide*. Sydney: Elsevier, Mosby.
- Brevoort, P. 1996. The US botanical market: an overview. *Herbal Gram* 36:49-57.
- Brownie, S., and S.P. Myers. 2003. Dietary and health supplement use among older Australians: results from a national survey. *Australasian Journal of Ageing* 22(4):171-178.
- Brownie, S., and M. Rolfé. 2004. Health characteristics of older Australian dietary supplement users compared with non supplement users. *Asia Pacific Journal of Clinical Nutrition*. 13 (4):365-371.
- Bruyere, O., A. Honore, O. Ethgen, L.C. Rovati, G. Giacovelli, Y.E. Henrotin, L. Seidel, and J. Y. Reginster. 2003. Correlation between radiographic severity of knee osteoarthritis and future disease progression. Results from a 3-year prospective, placebo-controlled study evaluating the effect of glucosamine sulphate. *Osteoarthritis and Cartilage* 11(1):1-5.
- Buchbinder, R., M. Gingold, S. Hall, and M. Cohen. 2002. Non-prescription complementary treatments used by rheumatoid arthritis patients attending a community-based rheumatology practice. *Internal Medicine Journal*. 32(5-6):208-14.
- Dergal, J.M., J.L. Gold, D.A. Laxer, M.S.W. Lee, M.A. Binns, K.L. Lanctot, M. Freedman, and P.A. Rochon. 2002. Potential interactions between herbal medicines and conventional drug therapies used by older adults attending a memory clinic. *Drugs Aging* 19(11):879-886.
- Eisenberg, D. 1997. Advising patients who seek alternative medical therapies. *Annals of Internal Medicine*. 127(1):61-69.
- Ervin, R. B., J. D. Wright, and J. Kennedy-Stephenson. 1999. Use of dietary supplements in the United States, 1988-94. *Vital & Health Statistics – Series 11: Data From the National Health Survey*. (244):i-iii, 1-14.
- Feskanich, D, WC Willett, and G. A. Colditz. 2003. Calcium, vitamin D, milk consumption, and hip fractures: a prospective study among postmenopausal women. *American Journal of Clinical Nutrition* 77(2):504-511.
- Freeman, M.S., R.G. Sargent, R.G. Sharpe, J.L. Waller, F.M. Powell, and W. Drane. 1998. Cognitive, behavioral and environmental correlates of nutrient supplement use among independently living older adults. *Journal of Nutrition for the Elderly* 17(3):19-40.
- Giveon, SM, N Liberman, S Klang, and E Kahan. 2004. Are people who use 'natural drugs' aware of their potentially harmful side effects and reporting to family physician? *Patient Education & Counseling* 53(1):5-11
- Goff, L. M., and M. Barasi. 1999. An assessment of the diets of people with rheumatoid arthritis. *Journal of Human Nutrition & Dietetics* 12(2):93-101.
- Gray, S. L., J. T. Hanlon, G. G. Fillenbaum, W. E. Wall, Jr., and C. Bales. 1996. Predictors of nutritional supplement use by the elderly. *Pharmacotherapy*. 16(4):715-20.
- Hale, W. E., R. B. Stewart, J. J. Cerda, R. G. Marks, and F. E. May. 1982. Use of nutritional supplements in an ambulatory elderly population. *Journal of the American Geriatrics Society*. 30(6):401-3.
- Heaney, R. P. 2000. Calcium, dairy products and osteoporosis. *Journal of the American College of Nutrition*. 19(2 Suppl):83S-99S.
- Higdon, J. 2003. *An Evidence-Based Approach to Vitamins and Minerals*. New York.: Thieme.
- Horwath, C. C., and A. Worsley. 1989. Dietary supplement use in a randomly selected group of elderly Australians. Results from a large nutrition and health survey. *Journal of the American Geriatrics Society*. 37(8):689-96.
- Horwath, C.C., and A. Worsley. 1989. Dietary supplement use in a randomly selected group of elderly Australians. Results from a large nutrition and health survey. *Journal of the American Geriatrics Society* 37(8):689-696.
- Houston, D.K., T.D. Daniel, M.A. Johnson, and L.W. Poon. 1998. Demographic characteristics of supplement users in an elderly population. *The Journal of Applied Gerontology*. 17(1):79-96.
- Jamison, J. 2003. *Clinical Guide to Nutrition and Dietary Supplements in Disease Management*. Melbourne.: Churchill Livingstone.
- Janssen, H. C., M. M. Samson, and H. J. Verhaar. 2002. Vitamin D deficiency, muscle function, and falls in elderly people. *American Journal of Clinical Nutrition*. 75(4):611-5.
- Klepser, T.B., W.R. Doucette, M.R. Horton, L.M. Buys, M.E. Ernst, J.K. Ford, J.D. Hoehns, H.A. Kautzman, C.D. Logemann, J.M. Swegle, M. Ritho, and M.E. Klepser. 2000. Assessment of patients' perceptions and beliefs regarding herbal therapies. *Pharmacotherapy*. 20(1):83-87.
- Leak, J.A. 1999. Herbal medicine: is it an alternative or an unknown? A brief review of popular herbs used by patients in a pain and symptom management practice setting. *Current Reviews in Pain* 3:226-236.
- Looker, A., C. T. Sempos, C. Johnson, and E. A. Yetley. 1988. Vitamin-mineral supplement use: association with dietary intake and iron status of adults. *Journal of the American Dietetic Association* 88(7):808-814.
- Ly, L, L Percy, and S Dhanani. 2002. Use of dietary supplements and their interactions with prescription drugs in the elderly. *American Journal of Health-System Pharmacy*. 59(18):1759-1762.
- Lyle, B. J., J. A. Mares-Perlman, B. E. Klein, R. Klein, and J. L. Greger. 1998. Supplement users differ from nonusers in demographic, lifestyle, dietary and health characteristics. *Journal of Nutrition*. 128(12):2355-62.
- MacLennan, A. H., D. H. Wilson, and A. W. Taylor. 2002. The escalating cost and prevalence of alternative medicine. *Preventive Medicine*. 35(2):166-73.
- Magarey, A.M., J.A. Tiddy, and P.C. Wilson. 1993. The diets of elderly men and the use of dietary supplements: Australian non-veterans compared with war veterans. *Australian Journal of Nutrition & Dietetics* 50(1):25-28.
- Maher, T.J. 2000. Osteoporosis and calcium. *New Hope Institute of Retailing*.
- Pavelka, K., J. Gatterova, M. Olejarova, S. Machacek, G. Giacovelli, and L.C. Rovati. 2002. Glucosamine sulphate use and delay of progression of knee osteoarthritis: a 3-year, randomized, placebo-controlled, double-blind study. *Archives of Internal Medicine* 162(18):2113-23.
- Read, M. H., and A.S. Graney. 1982. Food supplement usage by the elderly. *Journal of the American Dietetic Association* 80(3):250-253.
- Richy, F., O. Bruyere, O. Ethgen, M. Cucherat, Y.E. Henrotin, and J. Y. Reginster. 2003. Structural and symptomatic efficacy of glucosamine and chondroitin in knee osteoarthritis: a comprehensive meta-analysis. *Archives of Internal Medicine* 163(13):1514-1522.

- Salmond, S. 2002. Polypharmacy and phytotherapy: issues of herb/drug interactions in the elderly. *Australian Journal of Medical Herbalism* 14(1):9-20.
- Semba, RD, E Garrett, BA Johnson, J. M. Guralnik, and LP Fried. 2000. Vitamin D deficiency among older women with and without disability. *American Journal of Clinical Nutrition* 72(6):1529-1534.
- Skidmore-Roth, L. 2001. *Handbook of Herbs and Natural Supplements*. St. Louis.: Mosby.
- Slesinski, M. J., A. F. Subar, and L. L. Kahle. 1995. Trends in use of vitamin and mineral supplements in the United States: the 1987 and 1992 National Health Interview Surveys. *Journal of the American Dietetic Association* 95(8):921-3.
- Stewart, M.L., J.T. McDonald, A. S. Levy, R.E. Schucker, and D.P. Henderson. 1985. Vitamin/mineral supplement use: a telephone survey of adults in the United States. *Journal of the American Dietetic Association* 85(12):1585-1590.
- Subar, A. F., and G. Block. 1990. Use of vitamin and mineral supplements: demographics and amounts of nutrients consumed. *American Journal of Epidemiology* 132(6):1091-1101.
- Vieth, R. 1999. Vitamin D supplementation, 25-hydroxyvitamin D concentrations, and safety. *American Journal of Clinical Nutrition* 69:842-856.
- Winslow, LC, and DJ Kroll. 1998. Herbs as medicines. *Archives of Internal Medicine* 158(20):2192-2199.
- Worsley, A., and D. Crawford. 1984. Australian dietary supplementation practices: Health and Dietary Supplements. *Medical Journal of Australia*. 140(10):579-583.
- Yu, X.Q., W. Smith, K. Webb, P. Mitchell, and S.R. Leeder. 1999. Prevalence and predictors of dietary supplement use in an older Australian population. *Australian Journal of Nutrition & Dietetics* 56 (2):69-75.
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