

The Prevalence and Pattern of Complementary and Alternative Medicine Use in Individuals With Diabetes

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OBJECTIVE — This study compared the prevalence and pattern of use of complementary and alternative medicine (CAM) in individuals with and without diabetes and identified factors associated with CAM use.

RESEARCH DESIGN AND METHODS — The 1996 Medical Expenditure Panel Survey, a nationally representative sample of the U.S. noninstitutionalized civilian population, was analyzed. Estimates of CAM use in individuals with common chronic conditions were determined, and estimates of CAM use in patients with diabetes were compared with that in individuals with chronic medical conditions. Patterns of use and costs of CAM use in patients with diabetes were compared with those in nondiabetic individuals. Multiple logistic regression was used to determine independent predictors of CAM use in individuals with diabetes, controlling for age, sex, race/ethnicity, household income, educational level, and comorbidity.

RESULTS — Individuals with diabetes were 1.6 times more likely to use CAM than individuals without diabetes (8 vs. 5%, $P < 0.0001$). In the general population, estimates of CAM use were not significantly different across selected chronic medical conditions, but diabetes was an independent predictor of CAM use. Among individuals with diabetes, older age (≥ 65 years) and higher educational attainment (high school education or higher) were independently associated with CAM use.

CONCLUSIONS — Diabetes is an independent predictor of CAM use in the general population and in individuals with diabetes. CAM use is more common in individuals aged ≥ 65 years and those with more than high school education.

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Diabetes is a chronic debilitating medical condition that affects ~16 million individuals in the U.S.; ~2,200 new cases of diabetes are diagnosed each day (1). Diabetes is associated with significant morbidity and mortality. It is the leading cause of end-stage renal disease and amputation of the lower extremity in the general population and the leading cause of new cases of blindness in

individuals aged 20–74 years. In addition, diabetes is the seventh leading cause of death in the U.S. (2). Furthermore, diabetes imposes significant financial burden on individuals with the disease. The annual medical cost associated with diabetes is ~98 billion dollars, including direct and indirect medical costs and lost productivity (3).

Complementary and alternative

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Abbreviations: CAM, complementary and alternative medicine; COPD, chronic obstructive pulmonary disease; ICD-9-CM, International Classification of Diseases, 9th edition, Clinical Modification; MEPS, Medical Expenditure Panel Survey; NCCAM, National Center for Complementary and Alternative Medicine.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

healthcare and medical practices, i.e. complementary and alternative medicine (CAM), are functionally defined as treatments and healthcare practices that are not taught widely in medical schools and are not generally available in U.S. hospitals (4). The National Center for Complementary and Alternative medicine (NCCAM) defines CAM as those healthcare and medical practices that are not currently an integral part of conventional medicine (5). The NCCAM definition restricts the term “conventional medicine” to medicine practiced by holders of MD (medical doctor) or DO (doctor of osteopathy) degrees, some of whom may also practice CAM (5).

There is evidence that an increasing number of individuals in the U.S. use one or more CAM remedies for the treatment of common medical conditions (4,6). There seem to be differences in CAM usage, based on age, sex, income level, and educational status. Eisenberg et al. (6) reported that CAM use was highest in individuals with college education, women, adults aged 35–49 years, and individuals with household incomes $> \$50,000$, whereas CAM use was lowest in African-Americans. Bausell et al. (7) found higher prevalence of CAM use in adults aged 30–49 years, women, individuals living in the Midwest, and whites compared with individuals of other racial or ethnic groups. In addition, several studies have observed an increased use of CAM in individuals with chronic medical conditions (6–8).

Current data suggest that most patients use CAM in addition to conventional medical treatments (6,9). However, data are sparse on the types of CAM used by individuals with diabetes. In addition, it is unknown whether individuals with diabetes use CAM more than those with common chronic medical conditions or what factors are associated with CAM use in individuals with diabetes. The Medical Expenditure Panel Survey (MEPS), which

is a nationally representative survey of the U.S. population, collected data on CAM use for the first time in the 1996 survey. The MEPS provides a unique opportunity to answer several of these questions because it collected data on medical conditions, health insurance, demographic information, and health care use and expenditures.

To provide preliminary data for future studies, we sought to ascertain 1) whether individuals with common chronic medical conditions, including diabetes, were more likely to use CAM than individuals without such chronic conditions; 2) whether CAM use in individuals with diabetes was higher than CAM use in individuals with other common chronic medical conditions; and 3) the pattern of use, costs, and factors independently associated with CAM use in individuals with diabetes.

RESEARCH DESIGN AND METHODS

Study design

We combined data from the household and medical conditions components of the 1996 MEPS to determine the prevalence and pattern of use of alternative care in individuals with diabetes. The household component of MEPS is a survey of the U.S. civilian, noninstitutionalized population, drawn from the National Health Interview Survey sample with oversampling of Hispanics and blacks. This survey, sponsored by the Agency for Health Care Research and Quality, provides national estimates of health care use, health conditions, health status, insurance coverage, and access to care (10). In 1996, questions on prevalence, pattern, and costs associated with CAM were incorporated into the survey. A total of ~21,571 individuals were surveyed, and the overall response rate for 1996 was 77.7%.

Medical conditions

For the medical conditions component of MEPS, interviewers recorded verbatim the medical conditions and procedures as reported by the respondents. Then, professional coders used the verbatim text to assign fully specified 1996 International Classification of Diseases, 9th edition, Clinical Modification (ICD-9-CM) codes, including medical conditions and V codes. The error rate for any coders did

not exceed 2.5% on verification. Assigned codes were verified by contacting medical providers and pharmacies that were identified by the respondents during the interview. To protect the confidentiality of respondents, fully specified ICD-9-CM codes were collapsed to three digits. For example, the ICD-9-CM code 250 (diabetes) represented diabetes, high blood glucose, juvenile diabetes, and adult-onset diabetes or diabetes neuropathy (11).

CAM

The MEPS defined CAM as “approaches to health care that are different from those typically practiced by medical doctors in the U.S.” This definition, which is similar to the NCCAM definition of CAM, included acupuncture, nutritional advice or lifestyle diets, massage therapy, herbal remedies, biofeedback, meditation, and imagery or relaxation techniques. Other treatments included in this definition of CAM were homeopathic treatment, spiritual healing or prayer, hypnosis, and traditional therapies such as Chinese, Ayurvedic, and Native American medicine. A card with the list above was presented to respondents. Then, the interviewer read the following statement verbatim to each respondent: “In order to get as complete a picture as possible of all sources of health care, we would also like to ask about the use of other forms of health care, including treatments you may have previously told me about, such as the treatments shown on this card. Frequently, this type of care is referred to as “complementary or alternative care.” During the calendar year 1996, did you consult someone who provides these types of treatment?” Individuals who responded affirmatively were asked to indicate the specific treatment, the type of CAM providers visited, and the number of visits to such providers. Respondents were also asked to indicate the cost of CAM visits, percentage of CAM costs covered by health insurance, and out-of-pocket costs for CAM.

Demographic variables

Variables of the study participants included age, sex, race/ethnicity, marital status, educational level, health insurance status, and income status. The total household income and the number of individuals in each household were used to compute poverty levels based on federal guidelines. Household incomes were sub-

sequently reported as a percentage of the federal poverty level. We classified households with combined incomes <125% of the federal poverty level as “poor” and households with incomes \geq 125% of federal poverty guidelines as “not poor.” Self-reported physical and mental health of respondents were classified into two categories: excellent, very good, and good were combined into one category, and fair and poor were combined to form the second category. Further details on technical and programming information are available (10,11).

Adjustment for chronic illness

The MEPS a priori designated certain conditions as priority conditions due to prevalence, expense, or relevance to policy. We selected certain chronic comorbid conditions to compare with diabetes, including cancer, chronic obstructive pulmonary disease (COPD), hypertension, and ischemic heart disease. These conditions were selected because prior studies had indicated that individuals with these conditions had higher CAM use than the general population (6,7). Consequently, we created three categories of comorbidity, depending on the number of chronic medical conditions. Individuals with diabetes only were put in a separate category. Individuals with diabetes and cancer, COPD, hypertension, or ischemic heart disease were put into a second category, whereas individuals with diabetes and two or more of these conditions were put into a third category for analyses.

Statistical analyses

We used SAS statistical software (SAS Institute, Cary, NC) (12) and SUDAAN statistical software (Research Triangle Institute, Research Triangle Park, NC) (13) for statistical analyses to generate variance estimates that accounted for the complex sampling design of the MEPS. In addition, SUDAAN was used to generate population estimates to make them applicable to the civilian noninstitutionalized adult population with diabetes in the U.S. We performed three statistical analyses. First, estimates of CAM use were compared in individuals with and without diabetes, cancer, COPD, hypertension, and ischemic heart disease in the general U.S. population. Then, the estimates of CAM use in individuals with diabetes were compared with those in individuals with cancer, COPD, hypertension, and isch-

emic heart disease using χ^2 statistics. Second, we used χ^2 and Student's *t* test statistics to compare the type of CAM used, the type of CAM provider seen, the pattern of use, and the costs associated with CAM use. Third, multiple logistic regression was used to determine factors that were independently associated with CAM use in the general population and in individuals with diabetes. In the multiple logistic regression models for the general population, whether CAM was used in 1996 was entered as a dichotomous dependent variable; independent variables included age, sex, education, race/ethnicity, marital status, and census region. Other independent variables included perceived physical health, perceived mental health, health insurance coverage, and household income as percentage of federal poverty level, employment, and number of comorbid conditions. Similarly, in the model for individuals with diabetes, the use of CAM was entered as the dependent variable. However, due to the small sample size of CAM users, we restricted the independent variables to age, sex, race, education, household income, and number of comorbid conditions. The Institutional Review Board of our institution approved the study.

RESULTS

Prevalence of CAM use in individuals with chronic medical conditions

Individuals with diabetes (8 vs. 5%, $P = 0.0067$), cancer (9 vs. 5%, $P = 0.0007$), and hypertension (6 vs. 5%, $P = 0.0277$) were more likely to use CAM than their counterparts with no chronic medical conditions in the general population. Patients with ischemic heart disease and COPD did not differ significantly in their use of CAM when compared with individuals without both chronic conditions. The estimates of CAM users among individuals with diabetes did not differ significantly from that in individuals with cancer, hypertension, ischemic heart disease, or COPD. Extrapolating to the U.S. population in 1996 (~265,639,034 civilian noninstitutionalized individuals), 12,963,185 individuals reported use of CAM. Similarly, among an estimated 9,652,897 individuals with diabetes in 1996, 759,683 reported use of CAM.

Table 1—Sample characteristics of individuals with diabetes in 1996 (n = 825)

	n	%
Age \geq 65 years	356	44
Women	472	55
Race/ethnicity		
Hispanic	172	11
Black	157	17
White/other	496	72
Married	475	59
Census region		
Northeast	158	19
Midwest	185	24
South	311	38
West	158	19
Physical health		
Excellent, very good, or good	421	52
Mental health		
Excellent, very good, or good	691	85
Education		
High school or more	463	61
Poverty		
Household income $>$ 125% federal poverty level	583	78
Health insurance		
Private	481	63
Public	272	29
Uninsured	72	8
Employed	281	35
Comorbidity (diabetes versus diabetes + 1 or more chronic condition)		
Diabetes only	318	36
Chronic comorbid conditions		
Diabetes and hypertension	374	46
Diabetes and ischemic heart disease	221	28
Diabetes and COPD	54	7
Diabetes and cancer	66	10

Sample characteristics of individuals with diabetes

The sample characteristics of individuals with diabetes are presented in Table 1. Approximately 44% were aged \geq 65 years, 55% were women, 72% were neither black nor Hispanic, and 59% were married. Of these individuals, 61% had at least a high school education, 35% were employed during the year of study, and only 8% reported not having health insurance coverage. A total of 64% of individuals had diabetes in addition to at least one other chronic medical condition. Of these individuals with diabetes, 46% had

hypertension, 28% had ischemic heart disease, 10% had some type of cancer, and 7% had COPD.

CAM use in individuals with and without diabetes

The pattern of use of CAM and the costs associated with CAM use in individuals with diabetes are presented in Table 2. The five most commonly used CAM therapies in individuals with diabetes, in order of importance, were nutritional advice and lifestyle diets, spiritual healing, herbal remedies, massage therapy, and meditation training. On the contrary, the most commonly used CAM therapies in individuals without diabetes, in order of importance, were massage therapy, herbal remedies, spiritual healing, nutritional advice and lifestyle diets, and meditation training.

Both groups received treatment from a variety of CAM providers, including physicians and nurses. Individuals with diabetes were more likely to see a nurse for CAM than individuals without diabetes (13 vs. 2%, $P = 0.0275$). In contrast, individuals with diabetes were less likely to see a massage therapist (16 vs. 32%, $P = 0.0099$) and an herbalist (6 vs. 14%, $P = 0.0165$) than individuals without diabetes. Individuals with diabetes were more likely to report the use of CAM for a specific health problem (81 vs. 63%, $P = 0.0075$). Similarly, individuals with diabetes were more likely to report discussing the use of CAM with their regular physician (57 vs. 29%, $P = 0.0024$) and being referred by their physician to a CAM provider (43 vs. 10%, $P = 0.001$).

The mean number of visits to CAM providers were not significantly different in individuals with and without diabetes (9 ± 2 vs. 13 ± 2 , $P = 0.1781$). Similarly, the mean amount in dollars spent per person for CAM was not different in both groups ($\$414 \pm 269$ vs. $\$236 \pm 26$, $P = 0.5106$). The percentage of CAM costs covered by health insurance was different between both groups, but this difference did not achieve statistical significance (27 vs. 12%, $P = 0.0549$).

Factors associated with use of CAM

The independent predictors of CAM use in both the general population and in individuals with diabetes are shown in Table 3. In the general population, women, those with high school education or more, those in poor physical health,

Table 2—Comparison of pattern of use among all CAM users in 1996 by diabetes status

	With diabetes (n = 62)	Without diabetes (n = 889)	P
Type of CAM received			
Acupuncture	6	11	0.1800
Nutritional advice	37	20	0.0199
Massage therapy	19	35	0.0110
Herbal remedies	20	33	0.0565
Biofeedback	3	2	0.4853
Meditation training	14	11	0.7058
Homeopathic therapy	3	10	0.0259
Spiritual healing	21	24	0.6112
Hypnosis	0	1	0.0102
Traditional medicine	2	6	0.0967
Other alternative therapy	6	6	0.9317
Provider of CAM			
Physician	7	4	0.3515
Nurse	13	2	0.0275
Homeopath/naturopath	6	6	1.0000
Chiropractor	9	12	0.3984
Clergy/spiritualist	18	20	0.8200
Massage therapist	16	32	0.0099
Acupuncturist	9	9	0.9652
Herbalist	6	14	0.0165
Use pattern and costs of CAM			
Used CAM for specific health problem	81	63	0.0075
Discussed CAM use with regular physician	57	29	0.0024
Referred by physician to CAM provider	43	10	0.0010
CAM covered by insurance (yes)	27	12	0.0549
Mean number of visits to CAM provider	9 (2)	13 (2)	0.1781
Mean amount spent for CAM	414 (269)	236 (26)	0.5106

Data are % or means (SEM).

those who were employed, and those with diabetes or diabetes in combination with other chronic medical conditions were most likely to use CAM. In addition, Hispanics and blacks were less likely to use CAM than whites and individuals of other races or ethnicities. Individuals who lived in the West were more likely to use CAM than those living in the Northeast, Midwest, or South. Finally, individuals with private health insurance were less likely to use CAM than those who were uninsured.

Among individuals with diabetes, those aged ≥ 65 years were three times more likely to use CAM than those aged < 65 years. Individuals with high school education and higher were 2.4 times more likely to use CAM than those who had not completed high school. Sex, race/ethnicity, household income, and comorbidity were not significant predictors of CAM use in individuals with diabetes.

CONCLUSIONS— This study has shown that although individuals with di-

abetes are more likely to use CAM than individuals without diabetes, estimates of CAM use in individuals with diabetes are comparable to those in individuals with other common chronic medical conditions. In addition, using nationally representative data, this study has provided preliminary estimates on pattern of use, associated costs, and factors associated with CAM use in individuals with diabetes.

The estimates of CAM use in this study differ considerably from those of Eisenberg et al. (4,6) but closely approximate those from two other studies using data from the MEPS (7,9). There are three possible reasons for these differences. One reason is the heterogeneity of CAM practices (5,14), which means that estimates of CAM use will change depending on what is included or excluded in the definition of CAM. The second reason is the oversampling of Hispanics and blacks and the use of direct household interview rather than telephone interviews in

MEPS. This approach may have increased the proportion of minorities and individuals of lower socioeconomic status, who have been shown to have lower usage of CAM (6, 7). The third reason is the difference in target population and study hypothesis across studies. This is particularly obvious in the MEPS sample. When Bausell et al. (7) focused on adults aged ≥ 18 years, they found that 9% of U.S. adults visited CAM providers. However, when Druss and Rosenheck (9) used the same data set with similar age cutoffs, but tested different hypotheses, they found that 6.5% of the U.S. population used both conventional and unconventional therapies. Both studies differ from our study, in which no age category was excluded and the emphasis was on CAM use as opposed to visits to CAM providers.

Patients with diabetes and other common chronic medical conditions were more likely to use CAM than individuals in the general population. This is not surprising because earlier studies have linked increased CAM use with the presence of chronic as opposed to acute or life-threatening medical conditions (4,8). However, the finding that diabetes is an independent predictor of CAM use in the general population is surprising, particularly because the presence of multiple chronic comorbid conditions did not explain the association between diabetes and CAM use. Adjusting for covariates, individuals with only diabetes were two times more likely to use CAM, whereas individuals with diabetes and additional chronic conditions were 1.8 times more likely to use CAM than the general population without chronic medical conditions. This observation will need to be explored in future studies.

Nutritional advice and lifestyle diet, spiritual healing, herbal remedies, massage, and meditation were the most frequently used CAM treatments among individuals with diabetes; this pattern approaches the pattern of CAM use in the general population (4,6,15,16). Although nutritional counseling and lifestyle modification are essential components of routine diabetes care, it is important to recognize that in this study, such advice/diets were obtained from CAM providers. The MEPS definition of CAM, which is similar to the NCCAM definition (5), implies that nutritional advice and lifestyle diets provided by CAM practitioners differ from conventional nutritional/dietary

Table 3—Independent predictors of CAM use in the general population and among individuals with diabetes in 1996

	General population	People with diabetes
n	21,571	825
Age ≥65 years	0.73 (0.48–1.11)	3.05 (1.40–6.67)*
Age <65 (reference)	1.00	1.00
Women	2.17 (1.82–2.83)*	1.72 (0.90–3.33)
Men (reference)	1.00	1.00
Hispanic	0.71 (0.52–0.98)*	1.10 (0.50–2.41)
Black	0.52 (0.33–0.82)*	0.81 (0.35–1.91)
White/other (reference)	1.00	1.00
Married	0.93 (0.75–1.14)	
Not married	1.00	
High school and higher	2.78 (1.96–3.85)*	2.43 (1.16–5.08)*
Less than high school (reference)	1.00	1.00
Northeastern	0.39 (0.28–0.54)*	
Midwestern	0.43 (0.31–0.59)*	
Southern	0.42 (0.33–0.54)*	
Western (reference)	1.00	
Poor physical health	1.56 (1.11–2.17)*	
Good physical health (reference)	1.00	
Poor mental health	1.19 (0.74–1.87)	
Good mental health (reference)	1.00	
Private insurance	0.71 (0.53–0.95)*	
Public insurance	0.79 (0.54–1.16)	
Uninsured (reference)	1.00	
Employed	1.48 (1.13–1.94)*	
Not employed (reference)	1.00	
125% + of poverty	1.33 (0.98–1.80)	1.29 (0.64–2.61)
<125% of poverty (reference)	1.00	1.00
Diabetes alone	2.16 (1.35–3.45)*	1.00 (Reference)
Diabetes + other chronic conditions	1.76 (1.06–2.95)*	1.11 (0.54–2.26)†
No comorbidity (reference)	1.00	1.00 (0.41–2.44)‡

Data are adjusted odds ratio (95% CI). *Statistically significant at $P < 0.05$; †diabetes plus one chronic condition; ‡diabetes plus two or more chronic conditions.

recommendations endorsed by diabetes educators or physicians.

Examples of nutritional advice and lifestyle diets offered by CAM practitioners include Ayurvedic diets, naturopathic or homeopathic nutrition/diets, and orthomolecular therapies such as magnesium, melatonin, or megadoses of vitamins (5). In addition, special diets, such as those proposed by Drs. Atkins, Ornish, Pritikin, and Weil, also qualify as CAM lifestyle nutrition/diets (5). It is unlikely that nutritional advice and lifestyle diets offered by CAM practitioners are consistent with the American Diabetes Association guidelines for dietary management of diabetes (17). In addition, it is currently unknown whether additional nutritional advice and lifestyle diets by CAM practitioners complement and reinforce American Diabetes Association

guidelines or conflict with conventional dietary recommendations.

Spiritual healing in MEPS refers to healing by someone other than self, such as the clergy or a spiritualist, and differs from self-prayer. This differentiation is important because an earlier study (6) reported that although only 7% of the U.S. population reported spiritual healing by others, up to 35% of the U.S. population used self-prayer as a form of treatment. Spiritual healing was the second most common type of CAM used by individuals with diabetes (21%) and the third most frequently used CAM in individuals without diabetes (24%). This finding suggests that substantial percentages of the U.S. population believe and seek spiritual healing as a form of treatment.

It seems that the search for spiritual healing may be well founded, based on

the results of a recent study (18). This systematic review of 23 trials and 2,774 patients found that prayer and distant healing yielded statistically significant treatment effects in 13 patients (57%), no effect over control interventions in 9 patients (39%), and a negative effect in 1 patient (4%). In contrast, the use of herbal remedies, which was reported by 20% of individuals with diabetes, has not been shown to improve glucose control and may even be harmful in individuals with diabetes (19,20).

There are some limitations to this study. A major limitation is the small number of individuals with diabetes that used CAM in the 1996 MEPS household sample. This limited the type of analysis that could be performed and the number of independent predictors of CAM entered into the multiple logistic regression models. However, the MEPS is the first nationally representative survey that provides detailed information about the use of CAM and has data on medical conditions. The MEPS offers an exceptional opportunity to provide baseline data on CAM use in individuals with diabetes in the U.S. noninstitutionalized civilian population.

A second limitation of this study is that MEPS based CAM use on visits to a practitioner and excluded treatments obtained by individuals without consultation with a CAM practitioner. This may decrease the estimates of CAM use in both comparison groups. Recall bias is another potential limitation. Studies have shown that self-reports are reliable for the diagnosis of diabetes (21,22), but no studies validate recall of visits to CAM practitioners. If recall was low, it was likely similarly low across the sample because there are no obvious reasons to expect differential reporting of CAM use. The fourth limitation is the ambiguous definition of CAM (5,14), which allows for estimates that are dependent on the inclusion and exclusion criteria used to define CAM. This limitation may interfere with the ability of researchers to compare findings across studies.

The major implication of this study is that individuals with diabetes seem to use CAM as a complement rather than as an alternative to conventional treatment. In this study, 57% of individuals with diabetes who used CAM discussed it with their regular physician and 43% were actually referred to CAM users by a physician.

This is reassuring because it means that patients with diabetes are not abandoning conventional treatments, which have been rigorously tested, for unconventional treatments, which lack properly designed efficacy trials. On the other hand, it means that health care providers will need to acknowledge CAM use, learn to discuss CAM use with their patients, and be able to do so candidly and without prejudice.

In an editorial published in the *Journal of the American Medical Association*, Wayne Jonas said “alternative medicine is here to stay” and that the challenge of the health care community is to “separate the pearls from the mud” (23). The increase in prevalence of diabetes (1), the search by patients for holistic medicine, and the skepticism some patients have about the efficacy of modern medicine (24) make the appropriateness of this statement even more evident. Differentiating efficacious CAM treatments from bogus treatments will remain a daunting task, and the absence of properly designed and conducted efficacy trials for many treatments further complicates the problem (25). Nonetheless, to foster collaboration with patients, health care providers must respect patients’ wishes to use CAM and provide unbiased advice about CAM treatments to patients. In addition, health care providers will need to understand the benefits and limitations of currently available alternative treatments.

There are three important areas for future research. First, there is a need to replicate the findings from the 1996 MEPS in current surveys. Second, there is an urgent need to use rigorous research designs to establish the efficacy of several complementary and alternative treatments that are currently being used by individuals with diabetes. Third, future studies must determine the effectiveness of CAM use in typical clinical situations and the effect of CAM on the quality of life in individuals with diabetes.

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