

PREVENTATIVE EFFECTS OF CRANBERRY PRODUCTS AGAINST URINARY TRACT
INFECTIONS IN HEALTHY, IMMUNOCOMPETENT WOMEN

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Abstract

Urinary tract infections (UTIs) are commonly diagnosed in an estimated 300 million women per year around the world. Annual health care costs for diagnosis and treatment of UTIs in the United States is approximately \$1.6 billion. Previous research suggests cranberry products, a complementary and alternative medicine (CAM), provides protection against UTI recurrence in women. A demand for alternative, cost-effective methods for UTI prevention is needed due to rising antibiotic resistance rates. In this cross-sectional study, the specific aims examined women's use, knowledge of, and attitudes toward CAM, and the use of cranberry products to prevent UTIs. An online self-administered questionnaire, the Holistic Complementary and Alternative Medicine Questionnaire (HCAMQ), was distributed to a convenience sample of healthy women 18 to 65 years of age who attended Texas State University. Findings revealed 27% of women have used CAM in the past, but only 9.2% are currently using it. The most common types of CAM used are vitamins and herbal supplements (61%), meditation/mindfulness (48%), yoga (35%), and acupuncture (22%). The HCAMQ survey scores indicated a more positive attitude towards CAM and holistic health (HH). About 60% of women admitted to using cranberry product to prevent UTIs with positive results in 82% of them. Although 73% of participants believe CAM is worth trying, 82% of them believe more testing is needed and 67% believe CAM can be dangerous because it prevents patients from seeking traditional treatment for their illnesses. Increased patient education is needed to change attitudes and increase usage of CAM.

Key words: urinary tract infection, cranberry, complementary and alternative medicine, attitudes, knowledge

Preventative Effects of Cranberry Products Against Urinary Tract Infections
in Healthy, Immunocompetent Women

Urinary tract infections (UTIs) are one of the most commonly diagnosed bacterial infections worldwide with an estimated 300 million women per year being diagnosed (Jhang & Kuo, 2017). *Escherinchia coli* (*E. coli*) is the most common cause of UTIs, which is typically treated with antibiotics. However, due to a worldwide increase in antimicrobial resistance, patients are not being treated appropriately thus linking inappropriate antibiotic therapy to worsening outcomes such as pyelonephritis, sepsis, and morbidity (Reid, 2001). Due to the increase in multidrug-resistant bacteria, effective preventative approaches are needed to minimize use of antibiotic therapy. Cranberry-containing products is a non-pharmacological, nutritive preventative method that has long been evaluated in its attempt to reduce UTI incidence in otherwise healthy adult women.

It is estimated that up to 30% of women with a diagnosed uncomplicated UTI will have recurrence within six months (Maki et al., 2016). An uncomplicated UTI is an infection that does not progress to pyelonephritis, sepsis, and/or morbidity and does not contribute to functional or anatomical abnormalities of the urinary tract (Mansour, Hariri, Shelh, Irani, & Mroueh, 2014). Recurrences are traditionally defined as greater than or equal to two uncomplicated UTIs in the past six months, or at least three UTIs within the preceding year (Nicolle, 2011). Although usually not life-threatening, the high incidence of recurrence significantly increases health care costs and can have a negative impact on a patient's quality of life (Jhang & Kuo, 2017). Annual health care costs for the diagnosis and treatment of UTIs in the United States (U.S.) accounts for approximately 1.6 billion dollars (Bass-Ware, Weed, Johnson, & Spurlock, 2014). In fact, some researchers believe that recurrent UTIs should be considered a different disease from the initial

infection due to new research regarding the pathogenetic mechanisms of recurrence (Jhang & Kuo, 2017). This proposition, in addition to the increased rates of antimicrobial resistance, implies that prevention of recurrent UTIs is a subject much deserving of further research.

Research findings demonstrate cranberry products as having both clinical benefit and preventative capability for UTI symptoms (Bass-Ware et al., 2014). Constituents that contribute to the clinical benefit of cranberry include phenolic acids, flavonoids, anthocyanins, proanthocyanidins, and triterpenoids (Vostalova et al., 2015). A-type proanthocyanidins are the most effective in inhibiting bacterial adhesion of *E. coli* to the urinary tract (Vostalova et al., 2015). If adhesion of bacteria to the uroepithelium of the bladder is inhibited, then the bacteria will be unable to initiate infection (Bass-Ware et al., 2014). The prophylactic efficacy of cranberry products due to its chemical composition has shown to be responsible for the reduction in incidence and recurrence of UTIs. Women who consume cranberry products on a regular basis are 38% less likely to develop symptoms of UTI (Wang et al., 2012). Furthermore, the results of a recent meta-analysis concluded that cranberry products were shown to reduce the risk of UTI recurrence by 26% among otherwise healthy women (Fu, Liska, Talan, & Chung, 2017). While there has not yet been sufficient evidence to integrate nutritive, non-pharmacological interventions into clinical practice, the existing results of randomized controlled trials suggest that the use of cranberry products as prophylaxis to UTI occurrence and recurrence warranted further investigation.

Literature Review

A review of the literature was performed to synthesize the evidence regarding the efficacy of prophylactic cranberry use for the prevention of uncomplicated UTIs. There are noticeable inconclusive findings regarding cranberry products' efficacy on UTI reduction.

Possible explanations that contributed to the discrepancies found in the literature are deliberated within three separate sections comprising the literature review: (a) clinical benefit of cranberry product in preventing UTIs, (b) attitude and use of cranberry products, and (c) knowledge and use of cranberry products. Appendix A illustrates a scholarly article grid on the published evidence that also examines the strength of the articles discussed in the literature review.

Clinical Benefit of Cranberry Product in Preventing UTIs

In a Cochrane review by Jepson, Williams, and Craig (2012), findings suggested that cranberry had no overall benefit in UTI recurrence compared with placebo (RR = 0.86, 95% CI 0.71 to 1.04). Prior findings in a double-blind, randomized, placebo-controlled trial by Barbosa-Cesnik et al. (2011) showed agreement with Jepson et al. (2012) with statistical evidence showing that the recurrence rate of uncomplicated UTI in otherwise healthy college women was 16.9% (95% CI 0.128 to 0.21) with similar distribution of recurrences found between the control and placebo groups. In contrast, a meta-analysis by Wang et al. (2012) suggested the opposite. The use of cranberry products more than twice daily was associated with a protective effect (RR = 0.58, 95% CI 0.40 to 0.84) as well in women who were cranberry juice drinkers (RR = 0.47, 95% CI 0.30 to 0.72) and in women with recurrent UTIs (RR = 0.53, 95% CI, 0.33 to 0.83) (Wang et al., 2012).

A randomized, double-blind, placebo-controlled study by Maki et al. (2016) further supports findings from Wang et al. (2012) by discovering that the daily consumption of a cranberry beverage for a 24-week period produced a 39% reduction in clinical UTI episodes in healthy women with a recent history of UTI within the past year. Additionally, the annualized UTI incidence density was significantly reduced in the cranberry (control) group compared with the placebo group ($p = 0.017$). That same year, Singh, Gautman, and Kaur (2016) published a

study evaluating the efficacy of cranberry products on the incidence of recurrent UTIs in patients prone to recurrent UTIs and those who do not respond to antimicrobials. Singh et al.'s (2016) randomized, placebo-controlled trial found that consumption of a cranberry supplement for a 12-week period was significantly effective in lowering the episodes of recurrent UTI ($p < 0.001$), compared to the 24-week period in the study by Maki et al. (2016).

However, all three of these studies did not distinguish between complicated and uncomplicated UTIs in the reported findings; nor, was it evident as to whether the findings were generalizable to healthy women at risk for an uncomplicated UTI. In terms of research specific to the demographics of the proposed Capstone study, according to Maki et al. (2016), there was no statistical heterogeneity in the treatment responses for subjects < 50 and > 50 years of age (p -treatment by age-group interaction = 0.526).

Attitudes and Use of Cranberry Products

A randomized, double-blind and placebo-controlled trial by Vostalova et al. (2015) found that inconsistencies and biases in previous research may be due to low compliance and/or acceptability of the cranberry products. To fully evaluate the efficacy of cranberry products to prevent occurrence or recurrence of UTIs, the product use and compliance with regimen must be considered. Hence, an in-depth review of the literature was performed to determine the attitudes and use of cranberry products in women with or without history of UTIs.

Torine Litherland's study (2011) explored what diabetic women do to prevent getting a UTI and what they do to self-treat when they first notice symptoms. Data from 42 women with a history of uncomplicated UTIs indicated that 19 (42.5%) of the women reported no self-treatment method (Torine Litherland, 2011). Among the 23 women who used self-treatment methods, 14 (61%) would take different herbs and plant extracts, the most popular being

cranberry tablets (Tordine Litherland, 2011). This particular study distinguishes between the women using self-treatment methods based on self-diagnosis from those who were not clinically diagnosed through microbiologic confirmation for a UTI. With 83.3% of study participants implementing changes in their daily routines to prevent UTIs, the attitude and compliance of effective prophylactic self-treatment methods for women with history of UTI can contribute to reducing the need for antibiotics (Tordine Litherland, 2011).

Comparatively, in a randomized, placebo-controlled study, Wing et al. (2015) explored the attitude and compliance associated with prophylactic use of cranberry products in pregnant women. With 8% of participant compliance, the ability to comply long-term was less than anticipated (Wing et al., 2015). Ten participants expressed disinterest in continued participation in the trial within the first four weeks after enrollment due to the inconvenience of daily capsule ingestion (Wing et al., 2015). Only one participant stopped taking the daily cranberry product due to intolerability (Wing et al., 2015). With 67% of participants being Hispanic and 80% receiving public funding (Wing et al., 2015), a barrier that may have contributed to results that were much less than anticipated may be due to socioeconomic status and cultural preference among Hispanics. Additionally, common barriers among minority women included skepticism toward the efficacy of supplements (Wing et al., 2015). These results demonstrate that willingness and acceptability of the use of cranberry products may be influenced by race and socioeconomic status. This is an important consideration as Hispanics were considered high risk for recurrent UTIs in this study (Wing et al., 2015).

Knowledge and Use of Cranberry Products

There is a trend toward the use of complementary and alternative medicine (CAM) that presents more compliance and acceptance of phytotherapeutic drugs, such as cranberry (Micali et

al., 2014). However, the correlations between knowledge and use of CAM must be closely examined. Loh, Ghorab, Clarke, Conroy, and Barlow (2013) formulated a survey given to 319 Irish medical students to evaluate the interest, knowledge of, use, and attitude toward CAM. Findings indicated that a majority of students showed an interest in various CAM modalities, but declared limited knowledge on it (Loh et al., 2013). Furthermore, students also showed more positive attitudes towards these modalities despite their limited knowledge (Loh et al., 2013); thus, suggesting the students' interests may have been influenced by factors other than their knowledge. A limitation to this study may be that it did not use race or ethnicity as an influencing factor of the students' attitudes, interests, and use of CAM modalities, despite published literature suggesting ethnicity is a large factor that may influence the use of CAM modalities.

Lastly, Fortier et al. (2014) reviewed a national report stating that non-Hispanic white adults are more likely to use CAM (43%) when compared to Hispanic adults (24%). A cross-sectional survey design evaluating potential ethnic differences in beliefs and use of CAM among mothers of children undergoing elective surgery provided further evidence of these percentages; findings showed there was no statistical difference ($p = 0.71$) among the ethnic groups in regard to holistic health beliefs including benefits and/or risks of using CAM (Fortier et al., 2014). However, additional results found that Spanish-speaking Hispanic mothers used CAM modalities to a lesser degree than both English-speaking Hispanics and English-speaking whites ($p = .02$). This evidence suggests that ethnicity may influence CAM use and brings further attention to the need to understand cultural sensitivity and its correlation regarding knowledge and the use of CAM.

Proposal

According to the National Center for Complementary and Integrative Health (2017), a survey done in 2012 reports that 33.2% of Americans use complementary therapies. One of the most commonly used therapies reported was natural products, which is defined as supplements other than vitamins and minerals (National Center for Complementary and Integrative Health, 2017). Included in this category are cranberry products and according to the survey, 1.9 million Americans report using cranberry products (National Center for Complementary and Integrative Health, 2017). As shown in the literature review, the findings on the efficacy of cranberry products in the prevention and treatment of UTIs is inconclusive and, at times, conflicting. More research is needed to clarify these conflicting findings and explore attitudes and perceptions regarding the use of cranberry products in the treatment and prevention of UTIs. The Capstone study addressed specific areas of research that are found to be lacking.

Study Aims

The aims of the proposed Capstone study were: (1) to explore the attitude and knowledge on the use of complementary and alternative medicine in healthy, immunocompetent women 18 to 65 years of age enrolled at Texas State University, and (2) to explore the attitude and use of cranberry products as a preventative method in UTI recurrence in otherwise healthy, immunocompetent women 18 to 65 years of age enrolled at Texas State University. The purpose of this Capstone study was to explore three major constructs of attitude, knowledge, and use of cranberry products in healthy, immunocompetent women, 18 to 65 years of age, to determine both the perceived and actual efficacy of this CAM treatment in the prevention and recurrence of UTIs.

Methods

Study Design and Sampling Method

The Capstone study was a cross-sectional design that collected data from participants at one time during the designated time frame. The study examined the attitude, knowledge, and use of complementary therapies including the use of cranberry products in the prevention of UTIs among healthy, immunocompetent women. A non-experimental observational design best accommodated the exploration of the study variables and the timely completion of the study.

Researchers used convenience sampling to recruit study participants. Those included in this study were healthy, immunocompetent women, ages 18-65 years old enrolled as students at Texas State University, with no major comorbidities, non-pregnant, with the presence or absence of equal to or greater than two UTI's in the past six months. The term "immunocompetent" was defined as "capable of developing an immune response; possessing a normal immune system" (Medical Dictionary, 2018). Participants also needed to be literate in the English language, meaning they could read, write, and comprehend English. Exclusion criteria included men, children, and women who were pregnant or had a current bladder catheter, nephrostomy or urostomy, as well as presenting with kidney disease, kidney stones, anatomical abnormalities of the urinary tract, spinal cord injury, those who had cancer, human immunodeficiency virus (HIV), or type 1 and/or type 2 diabetes.

A researcher-developed screening tool (Appendix B) was used to determine participants' eligibility to be included in the study. The tool contained questions regarding inclusion and exclusion criteria described above, such as pregnancy status, current medical problems, and primary language spoken. To ensure that the sample size was large enough to be representative of the target population, participants were recruited from the student population at Texas State

University at both the San Marcos and Round Rock campuses. Based on a power analysis, a sample size estimate of 110 was needed to achieve statistical significance with a maximum p -value of 0.05 and a moderate effect size of 80%. Researchers added a 20% oversampling to account for missing data to bring the total sample size needed to 132 participants.

Study Instruments

Study instruments selected for the study included a demographics questionnaire (Appendix C) and the Holistic Complementary and Alternative Medicine Questionnaire (HCAMQ) (Hyland, Lewith, & Westoby, 2019) (Appendix D). The demographics questionnaire was designed by the research team and was divided into two sections. The first section included participant's age, gender, ethnicity, education level, and socio-economic data. The second section included questions regarding the use of CAM, the type and frequency, use and result of cranberry products for UTI.

The HCAMQ measures attitudes towards complementary or alternative medicine (CAM) and holistic health (HH) beliefs (Hyland et al., 2019). The survey consisted of 11 questions and participant responses were rated on a Likert scale, ranging from 1-strongly agree to 6-strongly disagree. The scoring tool used two subscales to measure attitudes towards CAM and HH with formulaic reversed scoring. Based on the number of study participants (n), a range was calculated using $(n \times 5)$ and $(n \times 30)$ for the low- and high-end of the range for HH subsection. The same procedure using $(n \times 6)$ and $(n \times 36)$ was used to find the high- and low-end of the range for the CAM subsection. A score on the lower end of the range indicated a more positive attitude towards CAM and HH. The HCAMQ was found to have good test retest reliability ($r=.86$ and 0.82 for the CAM subscale and 0.77 for the HH subscale) and good internal

consistency for the total instrument ($\alpha = 0.80$, and 0.83 for both subscales respectively) (Hyland, Lewith, & Westoby, 2003).

Data Collection Procedures

A recruitment email was composed per University policy and was sent to female students enrolled in Texas State University. This email included an informed consent cover letter with an embedded link to a screening tool (Appendix B). The voluntary participant responses were screened by the researchers and selected in accordance with the inclusion/exclusion criteria: females aged 18 to 65 years of age enrolled as students at Texas State University, immunocompetent with no major comorbidities, non-pregnant, with the presence or absence of equal to or greater than two UTIs in the past six months. Once the participant qualified via the screening tool, she was redirected to (1) a 13-item researcher-designed demographic questionnaire (Appendix C) that collected demographic data and assessed cranberry use, and (2) an 11-item Holistic Complementary and Alternative Health Questionnaire (HCAHQ) (Appendix D) that measured attitude toward and understanding of CAM and holistic health (HH) beliefs. An electronic version of these tools were created using Qualtrics, a web-based platform used for data collection and to maintain anonymity. The information collected in the electronic surveys were not damaging to the University in any way. The HCAHQ responses were sorted, scored and analyzed based on numerical scores of Likert scale questions. All web-based documents were numerically coded for data management and to maintain anonymity.

Data Analysis

Statistical analysis using descriptive and inferential methods was computed using the latest version of a Windows statistics software package, Statistical Package for the Social Sciences (SPSS). Descriptive statistics was used to summarize the characteristics of the

population study, including demographics, and attitudes toward and knowledge of the use of cranberry products. Means for age and the number of diagnosed UTIs of CAM and non-CAM users within the given time frame of the previous 12 months was used for comparison.

Categorical variables were reported as a frequency and percentage. In this study, the independent variables are the attitudes and knowledge of CAMs, focusing on cranberry products, while the use of cranberry is considered the dependent variable. Attitudes toward cranberry use was considered a descriptive factor of interest. A *p*-value of less than or equal to 0.05 marked statistical significance with a moderate effect of 80%.

Ethics and the Use of Human Subjects

The benefits of using a self-administered questionnaire, such as the HCAMQ, include low cost, expediency of administration, and the preserved anonymity of participants (Polit & Beck, 2017). With the intent to protect the rights of human subjects, a formal review of the proposed study was conducted by a Texas State Institutional Review Board. As the online survey would seemingly present a minimal risk to participants, the researchers' expectation of an exempted review was approved. Researchers obtained informed consent by preceding the electronic questionnaire with a cover letter explaining the purpose, methods of the study, risk to participants, and the voluntary nature of participation. Completion of the study questionnaire indicated passive consent to participate in the study. Researchers will not have access to participants' personal information except for the demographics and self-reported practices and opinions supplied by the questionnaire. Furthermore, only aggregate data was reported. No identifying data about any individual participant will be published upon completion of the study as questionnaires were coded to ensure confidentiality and anonymity.

Results

Sample Characteristics

The total number of participants (N) in the study was 213. A large majority of study participants (64%) identified themselves as single, aged 18 to 49 (92%) with an education level of a bachelor's degree or higher (89%). When asked about current and past CAM use, only 27% of participants reported past CAM use and 9% of participants reported current CAM use. The frequency of UTIs was also explored along with cranberry use and results from cranberry use. According to participants, 82% have not had a UTI in the last 12 months, while 16% reported one to two UTIs, and 2% reported three to four UTIs in the last 12 months. The use of cranberry products, specifically for the treatment or prevention of UTIs, was also measured. Participants reported that 60% of them have used cranberry in the past and 82% of those who used cranberry products had a positive result in the prevention or treatment of UTIs (Figures 1 and 2).

Key Findings

The HCAMQ is divided into two subsections. One relates to attitudes toward CAM and the other toward holistic health (HH). Participants were not required to answer every question; therefore out of the total study sample of N = 213, only n = 197 answered the questions in the HH section and n = 195 answered the questions in the CAM section. Participant responses to questions in the subsection regarding attitudes toward CAM and its use were varied. The calculated range for the CAM subsection of the HCAMQ, using n=195, was 1170-7020. Scores that fall in the lower end of the range are considered positive, according to the HCAMQ scoring tool. The total score of participants' responses was 1177, which indicates a positive response. While 81% of participants agreed CAM needs more scientific testing before it can be accepted for conventional treatment and 67% agreed CAM could be dangerous in that it may prevent

people from getting proper treatment, 73% did agree it is worthwhile trying CAM before going to see a primary care provider (PCP) (Figure 3).

The responses to the HH section of the HCAMQ were overwhelmingly positive. The calculated range for the HH section of the HCAMQ, using n=197, was 985-5910. The total score of participants' responses was 985. Positive responses to questions regarding the beliefs that stress and depression affected illness and the importance of work-life balance ranged from 98-100% (Figure 4).

Discussion

Interpretation of Findings

This Capstone study was designed to (1) explore the attitude and knowledge on the use of CAM and (2) to explore the attitude and use of cranberry products as a preventative method in UTI recurrence in otherwise healthy, immunocompetent women. The findings from the Capstone study corresponding to the exploration of the attitude and knowledge on the use of CAM indicated that attitude had a greater impact on CAM use, unmatched to the negligible influence of CAM knowledge. Researchers used statements regarding HH beliefs to evaluate factors that influenced participants' views and the likelihood of using CAM for the treatment of minor ailments.

Participants demonstrated limited knowledge regarding what constitutes CAM with only 27% of participants admitting to past use of CAM and 60% reporting a history of using cranberry products to prevent or treat a UTI. This evidence supports the conclusion that participants were not aware of the classification of cranberry products as a CAM modality. Another study measuring knowledge and use of CAM (Loh et al., 2013) revealed similar results in that participants demonstrated poor baseline knowledge of CAM modalities. As a whole, the

Capstone study revealed an unclear understanding of what therapies constitute CAM, supporting that patient education is needed to increase knowledge of and usage of CAM.

Despite the limited knowledge the participants had regarding CAM, they still demonstrated positive attitudes towards CAM with participants giving similar responses and strong agreement to the statement “it is worthwhile to try complementary medicine before going to the doctor.” However, it is noted there were large percentages of participants who agreed with the HCAMQ statements “CAM needs more scientific testing before it can be accepted for conventional treatment” and “CAM could be dangerous in that it may prevent people from getting proper treatment.” This evidence also supports the need for patient education about CAM to clarify its use and potential benefits in certain patient populations.

Positive attitudes toward general holistic principles as shown by strong agreements to statements regarding the substantial impact of stress, depression, and work/life balance has on overall health, was shown to be the most influential factor toward CAM use. Although findings demonstrated an overwhelming positive attitude toward the concept of HH, this counter-intuitive finding may reflect some participant’s views on Western medicine or allied health rather than CAM and/or HH. To address the attitude and use of cranberry products as a preventative method in UTI recurrence, the positive attitudes expressed toward HH beliefs and mixed responses regarding CAM did not relate with actual use of cranberry products for UTI etiology. Thus, this finding suggests a knowledge deficit and perhaps a stronger inclination toward the utilization of CAM treatments than participants were aware of themselves.

Implications for Practice

The implications of these findings for clinical practice are multifold. Foremost, health care providers should be aware that there is a lack of knowledge regarding what therapies

actually constitute CAM. As the current study suggests, a significant portion of the population unknowingly utilizes CAM, this information could have a notable impact on patients' health. There are well-acknowledged risks associated with using certain CAM therapies in combination with Western medicine. With a lack of knowledge on what constitutes CAM, users are less likely to report these treatments during health care visits, which may influence the care they receive and prescribed treatment modalities. In addition to patient awareness, providers should be further educated on what CAM therapies are safe and supported by evidence. The level of evidence required for use by practitioners will likely vary by the type, setting, and philosophy of the provider, and be influenced by experience, familiarity, and comfort with CAM treatments as adjunctive therapies. This may be an area of interest for future research studies.

Study Limitations and Recommendations for Future Study

Limitations of the study include the cross-sectional design, lack of information to participants regarding the definition of CAM, and not including race, ethnicity, or cultural beliefs in the demographics as an influencing factor in attitudes toward CAM. A cross-sectional study design is intended to collect data from participants at one point in time yet cost effective (Polit & Beck, 2017). This does not allow for on-going data analysis or development of cause-and-effect between study variables. Future study using a longitudinal design would capture long-term effects and yield pertinent clinical information for providers while a randomized clinical trial could delve into etiologies.

Another study limitation is the lack of information provided to study participants regarding the definition of CAM. The definition of CAM provided on the section of the survey regarding CAM use reads "therapies that are used in conjunction with traditional Western medicine." This definition is vague and did not give participants categories or examples of

therapies that are included in CAM. This may have skewed results on the questions regarding past and current CAM use as only 27% of participants noted that they have used CAM in the past and 60% noted that they have used cranberry products in the past for treatment or prevention of UTIs. Cranberry is considered a CAM therapy and the data suggests that participants did not understand that concept. Hence, a consensus on a universal definition of CAM and its specific therapies needs to be agreed upon by the scientific community to support and inform clinical practice.

Lastly, as stated in the literature review, Wing et al. (2015) discussed cultural barriers in the use of CAM that included skepticism toward the efficacy of supplements among minority women. Also, Fortier et al. (2014) reviewed a national report stating that non-Hispanic white adults were more likely to use CAM (43%) when compared to Hispanic adults (24%). Evidence has shown that race, culture, and ethnicity play an influencing role in the attitude and use of CAM. Researchers did not take these factors into consideration when collecting data regarding demographics and analyzing trends in data. Perhaps a focal study on minority women or Hispanic ethnic subgroups would provide a comparative analysis to determine significant correlations.

Conclusion

Urinary tract infections, known as UTIs, affect 300 million women each year. Standard treatment currently involves the use of antibiotic therapy. As the incidence of multi-drug resistant bacteria has risen, alternative, cost-effective methods have been researched to not only provide protection against UTI occurrence, but to also prevent or limit reoccurrence. The use of cranberry products for uncomplicated UTIs in healthy, immunocompetent women is one such treatment method. This cross-sectional study provided information regarding attitude and

knowledge factors on the likelihood of CAM use for the treatment of minor ailments, specifically for UTIs. The results demonstrate a relatively positive attitude toward HH beliefs and CAM, despite participants having limited knowledge concerning various CAM modalities. A lack of knowledge induces caution of CAM, creating an ideal opportunity for health care providers to advocate for CAM use and educate patients about it.

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Torine Litherland, A. (2011). Urinary tract infection: Diabetic women's strategies for prevention. *British Journal of Nursing*, 20(13), 791. Retrieved from <http://libproxy.txstate.edu/login?url=http://search.ebscohost.com.libproxy.txstate.edu/login.aspx?direct=true&db=mdc&AN=21841686&site=ehost-live&scope=site>

Vostalova, J., Vidlar, A., Simanek, V., Galandakova, A., Kosina, P., Vacek, J., . . . Student, V.

(2015). Are high proanthocyanidins key to cranberry efficacy in the prevention of recurrent urinary tract infection? *Phytotherapy Research: PTR*, 29(10), 1559-1567.

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Wang, C., Fang, C., Chen, N., Liu, S. S., Yu, P., Wu, T., . . . Chen, S. (2012). Cranberry-containing products for prevention of urinary tract infections in susceptible populations: A systematic review and meta-analysis of randomized controlled trials. *Archives of Internal Medicine*, 172(13), 988-996. doi: 10.1001/archinternmed.2012.3004

Wing, D. A., Rumney, P. J., Hindra, S., Guzman, L., Le, J., & Nageotte, M. (2015). Pilot study to evaluate compliance and tolerability of cranberry capsules in pregnancy for the prevention of asymptomatic bacteriuria. *Journal of Alternative and Complementary Medicine*, 21(11), 700-706. doi: 10.1089/acm.2014.0272

Cranberry Use

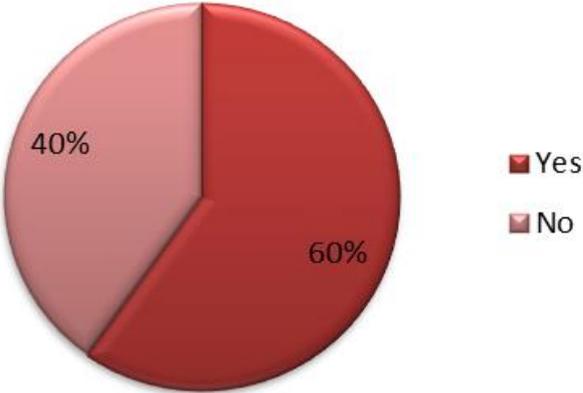


Figure 1 Reported participants' use of Cranberry products

Cranberry Use Results

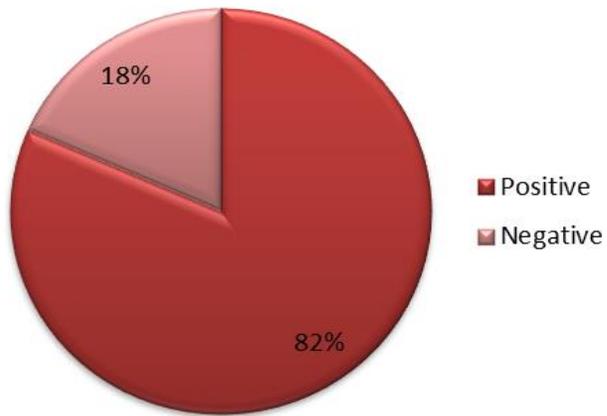


Figure 2 Participants' reported results from the use of cranberry products

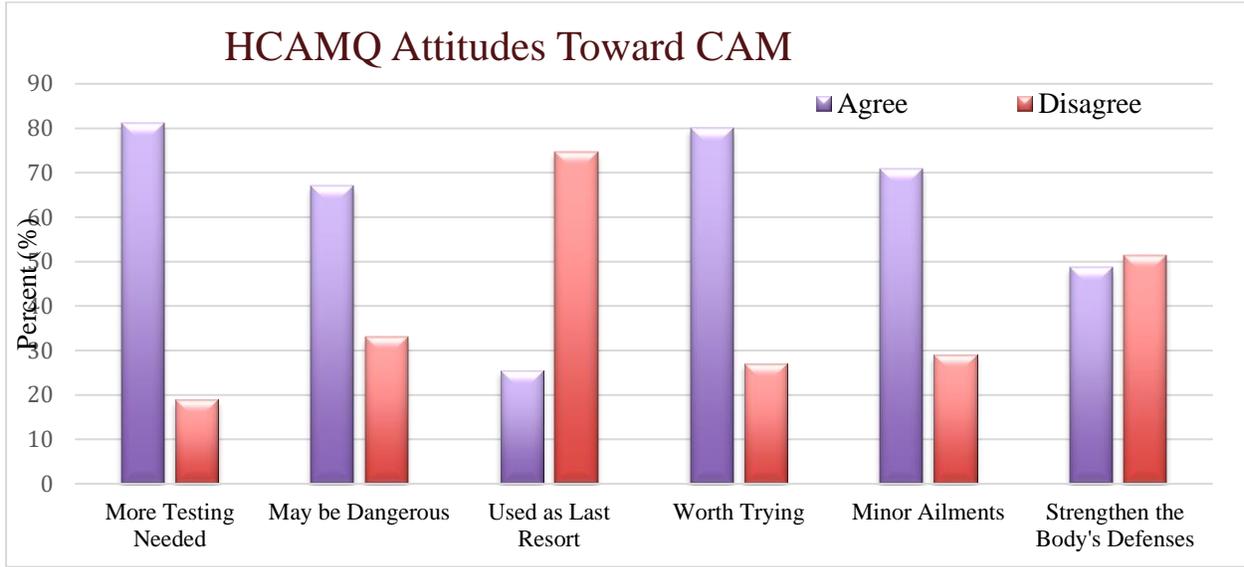


Figure 3 Participants' responses to questions regarding CAM use in the subsection on the HCAMQ

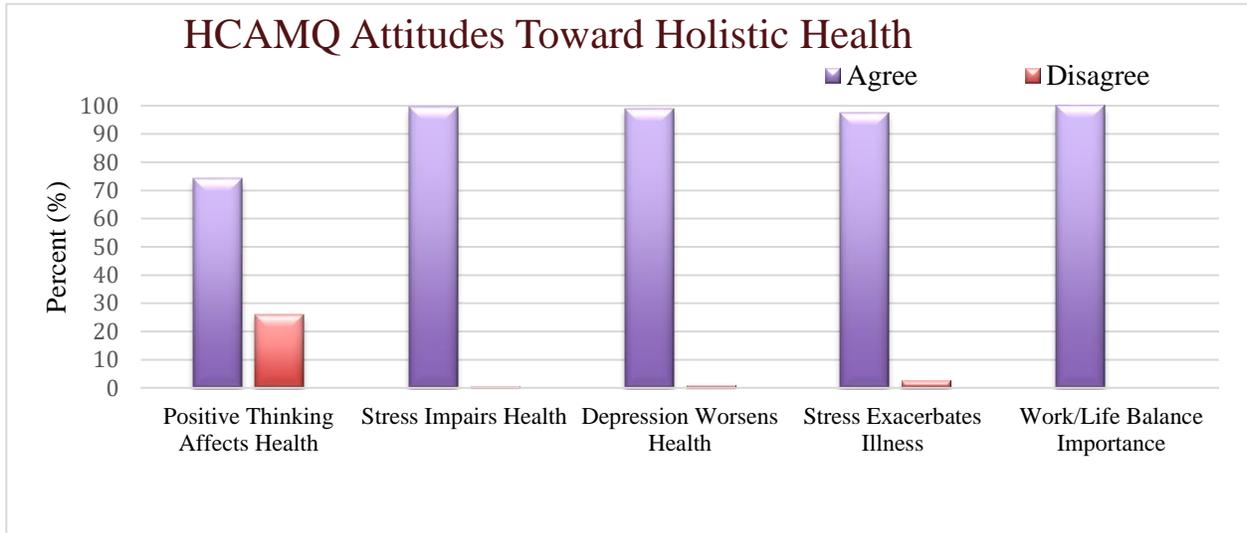


Figure 4 Participants' responses to questions regarding HH in the subsection on the HCAMQ

Appendix A

Scholarly Article Grid

Citation (APA)	Purpose	Design; Level of Evidence	Sample	Measurement	Results/ Conclusions	Ranking/ Strength of Recom- mend- ation
1. Barbosa-Cesnik, C., Brown, M. B., Buxton, M., Zhang, L., DeBusscher, J., & Foxman, B. (2011). Cranberry juice fails to prevent recurrent urinary tract infection: Results from a randomized placebo-controlled trial. <i>Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America</i> , 52(1), 23-30. doi: 10.1093/cid/ciq073	Determine the effect of regularly drinking cranberry juice cocktail and its efficacy in reducing the rate of recurrent UTI and accompanied symptoms.	Randomized, double-blind trial (Level II)	N = 319 Randomly assigned healthy college women with history of an acute UTI	Web based questionnaire created by authors completed at 1 week and at 1, 2, 4, and 5 months. Questionnaire regarded UTI symptoms, risk and behavioral factors associated with UTI, diet, compliance, gastrointestinal or any other symptoms, and medical history. Medical record review at the end of the study where urine specimens were collected to confirm UTI diagnosis.	UTI recurrence rate and distribution of recurrence rate was fairly similar between control and placebo groups. Cranberry group had a slightly higher recurrence rate compared to placebo (20.0% versus 14.0%). Presence of UTI symptoms at ≥ 1 month was similar between both groups with no notable differences.	A

<p>2. Maki, K. C., Kaspar, K. L., Khoo, C., Derrig, L. H., Schild, A. L., & Gupta, K. (2016). Consumption of cranberry juice beverage lowered the number of clinical urinary tract infection episodes in women with a recent history of urinary tract infection. <i>The American Journal of Clinical Nutrition</i>, 103(6), 1434-1442. doi: 10.3945/ajcn.116.130542</p>	<p>Compare the effects of the consumption of a cranberry beverage with that of a placebo beverage on the symptomatic UTI incidence density in otherwise healthy women with a recent history of UTI.</p>	<p>Double-blind, randomized, placebo-controlled trial (Level II)</p>	<p>N = 373 Randomly assigned (1:1 ratio) women with a history of ≥ 2 UTIs that was medically treated within the past year</p>	<p>Validated daily diary Telephone calls to confirm compliance Office visit to collect clean-catch urine specimen to r/o UTI</p>	<p>Clinical UTI episodes were reduced in the cranberry group compared to placebo group. One clinical UTI episode was prevented for every 3.2 woman-years of the cranberry intervention.</p>	<p>A</p>
<p>3. Singh, I., Gautam, L. K., & Kaur, I. R. (2016). Effect of oral cranberry extract (standardized proanthocyanidin-A) in patients with recurrent UTI by pathogenic E. coli: A randomized placebo-controlled clinical research study. <i>International Urology and Nephrology</i>, 48(9), 1379-1386. doi: 10.1007/s11255-016-1342-8</p>	<p>Evaluate the effect of cranberry extract (proanthocyanidin -A) on the in-vitro bacterial properties of <i>E. coli</i> and its efficacy in patients with uncomplicated recurrent UTIs.</p>	<p>Randomized placebo-controlled clinical research study (Level II)</p>	<p>N = 60 Randomly assigned women with history of subclinical asymptomatic UTI and/or recurrent UTIs</p>	<p>Routine urine microscopy, pH (dipstick) and culture, patient's self-reported well-being score and objective outcome measures calculated at 3, 6, and 12 weeks.</p>	<p>Efficacy of standardized cranberry extract containing PAC-A was superior to placebo in terms of decreased bacterial adhesion and in preventing recurrent UTI symptoms.</p>	<p>A</p>

<p>4. Vostalova, J., Vidlar, A., Simanek, V., Galandakova, A., Kosina, P., Vacek, J.,...Student, V. (2015). Are high proanthocyanidins key to cranberry efficacy in the prevention of recurrent urinary tract infection? <i>Phytotherapy Research: PTR</i>, 29(10), 1559-1567. doi: 10.1002/ptr.5427</p>	<p>Determine whether whole cranberry fruit powder (proanthocyanidin content 0.56%) could prevent recurrent UTI in women age 18 to 75 years with history of ≥ 2 UTIs in the last year.</p>	<p>Randomized double-blind and placebo-controlled trial (Level II)</p>	<p>N = 182 Randomly assigned healthy women ages 18 to 75 years with a history of UTIs within the past year</p>	<p>Office visit at 3 and 6 months where a detailed medical history, assessment of concurrent medications, dietary habits, kidney and bladder ultrasound, laboratory blood work, and urinalysis is ordered to confirm or r/o diagnosis of UTI.</p> <p>Kaplan-Meier estimate used to describe distribution of time to first UTI.</p>	<p>UTI diagnosis was significantly lower in the cranberry group (10.8%) versus in the placebo group (25.8%).</p> <p>Cranberry group had a longer time to first UTI than the placebo group ($p = 0.04$).</p>	<p>A</p>
<p>5. Torrine Litherland, A. (2011). Urinary tract infection: Diabetic women's strategies for prevention. <i>British Journal of Nursing (Mark Allen Publishing)</i>, 20(13), 791. Retrieved from http://libproxy.txstate.edu/login?url=http://search.ebscohost.com.libproxy.txstate.edu/login.aspx?direct=true&db=mdc&AN=21841686&site=ehost-live&scope=site</p>	<p>Explore strategies used by diabetic women for prevention and self-treatment of UTI.</p>	<p>Single, cross-sectional study (Level VI)</p>	<p>N = 42 Convenience sampling of women with diabetes mellitus who had at least 1 episode of UTI within the last six months</p>	<p>Interview asking participants strategies they do to prevent UTIs or what they do when they first notice symptoms</p>	<p>54.5% of participants who used self-treatment strategies when they first noticed symptoms of UTI admitted to using cranberry tablets or capsules.</p>	<p>B</p>

<p>6. Wing, D. A., Rumney, P. J., Hindra, S., Guzman, L., Le, J., & Nageotte, M. (2015). Pilot study to evaluate compliance and tolerability of cranberry capsules in pregnancy for the prevention of asymptomatic bacteriuria. <i>Journal of Alternative and Complementary Medicine (New York, N.Y.)</i>, 21(11), 700-706. doi: 10.1089/acm.2014.0272</p>	<p>Evaluate the compliance of taking daily cranberry capsules for asymptomatic bacteriuria prevention in pregnancy.</p>	<p>Pilot randomized, placebo-controlled study (Level IIb)</p>	<p>N = 49 Randomization stratified by site</p>	<p>Research coordinator contact to determine compliance or tolerance. Compliance measured objectively by capsule counts at monthly visits.</p> <p>Daily dietary diary in which participants maintained a daily dietary diary where the total # of capsules consumed was recorded along with side effects, if any</p> <p>Follow up visits where a clean-catch urine specimen was collected for dipstick urinalysis with possible urine culture being collected to r/o UTI</p> <p>Mantel-Haenszel test used to estimate common odds ratio to test for association of cranberry consumption and achieving $\geq 75\%$ compliance</p>	<p>Average compliance rate was 82% (range, 20% to 100%), with 74% of patients achieving good compliance. Results were similar between control (cranberry capsules) and placebo.</p>	<p>A</p>
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<p>7. Loh, K. P., Ghorab, H., Clarke, E., Conroy, R., & Barlow, J. (2013). Medical students' knowledge, perceptions, and interest in complementary and alternative medicine. <i>Journal of Alternative and Complementary Medicine (New York, N.Y.)</i>, 19(4), 360-366. doi: 10.1089/acm.2012.0014</p>	<p>Assess the knowledge, interest, use, and attitudes of Irish medical students regarding complementary and alternative medicine.</p>	<p>Cross sectional survey (Level VI)</p>	<p>N = 319 Convenience sampling of Irish medical students (under-graduate and graduate) at Royal College of Surgeons</p>	<p>Survey questionnaire that assessed the self-perceived level of knowledge of students in various CAM modalities. The first part of the survey asked about religion and the second part of the survey asked about knowledge, interest, and attitude toward 15 CAM modalities.</p> <p>A pilot was performed prior to administration of this survey.</p> <p>Mokken scaling used to correlate interest in different CAM modalities with a single underlying dimension.</p>	<p>65% of medical students reported they have not acquired sufficient knowledge about CAM modalities, with knowledge of CAM modalities rated as minimal or none.</p> <p>Attitudes toward CAM modalities were positive from medical students. More than half of the students had no opinion on 7 of the 15 CAM modalities presented in the survey.</p>	<p>B</p>
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<p>8. Fortier, M. A., Gillis, S., Gomez, S. H., Wang, S., Tan, E. T., & Kain, Z. N. (2014) Attitudes toward and use of complementary and alternative medicine among hispanic and white mothers. <i>Alternative Therapies in Health and Medicine</i>, 20(1), 13-19. Retrieved from http://libproxy.txstate.edu/login?url=http://search.ebscohost.com/libproxy.txstate.edu/login.aspx?direct=true&db=mdc&AN=24445352&site=ehost-live&scope=site</p>	<p>Examine the differences in CAM beliefs and use in English and Spanish-speaking Hispanic and non-Hispanic others of children undergoing elective surgery.</p>	<p>Cross sectional survey (Level VI)</p>	<p>N = 206 Maximum variation sampling with mothers classified into groups based on self-reported ethnicity</p>	<p>Self-administered questionnaire asking about demographics and personal use of CAM modalities. Respondents indicated their personal use of 27 different CAM modalities. Percentage of mother’s use of various CAM modalities by ethnic/language group was evaluated.</p> <p>Holistic and Complementary and Alternative Medicine Questionnaire (HCAMQ); Cronbach’s α demonstrated adequate reliability ($\alpha \geq .60$) 11-item scale with participants responding using a 7-point Likert type scale assessing their agreement with each item regarding CAM validity beliefs.</p>	<p>There was a significant group difference in CAM use among ethnicities ($P < .0001$).</p> <p>There was no significant difference observed between different ethnic groups for beliefs and beneficial use of CAM modalities.</p>	<p>B</p>
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<p>9. Jepson, R. G., Williams, G., & Craig, J.C. (2012). Cranberries for preventing urinary tract infections. <i>The Cochrane Database of Systematic Reviews</i>, 158(10). doi: 10.1002/14651858.CD001321.pub5</p>	<p>Assess the effectiveness of cranberry products in preventing UTIs in susceptible populations.</p>	<p>Systematic Review (Level I)</p>	<p>N = 4473 24 RCTS and quasi-RCTS reviewed: 13 studies evaluated cranberry juice/ concentrate; 9 studies evaluated cranberry tablets or capsules; 1 study compared cranberry juice and tablets; and 1 study compared cranberry tablets and capsules</p>	<p>Two authors assessed and extracted data. Information collected based on incidence of symptomatic UTIs, positive culture results, adverse side effects, and adherence to therapy.</p> <p>Risk ratio (RR) calculated; if not appropriate a narrative synthesis was performed.</p> <p>Quality of studies assessed using Cochrane risk of bias assessment tool.</p>	<p>Cranberry product use compared with placebo showed no significant reduction in the occurrence of symptomatic UTI.</p> <p>The effectiveness of cranberry was not significantly different to antibiotics for women.</p> <p>Given the large number of dropouts and lack of compliance in the reviewed studies, the benefit of cranberry for preventing UTIs is small, thus cranberry products cannot be recommended for the prevention of UTIs.</p>	<p>A</p>
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<p>10. Wang, C., Fang, C., Chen, N., Liu, S. S., Yu, P., Wu, T., ... Chen, S. (2012). Cranberry-containing products for prevention of urinary tract infections in susceptible populations: A systematic review and meta-analysis of randomized controlled trials. <i>Archives of Internal Medicine</i>, 172(13), 988-996. doi: 10.1001/archinternmed,2012.3004</p>	<p>Evaluate cranberry-containing products and their prevention of UTI and to examine the factors that influence their efficacy.</p>	<p>Systematic Review and Meta-analysis of RCT (Level I)</p>	<p>N = 1616 Systematic search of MEDLINE, EMBASE, and the Cochrane Central Register for RCTs that compared prevention of UTIs in cranberry-containing product users versus placebo groups. 13 trials were used for qualitative synthesis.</p>	<p>Four authors assessed and extracted data to determine relevant trials.</p> <p>Quality of studies assessed using Cochrane risk of bias assessment tool.</p> <p>Galbraith plot used to identify potential sources of heterogeneity.</p>	<p>Random-effects pooled RR for cranberry users versus nonusers was 0.62 (95% CI, 0.49 – 0.80).</p> <p>Women with recurrent UTIs (RR 0.53; 95% CI 0.33 – 0.83), cranberry juice drinkers (RR 0.47; 95% CI 0.30 – 0.72); and subjects using cranberry-containing products > 2 daily (RR 0.58; 95% CI 0.40 – 0.84).</p> <p>Cranberry containing products are associated with protective effects against UTIs</p>	<p>A</p>
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Appendix B

Screening Tool

- | | | | |
|--|--|---------|-------|
| 1. What is your gender? | Male | Female | Other |
| 2. What is your primary language? | English | Spanish | Other |
| 3. Are you currently pregnant? | Yes | No | |
| 4. How many urinary tract infections have you had in the last 12 months? | None | 1-2 | 3-4 |
| | 5 or more | | |
| 5. Past Medical History
(mark if you have had or have any of the conditions listed) | Kidney disease | | |
| | Spinal cord injury | | |
| | HIV | | |
| | Bladder Disease | | |
| | Catheters or ostomies (tubes and bags) | | |
| | Diabetes | | |
| | Cancer | | |
| | Steroid use for 3 months or longer | | |

Appendix C

Demographics Survey

Instructions: Circle your answers

- | | | | | |
|---------------------|----------------------|--------------|------------------|--------------------|
| 1. Age: | 18-25 years | 50-64 years | 26-49 years | 65 years and older |
| 2. Marital Status: | Single | Married | Divorced | Widowed |
| 3. Education Level: | High School Graduate | Some College | Bachelors Degree | Masters Degree |
| | Doctoral Degree | | | |

Knowledge and Use of Complementary Alternative Medication (CAM)*

- | | | | | |
|--|------------------------|--------------------|-------------|------|
| 4. Have you used CAM in the past? | Yes | No | | |
| 5. Are you currently using CAM? | Yes | No | | |
| 6. If yes, which kind? | Vitamins | Herbal supplements | Acupuncture | Yoga |
| | Meditation/Mindfulness | | | |
| 7. Have you ever used cranberry products to prevent a urinary tract infection (UTI)? | Yes | No | | |
| 8. If so, did you notice a positive result? | Yes | No | | |

*CAM is defined as therapies that are used in conjunction with traditional Western medicine.

Appendix D

Holistic Complementary and Alternative Health Questionnaire

Instructions: Choose the number that reflects your level of agreement with each statement

	Strongly Agree	Agree	Mildly Agree	Mildly Disagree	Disagree	Strongly Disagree
1. Positive thinking can help you fight off a minor illness	1	2	3	4	5	6
2. Complementary medicine should be subject to more scientific testing before it can be accepted by conventional doctors	1	2	3	4	5	6
3. When people are stressed it is important that they are careful about other aspects of their lifestyle (e.g. healthy eating) as their body already has enough to cope with	1	2	3	4	5	6
4. Complementary medicine can be dangerous in that it may prevent people getting proper treatment	1	2	3	4	5	6
5. The symptoms of an illness can be made worse by depression	1	2	3	4	5	6
6. Complementary medicine should only be used as a last resort when conventional medicine has nothing to offer	1	2	3	4	5	6
7. If a person experiences a series of stressful life events they are more likely to become ill	1	2	3	4	5	6
8. It is worthwhile trying complementary medicine before going to the doctor	1	2	3	4	5	6
9. Complementary medicine should not only be used for minor ailments and not for the treatment of more serious illness	1	2	3	4	5	6

10. It is important to find a balance between work and relaxation in order to stay healthy	1	2	3	4	5	6
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11. Complementary medicine builds up the body's own defenses, so leading to a permanent cure	1	2	3	4	5	6
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