Patterns of complementary and alternative medicine (CAM) use among dental patients

Introduction
Complementary and alternative medicine (CAM) is a diverse collection of approaches used to prevent or treat diseases. In the United States, a general population study found that 38.3% of adults reported using CAM therapies in the last 12 months (NHIS, 2008); some to augment conventional medical care and others as a substitute to modern medicine. Other studies of the CAM usage in the general population have reported between 32% and 42% usage (Eisenberg et al., 1990; Landmark Health Care, 1998).

Studies focused on specific patient populations including those with diabetes (Egede, 2002), breast cancer (Wanchai, 2010), fibromyalgia (Terhorst, 2011), chronic fatigue syndrome (Jones, 2007), and chronic hepatitis C report usage estimates that tend to be higher than those in the general population. Rates ranging from 91%, reported in cancer patients (Yates, 2005) and 80% in chronic hepatitis C patients (both studies included prayer), to 69.2% in arthritis patients (Herman, 2004) and 50% in fibromyalgia patients (excluding prayer; Wahner, 2005). Recently, in a clinic setting, 82% usage was reported by dermatology patients (Kalaaji, 2011). This array of reported percentages indicates that rate of CAM can vary widely depending on the patient population and geographic region of interest.

The prevalence of CAM use in dental populations has been studied (Spector et al., 2012); however, the patient demographics that may be associated with CAM usage in dental patients have not been determined. Differences in CAM usage on the basis of sex, age, annual income, and educational status have been found in general population studies as well as specific patient populations (Eisenberg, 1998; Bausell, 2001; Jones, 2007; Ni, 2002). In addition, higher rates of
usage have been reported in patients with chronic diseases (Eisenberg, 1998; Bausell, 2001; Astin, 1998; Egede, 2002). Understanding the patterns of CAM usage in the dental patient population may improve the impact of conventional treatments and prescribed drugs and has the potential to optimize treatment outcomes in dentistry.

The goals of this study were to examine the relationships between dental patient characteristics and current usage of CAM therapies and identify trends of usage across demographic groups of dental patients.

Methods
Using previous national studies as guides (Barnes, 2003; Eisenberg, 1998), data related to utilization of 26 different therapies were gathered by the data collection instrument. However, for the purpose of these analyses, CAM therapies related to prayer – either the use of personal prayer or the prayer of others - were excluded for the purpose of these analyses. The taxonomy of CAM therapies employed by Barnes, 2003 was used in this study to examine usages of different types of therapies. These categories include alternative medical systems, biologically based therapies, manipulative and body based therapies, and mind-body therapies. Details of the study inclusion and exclusion criteria have been previously published (Spector et al., 2012). The study protocol was approved by the Institutional Review Board at The University of Iowa (IRB#200806723).

The statistical analysis consisted of descriptive techniques to summarize and identify trends in CAM use. The standard Chi-Square test of independence was used to assess whether the CAM usage differed significantly by gender. The Cochran-Armitage Trend test was used to test for a trend in CAM usage across levels of income, education, and age. Multivariable logistic
regression was used to estimate odds of CAM usage in the past 12 months based on dental patient characteristics showing strong bivariate relationships with usage. Chi-square residuals were examined to validate the fit of the logistic model and model diagnostics were conducted including examination of lack-of-fit statistics such as the Hosmer-Lemeshow test. Odds ratios and confidence intervals were calculated for CAM usage for each covariate.

A negative binomial model was fit to examine important factors in the count of CAM therapies currently used by each participant, excluding prayer. A Poisson model was initially fit, but after examination of the deviance statistics it was determined that the assumptions of the Poisson model were not valid for these data (p<0.0001). Deviance statistics of the negative binomial model indicated an adequate fit (chi square p=0.3126) and Vuong test (V=1.18, p=0.1172); despite the large number of non-users, the zero-inflated model was indistinguishable from the ordinary negative binomial model. (Hilbe, 2008) The more parsimonious negative binomial model was chosen for this analysis and a total of n=390 subjects had sufficient data to be included in the modeling process. A level of significance of $\alpha=0.05$ was specified.

Results
Demographics
The demographic profile of the 402 respondents is described in Table 1. More than half of the respondents were female (58.1%). Of respondents who recorded an income, nearly 75% earned less than $55,000/year, with 6.4% reporting income of $100,000 or more. Of respondents reporting age, 30.8% were between 18 and 39 years, 27.3% were 40-59 years, 24% were 60-69 years, and 17.9% were 70 or older. Nearly all respondents recorded white or Caucasian race and 64.8% had not earned a college degree

Current CAM Usage
Of the 402 participants, 306 (76.1%) recorded usage of at least one CAM treatment in the past 12 months, with 268 (66.7%) reporting at least one CAM treatment, other than prayer or the prayer of others, in the past 12 months. Table 2 shows the recorded CAM usage in the past 12 months by therapy. The CAM therapy used most commonly by respondents in the past 12 months was chiropractic care (26.1%) followed by megavitamin (26.0%) and non vitamin non herbal (23.9%). Note that each survey can report multiple CAM therapies.

Current Usage by Therapy Category
Biologically based therapies were the most commonly used types of CAM Therapies. Over 45% of participants recorded using at least one of the following in the last 12 months: megavitamin, non-vitamin herbal and non-herbal, chelation or diet based therapy, topical herbal oral or folk medicine.

Over one-third (35.6%) of participants used manipulative and body based therapies, either chiropractic care or massage therapy, in the past 12 months. About 32% of participants reported current use of mind-body therapies such as deep breathing, meditation, yoga, etc.

Alternative medical systems were the least frequently reported type of CAM, with only 7.0% of respondents reporting current use of therapies such as Ayurveda, homeopathic treatment, naturopathy or acupuncture. Personal prayer and/or prayer by others in the last 12 months were reported by 43.8% of respondents.

Bivariate Analysis – CAM use in the past 12 months excluding prayer

Age and CAM Usage
Current usage of CAM therapies excluding prayer (personal and that of others) was highest in the 40-49 year old age group (75.5%) as opposed to 57.7% in the 70 years and older group (Table 3). The Cochran-Armitage test for trend showed a significant decreasing trend (p=0.02)
in current usage excluding prayer across ascending age groups with the higher usage among the younger subjects when compared to subjects in the older age groups.

*Gender and Usage*
Women reported more CAM usage than men with 75.1% of women reporting using at least one CAM therapy other than prayer in the last 12 months (Table 3). For men, only 55.2% reported currently using a CAM therapy other than prayer. This was a significant difference in usage between genders (Chi-square p<0.0001).

*Family Income and Usage*
For current CAM use excluding prayer, the highest usage is among the $100,000+ category (84.0%) as compared to 61.1% usage among respondents making $35,000-54,999/year. There was a significant increasing trend in usage from lower to higher incomes for current CAM usage excluding prayer (Cochran-Armitage p=0.02) (Table 3).

*Education and Usage*
A significant increasing trend in current CAM usage was found across education levels (Cochran-Armitage p=0.0001) with masters, doctorate or professional degree holders recording a usage of 82.9% and bachelors of science degree holders recording a usage of 81.3% compared to 57.7% among high school/GED degree holders and 41.7% among those with less than a high school education (Table 3).

*Number of Therapies Used*
The number of CAM therapies, excluding prayer, currently used ranged from 0 to 13 with an average of about 2 per person (median=1; mean=2.1, st.dev=2.4). (Figure 1)

*Multivariable Analysis*
A multivariable logistic model was fit to examine the relationship of dental patient demographics to current usage of CAM therapies excluding prayer. Family income, education,
age group, and gender were initially included in the model along with all interactions. Interactions were not statistically significant and were not included from the final model. After adjusting for education and gender, neither family income (p=0.38) nor age group (p=0.58) were significantly associated with current CAM usage. The final model included education and gender; adjusted odds ratios for CAM usage are included in Table 4.

Education was a significant factor in current CAM usage (p<0.0001) and the odds of current use of CAM therapies increased in subjects with more education compared to subjects with less education. A significant difference in the odds (p<0.04 for all) occurred in participants with all levels of education including some college or any level of college degree when compared to those with less than a high school degree. The odds of CAM therapy usage for females were over 2.5 times those of males (OR=2.6, 95%CI (1.95, 3.57), p<0.0001).

**Biologically Based Therapies**
The odds of current use of a biologically based CAM therapy were modeled using a multivariable logistic model. Similar to the multivariable modeling of all CAM usage, gender (LR p=0.0057) and education (p=0.0008) were found to be significant factors of current usage of biologically based therapies. The odds of use in females was 1.8 times the odds of use in males for current biologically based CAM therapy (95%CI: (1.18, 2.79), p=0.0062) and participants who had attained higher levels of education had higher odds of biologically based therapy use.

**Manipulative and Body Based Therapies**
Income and gender were significant factors in the current use of manipulative and body based therapies including chiropractic care and massage therapy. The odds of use in females was 1.8 times the odds of use in males for this type of CAM in the last 12 months (p<0.0107).
Participants with the highest level of annual income, $100,000/year or more, had odds of use 3.5 times (95%CI: (1.39, 8.85), p=0.0081) that of subjects with an annual income below $20,000.

Mind-Body Therapies
Age group was a significant factor in the current use of mind-body therapies (LR p=0.0033) with 18-29 year olds with an OR=4.3 (95%CI: (1.73, 10.8), p=0.0018) compared to those 70 years and older. All age groups under 60 years of age were significantly more likely to be users of mind-body therapies (p<0.0120) than the age group including participants 70 years of age and older. Gender (p=0.0345) and education (p<0.0001) were also significant factors of mind-body CAM usage; the odds of use in females was 1.7 times that of males for mind-body therapies (95% CI: (1.03, 2.78), p=0.0364) and those with a master’s degree or higher were 15.4 times as likely (95% CI: (1.67, 141.9), p=0.0157) as those with less than a high school degree to be current users of mind-body therapies.

The usage of alternative medical systems was not sufficiently prevalent to be amenable to a logistic modeling procedure.

Multiple CAM Therapy Usage
A negative binomial count regression model was fit to determine which covariates may be important in the prediction of the number of CAM therapies currently used by dental patients. (Figure 1)

The interaction of age and education was significant in the model (p=0.0058) indicating that the effect of education on the number of CAM therapies used differed significantly by age group. Higher levels of education were positively associated with the number of CAM therapies used in all age categories, however in the older age groups this increase was greater than in younger age groups. (Figure 2)
After adjusting for the interaction of age and education as well as the main effects of age and education, the gender effect was significant with females using on average 1.8 more CAM therapies than males (95% CI: (1.43, 2.29), p<0.0001).

Conclusions
In this study of CAM use in a dental patient population, gender was a significant factor impacting CAM usage, type and number of CAM therapies used throughout this study with a higher percentage of usage and number of therapies used by women when compared to men. Increased levels of education were also a significant influence on usage of any CAM, biological and mind-body therapies. Education had a differing effect on number of CAM therapies by age group with a greater effect on those in older age groups than younger ones. Age was significant only in prediction of mind-body CAM usage and the number of CAM therapies used with younger age groups more likely to use mind-body therapies than persons of older age groups. Although significantly related to CAM usage in bivariate analysis, after adjusting for education and gender, annual family income was only a significant factor in usage of manipulative CAM therapies (chiropractic and massage therapy) where persons with higher income were more likely to use these therapies than persons with less income.

Discussion
CAM usage patterns discovered in national studies were also found in this study of the use of CAM therapies by dental patients including a gender difference and positive relationship with education level and usage (Eisenberg, 1993; 1997; Barnes 2003; 2008; Ni, 2001, Bausell et al., Hyodo, 2005). Previous studies have reported that CAM use was highest in individuals with college education, women, adults aged 35–49 years, and individuals with household incomes greater than $50,000. However, some studies have shown a relationship between higher
income and CAM usage (Barnes 2003; 2008) whereas in this study the effect of income was significant in bivariate analysis, but not significant once the model was adjusted for education and gender.

Rates of usage were found to be higher in a dental patient population than those found in general population studies, however they more closely compare to rates of usage in specific patient populations such as rates found among arthritis patients (Herman, 2004), fibromyalgia patients (Wahner, 2005), and patients seeking care at a dermatology clinic (Kalaaji, 2011). The usage of some alternative medical systems including acupuncture was lower in this study than in previous studies (Barnes, 2003; 2008; Eisenberg, 1998). One explanation for this difference could be that a substantial proportion of this patient population live in rural areas and may not have the level of access to providers of alternative medical systems available to a resident of an urban community.

The strengths of this study include the inclusion of a wide variety of CAM therapies and the taxonomy of therapies (biological, mind-body, etc.) to accurately characterize usage. The use of multivariate statistical methods allow for the control of potential confounding of the relationship between patient characteristics and usage by other covariates as well as an exploration of how multiple factors may interact in their effect on CAM usage. Limitations of this study include the convenience sampling and a relatively homogeneous sample with respect to race and ethnicity. The results are specific to a dental college clinic population and are not readily generalizable to a general population.

For a dental clinician, it is important to understand the demographic characteristics of dental patients that are more likely to be using CAM therapies. Previous studies have evidenced the
interactions of CAM therapies, particularly herbal therapies, with prescription drugs (Izzo and Ernst, 2001; Linde and Melrow, 1996; Lee, Koo, Park, 1987; Duche and Barr, 1998). In addition, studies on CAM use have documented that only one-fourth to one-half of CAM users report their usage to their medical providers. (Astin et al., 2000; Druss and Rosenheck, 2000; Eguchi et al., 2000; Eisenberg et al., 2001; Elder, 1997). Some patients reportedly did not realize the importance of disclosing use to their medical providers, or assumed doctors would ask about use if it were relevant. Others believed that disclosing use of CAM therapies would result in perceived doubt or disrespect of the doctor’s authority. (Astin et al., 2000; Eisenberg et al., 2001). Dental patients may also be hesitant to reveal CAM use to dental providers, however increased patient-provider communication about CAM therapies and their impact on conventional treatments and prescribed drugs has the potential to optimize dental treatment outcomes.