

Complementary and Alternative Medicine (CAM) use in Cancer Patients of Immigration Background

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Abstract

Background: Previous studies have shown that cancer patients are more likely to use complementary and alternative medicine (CAM) than non-cancer patients for immune enhancement and symptom relief. We hypothesized that cancer patients with immigration background may seek out CAM use more readily than the US born patients due to the impact from their cultural background.

Methods: This is a prospective, single institution, questionnaire study on cancer patient for the use of CAM. Correlates of CAM use with age, sex, cancer types, stages, race, birthplace, immigration duration, first language use, marital status, levels of poverty, education and anxiety, were studied.

Results: Among 658 patients, the prevalence of CAM use was 66.11%. CAM use was 71.98% in females and 54.34% in males ($p=1.13 \times 10^{-5}$), 67.09% in patients ≥ 38 years old and 46.88% in patients < 38 years old ($p=0.0215$). Patients of African descent had higher CAM use (72.73%) than the Caucasians and Others (63.53%) ($p=0.0371$). There was no difference of CAM use between the US born (68.77%) and the immigrants (63.98%) as a whole; however, Asian born immigrants had lower CAM use (53.77%) than the US born (66.50%) ($p=0.0161$), while the Latin-American born had a trend towards higher CAM use (74.83%, $P=0.0608$). The number of years living in the US by the immigrants did not have an association with CAM use. Among psychosocial economic factors, married patients had a lower CAM use (61.23%) than the unmarried (70.85%) ($p=0.0102$). The levels of education, poverty and anxiety did not show a statistical difference in relation to CAM use, nor was the difference between the early or late stages of disease. Prayer and spirituality, and Dietary medicine were the two most common CAM subtypes used (25.91% and 16.12%, respectively). African Americans showed the highest rate of using Prayer and spirituality (84.72%) while the Asian Americans had the lowest rate (40.32%).

Conclusions: Among cancer patients of multi-ethnic and immigration background, CAM use was higher in African American patients, and lower in Asian Americans, as compared to the US born, or to Caucasians. Cultural roots appeared to be a strong influencing factor for the selection of CAM.

Introduction

Complementary and alternative medicine (CAM) is defined as “health care approaches that are not typically part of conventional medical care or that may have origins outside of usual Western practice” by the National Center for Complementary and Integrative Health (1). It is referred to as “Complementary” if the non-mainstream approach is used together with conventional medicine, or referred to as “alternative”, if it is used in place of conventional medicine. The CAM use has been increasingly likely to be incorporated into conventional medicine for holistic patient care. According to the 2012 National Health Interview Survey (NHIS), the overall prevalence of complementary health approach was in 34% of the adults (2, 3). In the general public, CAM is most commonly used to treat a variety of musculoskeletal problems, head colds and cholesterol problems (4).

In the 2007 NHIS survey, 65% of respondents with history of diagnosis of cancer had used complementary approaches, comparing to 53% of other respondents (2). Patients with cancer seek out CAM use for different aims. A systemic review cited the following reasons for CAM use: a therapeutic response, wanting control, a strong belief in CAM, CAM as a last resort, and finding hope (5).

CAM use among patients from a variety of ethnic and cultural backgrounds is a topic of study interest, and a large study was carried out using the 1995 National Comparative Survey of minority health care of the commonwealth fund. This study found that the CAM use was prevalent equally among white, African-American, Latino, Asian and Native American populations (6).

Our cancer center is located in the inner city of New York City, and serves a large multi-ethnic immigrant population. Immigrants may face more barriers to accessing conventional health care systems, partly due to lack of familiarity to the system, language barriers, and influence from their home culture background. Immigrants may likely maintain traditional beliefs even after immigrating to the United States and may be more readily incorporate CAM use to conventional western medicine. We hypothesized that the closer a patient is to their original country of origin, measured by years of immigration to US, and the more their country of origin has impediments to “scientific” medicine, such as countries practice non-Western medicine, the more likely they will be using complementary (alternative) medicine. We also hypothesized that the more advanced the stage of cancer, the more likely a patient will try complementary (alternative) medicine.

In this study, we took an approach of prospectively providing surveys to our cancer patients for any use of CAM, its subtypes, and studied the CAM use in association with the patients’ disease type, stage, immigration status, ethnic groups, and socioeconomic status. We focused on dissecting out whether the different ethnic groups they belong to, duration of immigration years, education status, socioeconomic status and advanced disease stage, could be associated with an increased use of CAM.

Methods And Patients

This was a prospective study, and the study protocol was approved by the Maimonides Institutional Research Board (IRB). Patients who were followed up in the Maimonides Medical Center and had a diagnosis of cancer were enrolled after getting a consent, and were provided a brief written survey. The survey included demographic and disease-specific information on date of birth, gender, zip code of their residence, ethnicity, marital status, education level, birth place, first language, years living in the U.S., types of cancer, stage of cancer and anxiety level. The survey also captured information on the use of specific types of CAM (see below). For the uncommonly used CAM subtypes, the research staff would verbally explain to the patient based a written script detailing the explanation. The study initially aimed to collect data from at least 500 patients over a period of 12 months; it was then amended to enroll 700 patients, while the first 666 patients were included in this analysis. The study was started on October 23, 2015 and the cutoff date of enrollment for this analysis was October 31, 2020.

All of the patients' information were entered into a central third-party database system. At the beginning of data analysis, the data was downloaded into a local database for further analysis. An external statistician (YW), who was blinded from patients' protected health information and was not directly involved with data collection, was consulted to perform statistical analysis.

The definition of poverty level

We based a website on 'Percentage of Population below Poverty Threshold, by Neighborhood, 2014-2018' reported by the New York City Government Poverty Measure 2018 (7) for poverty measurement. Poverty is defined as household income level below \$35,044 for a two-adult, two-child family. We identified and correlated the Zip codes of patients' residence with the New York City Poverty map, and coded poverty level to be mild, intermediate and high in zip codes with <20%, 20-25%, >25% families below the poverty level.

CAM types

The selection of the 21 types of CAM was based on literature (7). To facilitate the understanding of CAM types used by patients, the individual CAM types were categorized into biologically-based medicine, energy medicine, manipulative and body-based medicine, mind-body medicine and whole/alternative medical systems (Supplemental Table 1).

Statistical analysis

Data was summarized by descriptive statistics (arithmetic means, medians, standard deviations, frequencies, and percentages). All statistical tests were 2-sided with a significance level of 0.05. To investigate factors possibly associated with CAM use, Fisher's exact test was performed in every category of demographic, socioeconomic, immigration and clinical factors, among each variable in the category, such as patients speaking different first languages in the First Language spoken category. Then we ran the univariate analysis with the inclusion of variables that reached significance in Fisher's exact test. To further explore the possible associations between CAM use and variables significant in univariate analysis, we conducted multivariate analyses; the final covariates included in the multivariate model were age, race, marital status, education status, birth place, first language, number of years living in the US, and cancer types. The multivariate logistic model was built from a two-sided stepwise regression based on the Akaike Information Criterion (AIC). AIC is an estimator of out-of-sample prediction error and thereby relative quality of statistical models for a given set of data. Given a collection of models for the data, AIC estimates the quality of each model, relative to each of the other models. Thus, AIC provides a means for model selection.

Results

1. Patient demographics

We enrolled 666 patients, and 658 patients were included in this analysis, as the other 6 patients had incomplete data. There was a female predominance in the study participants, with 439 (66.72%) to be females, and 219 (33.28%) to be males (Table 1). The median age was 63-year-old with a range between 26 to 100 years old. Most of the participants were over 50 years old, while those younger than 50 years old were only 18.24%.

Table 1
Demographics and Clinical Features of Patient Population

Patient Characteristics	N (%*)
Total Number of Patients	658
Gender	
Male	219 (33.28)
Female	439 (66.72)
Age	
Median (Range)	63 (26-100)
Age ≤ 30	8 (1.22)
Age 31-49	112 (17.02)
Age 50-69	355 (53.95)
Age ≥ 70	183 (27.81)
Cancer Types	
Breast	218 (31.28)
CNS	7 (1)
GI	132 (18.94)
GU	62 (8.9)
GYN	79 (11.33)
Head-Neck	15 (2.15)
Lung	77 (11.05)
Hematological	73 (10.47)
Other	13 (1.87)
Unknown	0 (0)
Multiple Cancer Types	21 (3.01)
Disease Stage	
Stage 0-1	122 (18.54)
Stage 2-3	297 (45.14)
Stage 4	213 (32.37)
Not Applicable	25 (3.8)

Patient Characteristics	N (%*)
Unknown	1 (0.15)
* Percentage calculated with Total Number of Patients as the denominator.	

All cancer types were represented in the participants, the most common to be breast cancer (31.28%), and some patients had multiple types of cancers. There were patients of all disease stages, 122 (18.547%) in stage 0-1, 297 (45.14%) in stage 2-3, and 213 (32.37%) in stage 4 (Table 1).

2. Immigration status and ethnicity:

Of the study population, 301 (45.74%) were US born, the rest were immigrants including 12 (1.82%) from Africa, 62 (9.42%) from Canada or Europe, 106 (16.11%) from East and South Asia, 151 (22.95%) from Latin America and the Caribbean islands, and 22 (3.34%) from Middle-Eastern countries (Table 3). English was the first language in 390 (59.27%) patients, followed by Chinese (n=87, 13.22%), Spanish (n=50, 7.6%) and Russian (n=31, 4.71%) (Table 2).

Table 2
Race and Immigration Background of Patient Population

Patient Characteristics	N (%*)
Total Number of Patients	658
Birth Place	
US Born	301 (45.74)
Non-US Born	353 (53.65)
Africa	12 (1.82)
Canada or Europe	62 (9.42)
East and South Asia	106 (16.11)
Latin America and the Caribbean	151 (22.95)
Middle-Eastern	22 (3.34)
Unknown	4 (0.61)
First Language	
English	390 (59.27)
Arabic	24 (3.65)
Chinese	87 (13.22)
Indian	9 (1.37)
Russian	31 (4.71)
Spanish	50 (7.6)
Multiple	10 (1.52)
Others	56 (8.51)
Unknown	1 (0.15)
Number of Years Living In The US	
US Born	301 (45.74)
Non-US Born	347 (52.74)
< 2 Years	9 (1.37)
2 - <10 Years	38 (5.78)
>= 10 Years	300 (45.59)
Unknown	10 (1.52)

Patient Characteristics	N (%*)
Race	
African	198 (30.09)
Non-US Origin	98 (14.89)
US Origin	100 (15.20)
Asian	113 (17.17)
Chinese	87 (13.22)
Non-Chinese	26 (3.95)
Caucasian	246 (37.39)
Hispanic	80 (12.16)
Non-US Origin	32 (4.86)
US Origin	48 (7.29)
Middle-Eastern	4 (0.61)
Multi-Racial	8 (1.22)
Other	8 (1.22)
Unknown	1 (0.15)
* Percentage calculated with Total Number of Patients as the denominator.	

Table 3	
Social Economic Data of Patient Population	
Patient Characteristics	N (%*)
Total Number of Patients	658
Educational Status	
Grade School or Less	76 (11.55)
Less than Grade School	20 (3.04)
Grade School	56 (8.51)
High School	295 (44.83)
College or Graduate	285 (43.31)
College/University	211 (32.07)
Graduate School	74 (11.25)
Unknown	2 (0.3)
Marital Status	
Married	325 (49.39)
Not Married	319 (48.48)
Divorced	66 (10.03)
Separated	12 (1.82)
Single	175 (26.6)
Widowed	66 (10.03)
Unknown	14 (2.13)
Zip Code (Poverty %)	
Brooklyn	578 (87.84)
< 20% below poverty	225 (34.19)
20% - < 25% below poverty	215 (32.67)
25% - < 30% below poverty	138 (20.97)
Unknown	1 (0.15)
Non-Brooklyn	79 (12.01)
Anxiety Level	

Table 3	
Social Economic Data of Patient Population	
0	2 (0.3)
1-3	401 (60.94)
4-6	126 (19.15)
7-10	121 (18.39)
Unknown	8 (1.22)
* Percentage calculated with Total Number of Patients as the denominator.	

Table 4
Univariate Analysis of Selected Patient Population

Patient Characteristics	All Patients, N (%)*	CAM Users, N (%)**	Univariate p-value
Total Number of Patients	658	435 (66.11)	
Gender			
Male	219 (33.28)	119 (54.34)	1.1322E-05
Female	439 (66.72)	316 (71.98)	Baseline
Age			
< 38	32 (4.86)	15 (46.88)	0.0215
≥ 38	626 (95.14)	420 (67.09)	Baseline
Cancer Types			
Breast and GYN	296 (44.98)	214 (72.3)	0.00252
Not Breast or GYN	362 (55.02)	221 (61.05)	Baseline
Unknown***	0 (0)	0 (0)	
Race			
African, Non-US and US Origin	198 (30.09)	144 (72.73)	0.0371
Asian, Chinese and Non-Chinese	113 (17.17)	62 (54.87)	0.1144
Caucasian and Others	266 (40.43)	169 (63.53)	Baseline
Hispanic, Non-US and US Origin	80 (12.16)	59 (73.75)	0.0928
Unknown***	1 (0.15)	1 (100)	
Birth Place			
US Born and Others	397 (60.33)	264 (66.5)	Baseline
East and South Asia	106 (16.11)	57 (53.77)	0.0161
Latin America and the Caribbean	151 (22.95)	113 (74.83)	0.0608
Unknown***	4 (0.61)	1 (25)	
First Language			
English	511 (77.66)	351 (68.69)	Baseline
Chinese	96 (14.59)	48 (50)	0.000489
Spanish	50 (7.6)	35 (70)	0.84855

Table 4			
Univariate Analysis of Selected Patient Population			
Unknown***	1 (0.15)	1 (100)	
Asian			
Asian, Chinese	87 (13.22)	43 (49.43)	0.04
Asian, Non-Chinese	26 (3.95)	19 (73.08)	Baseline
Hispanic			
Hispanic, Non-US Origin	32 (4.86)	24 (75)	1.00
Hispanic, US Origin	48 (7.29)	35 (72.92)	Baseline
Marital Status			
Married	325 (49.39)	199 (61.23)	0.0102
Non-Married	319 (48.48)	226 (70.85)	Baseline
Unknown***	14 (2.13)	10 (71.43)	
Educational Status			
Graduate School	74 (11.25)	55 (74.32)	0.117
Less Than Graduate School	582 (88.45)	379 (65.12)	Baseline
Unknown***	2 (0.3)	1 (50)	
	658 (100)	435 (66.11)	
* Percentage calculated with Total Number of Patients as the denominator.			
** Percentage calculated with Total Number of Patients for the subgroup at interest.			
*** 'Unknown' values are ignored during univariate analysis.			

Most of the immigrants have lived in the U.S. for more than 10 years (n=300, 45.59%, which was 86.46% of all immigrants), and very few (n=9, 1.37%, or 2.59% among all immigrants) were new immigrants of less than 2 years (Table 2).

Patient self-identified themselves into the following race groups: African (US Origin) (n=100, 15.20%), African (non-US Origin) (n=98, 14.89%), Asian (n=113, 17.17%), Caucasian (n=246, 37.39%), Hispanic (n=80, 12.16%), Middle-East2ern (n=4, 0.61%), multi-racial (n=8, 1.22%) and others (n=8, 1.22%) (Table 2).

3. The social economic status of the patients

The social economic status of the patients is displayed in Table 3. Regards to the education level, most of the patients received high school (44.83%), college or graduate schools (43.31%) education. Only 76 patients (11.55%) received only grade school or less education.

About half of the patients (49.39%) were married, and the other half of the patients had a status of single at the time of survey (n=319, 48.48%), including divorced (n=66, 10.03%), separated (n=12, 1.82%), single (n=175, 26.60%), or widowed (n=66, 10.03%).

A majority (n=578, 87.84%) of the patients lived in the same borough of Brooklyn where the cancer center is, while 79 (12.01%) patients resided in other boroughs. One hundred and thirty-eight (20.97%), 215 (32.67%), and 225 (34.19%) patients lived in regions with high, intermediate and low percentages of families with below poverty.

Patients were asked for their anxiety level on a 1-10 points scale. Most of the patients (n=401, 60.94%) had low level of anxiety (score 1-3), while 126 (19.15%), and 121 (18.39%) patients had intermediate (score 4-6) and high levels (score 7-10) of anxiety, respectively.

4. The difference in CAM use among different categories: demographics and clinical factors

Of the 658 patients, 435 (66.11%) patients used one or more types of CAM. The prevalence of CAM use was higher in females (71.98%) than the males (54.34%) ($p=1.13 \times 10^{-5}$). The age distribution of patients using CAM is illustrated in Figure 1. By treating age as categorical variables to be below 38 years old, and equal or above 38 years old, we found that patients ≥ 38 years old had significantly more CAM use (67.09%) than < 38 years old (46.88%) ($p=0.0215$) (Table 4). By dividing patients in the age groups of 31-49, 50-69 or age ≥ 70 , there was no difference in CAM use (data not shown).

Patients with earlier stages of disease had numerically higher CAM use than those at stage 3-4 (Supplemental Table 1A), and patients with breast and GYN cancers had higher CAM use (72.3%, $p=0.00252$), consistent with the data on the higher CAM use in females (Table 3).

5. The difference in CAM use among different categories: Race/ethnicity and immigration status

CAM use appeared to have differences among different races at initial analysis (supplemental Table S1B). We then grouped them into 4 race groups of (1) African American (US born + non-US born, n= 198, 30.09%), (2) Asian (n=113, 17.17%), (3) Caucasian + others (including Middle-Eastern, Multi-Racial and Others) (n=266, 40.43%), and (4) Hispanics (n=80, 12.16%) (Table 4), and their CAM use rate were 72.73%, 54.87%, 63.53% and 73.75%, respectively. Taking Caucasians and others as baseline (CAM use 63.53%), patients of African Americans had statistically higher CAM use (72.73%) ($p=0.0371$). Asian

patients appeared to have used CAMs less than the Caucasians, and the Hispanics appeared to have used CAMs more than the Caucasians, but the difference in those comparisons did not reach statistical significance. In this comparison, patients in each race category may be US born or non-US born.

In dividing the patients by their birth-place, there was no difference of CAM use between the US born patients (n=301, CAM use 68.77%) and all the immigrants (n=353, CAM use 64.31%) as a whole (Supplement Table S1B). However, Asian born immigrants (n=106) had statistically less CAM use (53.77%) than the US born and others (n=397, CAM use 66.50%) (p=0.0161), while the Latin-American born had a trend towards higher CAM use (n=151, CAM use 74.83%, p=0.0608) (Table 4).

In examining the first language use, we grouped all patients into 3 categories: (1) English and others, (2) Chinese and Indian, and (3) Spanish speaking. The CAM use rate were 68.69%, 50.00% and 70.00%, respectively. Taking English speaking group as baseline, the Chinese speaking patients had statically lower CAM use than the English-speaking patients (p=0.000489); while the difference in CAM use between the Spanish speaking patients and the English-speaking patients was not statistically different (p=0.8485) (Table 4).

In the group of Asian patients by race (n=113) (Table 4), 87 were Chinese, and 26 were non-Chinese. The CAM use was 49.43% in Chinese and 73.08% in non-Chinese respectively (p=4.30E-02), showing the Chinese patients were unlikely to use CAM.

In the group of Hispanic patients (n=80) as shown in Table 4, 48 were of US born, and 32 were of non-US born. The CAM use was similar (72.92% vs 75%) in the two groups, without statistical difference.

The number of years living in the US by the immigrants were studied. The CAM use was compared among US born, versus new immigrants (living in the U.S. less than 2 years), immigrants living in the U.S. for 2-10 years, or more than 10 years, and there was no difference among groups (Supplemental Table S1B).

6. The difference in CAM use among different categories: Socioeconomic status

Married patients had a statistically lower CAM use (n=325, 61.23%) than the non-married (n=319, 70.85%), taken together the single status due to divorce, separation, death of the partner, or true single status (p=0.0102) (Table 4).

The association of level of education with CAM use was examined by initial statistical test of the 5 different levels (less than grade school, grade school, high school, college, graduate school), and there was no statistical difference (supplemental Table S1C). We then consolidated the patients to 2 groups: (1) graduate school, and (2) less than graduate school. The patient group with the highest level of education (graduate school) had a numerically higher rate of CAM use (74.32%) than the rest of the

categories, while each of the other categories had similar CAM use rate, and there was no statistical difference either (Table 4 and Supplemental Table S1C).

The poverty levels of the patients were roughly determined according to the zip code of their residence, linked to the New York City defined percentages of families at poverty levels. Patients residing in areas with 3 different levels of poverty, high, intermediate and low, had similar likelihood of using CAM, and there was no statistical difference (Supplemental Table S1C).

Patients with low, intermediate or high anxiety levels were equally likely to use CAM, and there was no statistical difference among the 3 groups (Supplemental Table S1C).

In the multi-variate analysis, the effect of age, female sex, patients with breast and GYN cancers remained as statistically significant factors to predict higher CAM use (Supplemental Table S2).

7. CAM subtype use analysis

In this analysis, we counted the prevalence of the use of each of the 21 subtypes of CAM, in association with the different race groups, as listed in Supplemental Table S3, Supplemental Figure S1 and in Figure 2. As one patient may use more than one CAM subtypes, the total occurrence of CAM use was 435 (Supplemental Table S3). The most commonly used CAM subtype was “Prayer and Spirituality” (n=281, 64.6%), followed by “Dietary” (n=175, 40.23%), and “Herbal” (n=138, 31.72%). Other subtypes which had more than 5% uses were “Bodywork and Movement Therapy” (n=85, 19.54%), “Meditation” (n=67, 15.4%), “Guided Imagery” (n=63, 14.48%), “Physical Therapy” (n=59, 13.56%), “Relaxation Therapy” (n=46, 10.57%), “Energy Medicine” (n=32, 7.36%), “Massage Therapy” (n=31, 7.13%), Homeopathy (n=23, 5.29%) (Supplemental Table S3, Supplemental Figure S1 and in Figure 2).

Furthermore, about 84.72% of CAM users of African American patients of the combined US and Non-US origin used Prayer and Spirituality (n=122, 84.72%), which was the highest among all the ethnic groups. It was followed by Hispanics (n=42, 71.19%), Caucasians (n=84, 52.50%), and Asians (n=25, 40.32%). Chiropractic therapy was exclusively used by Caucasian CAM users (n=15, 9.38%) (Supplemental Table S3).

Prayer and Spirituality was also the most common CAM subtype among all types used by Asian CAM users (40.32%). Among all patients who used herbal medicine, there was no difference between African American, Hispanics, Caucasians and Asians (Supplemental Table S3 and Figure 2).

Of all the 435 CAM use occurrences, 150 (34.5%) patients used only 1 type, 119 (27.4%) patients used 2 types, 72 (16.6%) patients used 3 types, and 93 (21.4%) patients used equal or more than 4 types of CAM subtypes (Supplemental Table S4 and Supplemental Figure S2).

Discussion

We report here a large study from an inner-city community cancer center that serves a large population of immigrants, the prevalence of CAM use in cancer patients, and its association with patients' demographics, clinical factors, immigration status and ethnicity, as well as social economic status. We have shown here that the CAM use was quite common, in that about 66% of the cancer patients recalled its application. Its use was statistically higher in females than in males, in patients at least 38 years old than younger than 38 years old. Its use is higher in the ethnic group of African Americans, and lower in Asians in comparison to Caucasians. There was no difference among the US born and non-US born as a whole, and there was no association with the years of immigration to US. In terms of the social economic status, married patients had lower use than patients in single status did. Higher poverty level, higher anxiety level, or higher education did not have a correlative association with higher rate of CAM use.

The correlation of CAM use in cancer patients has been the topic of numerous past studies (8–11), however some had under-representation of non-Caucasian patients (9, 10). For example, a large Moffitt Cancer center study had 8.58% Hispanic/Latino patients, while other ethnic groups were not mentioned. Other publications have indicated that there was no relationship between ethnicity and CAM use based a systemic review by (12), and another analysis of the National probability survey of CAM utilizers also did not find a difference in the CAM use rate or different types by different ethnic groups (13).

We formed a hypothesis of this study that higher use of CAM may be found in immigrants due to the cultural influences from their country of birth than the US born patients. This focus on immigration status and ethnicity was tackled by multiple categories in the study, including race/ethnicity by self-report, birthplace, and first language use, all of which will presumably share some degree of overlap. At the foremost, when the category of race or ethnicity was studied, we found statistical significantly higher CAM use in African Americans (statistically significant) and lower CAM use in Asians (numerical, but not statistically significant), in comparison to Caucasians. The Hispanics appeared to have a numerical higher CAM use as well. This notion was supported by the study in birthplace. Asian born immigrants had statistically less CAM use than the US born, while the Latin-American born had a trend towards higher CAM use. In examining the first language use, we again found that Chinese-speaking patients had a statistically lower use of CAM than the English-speaking group. Incorporating the results from the above slightly different angles of study approach, the results were consistent that the African Americans and Hispanics ethnic groups may seek out CAM use more often, and Asians, or particular Chinese speaking Asians, may be less likely to use CAM.

In addition, In the Hispanics ethnic group, between the US born and non-US born individuals, there was no difference in CAM use. Furthermore, the duration of immigration and residence in US did not matter to the patient's believes in CAM use. All the above observations lead to the conclusion that the culture influence is more deeply rooted in the ethnic communities; and particularly in the Hispanic, regardless in the place of birth. Similarly, a study on the Hispanic patients living in the inner-city Los Angeles, CA, showed that the time since immigration does not influence the frequency of their CAM use (14).

By examining the subtypes of CAM use, it is apparent that 84.72% of African Americans CAM users and 71.19% Hispanics CAM users used prayer and spirituality. Our result is consistent with another large study from the NHIS dataset on the patterns of CAM use in African Americans (15), where prayer was the most common CAM used by 60% of the responders. A study based on the 2002 NHIS surgery also showed that the most common CAM was the use of prayer specifically for one's own health (43%) and prayer by others for one's own health (24%) (16). It has been long recognized and highlighted that religiousness and spiritual support is one of the most important coping mechanisms of the diagnosis of cancer (17). On the other hand, spirituality and religion may only play a minor role in their psychological well-being in the Asians, or particularly Chinese, as a larger percentage of Chinese are atheist, and therefore only 40.32% Asians CAM users used "Prayer and Spirituality", the lowest among all ethnic groups.

Contrary to our hypothesis, patients living in the poorest regions in Brooklyn by zip codes did not have higher or lower prevalence of CAM use when compared to the average of the entire patient cohort. It should also be pointed out that all the patients of minority ethnic groups and low socioeconomic groups in this study had governmental or private insurance to attend care in our private community hospital. All patients accepted conventional care with their cancer diagnosis. As suggested by other studies, CAM use can be the only measure of disease control in those who cannot afford conventional care (18); this notion was not covered in our study design. On the other hand, our study also did not find higher CAM use in more educated individuals as others reported (8).

The other interesting finding was the higher CAM use in unmarried versus married patients. Using 2017 NHIS data base and concentrated on the colorectal cancer survivors and CAM use, marital status was one of the predictors studied. Being dividing into 2 categories of "not in a relationship" versus "in a relationship", there was no statistical difference in the CAM use rate (19). Presumably, marriage and living with spouse may provide a more stable foundation in emotional needs, and patients living without a spouse may find higher need for support, or have more time to do so, or feel higher need for self-control. This correlation should require further focused study.

The percentage of cancer patients using CAM in this study (66.11%) was strikingly similar to the report from the 2007 National Health Interview Survey (NHIS) (1), where 65% respondents with history of a cancer diagnosis had used complementary approaches, in contrast to 53% of other respondents (1). Consistent with other reports, female patients were more likely to use CAM (5, 6, 20, 21). However, our study did not suggest a relationship of CAM use in patients with more advanced disease, or higher anxiety level.

Although we were able to detect some statistical difference in the CAM use in association with immigration duration or social economic factors, the difference was quite small. CAM use was universally high, suggesting a very high demand from cancer patients. A difference in the differential use of the various types by different ethnic groups could be due to access, familiarity, and their culture background.

The strength of this study is its large size, inclusion of large proportion of immigrants of various background, and dogmatic analysis of numerous demographics, socioeconomic and clinical factors. The other strength of our study is the analysis on the different CAM types and its association with immigration factor. An association of preferentially used particular CAM types with particular ethnic groups was unveiled.

There are a number of weaknesses in the study. (a) There are overlaps in the definitions of the different CAM types, for example, the category of herbal medicine and Chinese traditional medicine may have a large overlap. (b) The economic status of each patient was inferred by the zip code of their residence with the percentage of families at poverty level, instead of actual household income level. (c) Our study did not specify during which stage of the cancer treatment was CAM utilized. As 70% of patients in early stage, curable disease status (stage 0-3) used CAM just as frequently as patients with incurable metastatic diseases, the goals of using CAM in these situations may be different. (d) The study may have enrolled disproportionately lower percentages of patients who whose first language was non-English, due to the lack of availability in the non-English speaking research staff. (e) There were relatively few new immigrants in this study, lessening the strength of study of the relationship between the immigration duration and CAM use.

Conclusion

Among cancer patients of multi-ethnic groups with immigration background served in a community hospital in Brooklyn, New York, CAM use appeared to be higher in the African American patients, and lower in the patients born in Eastern Asia, as compared to the US born, or to Caucasians. Cultural roots appeared to be a strong influencing factor among all the medical and socioeconomic factors.

Declarations

Ethics approval and consent to participate

The study protocol and patient consent form (2015-08-12-CC) wer approved by the Maimonides Medical Center Institutional Review Board (IRB), and every participant gave written informed consent before enrollment. All methods were performed in accordance with the Declaration of Helsinki.

Consent for publication

Not applicable

Availability of data and materials

All data generated or analyzed during this study are included in this published article and its supplementary information files.

Competing interests

The authors declare that they have no financial and/or nonfinancial competing interests.

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No funding was provided for this project.

Authors' contributions

PS initiated the project

VN, YX supervised the conduction of the project

WC, RH, CL, YM, MO and BV conducted the study survey

YX, AW and YW designed the analysis plan and wrote the main manuscript text

AW prepared the tables and figures

VN prepared the references

AX performed initial analysis of the data, and YW performed statistical analysis

All authors reviewed and approved the manuscript

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Figures

Figure 1. Age Distribution for Patients using CAM

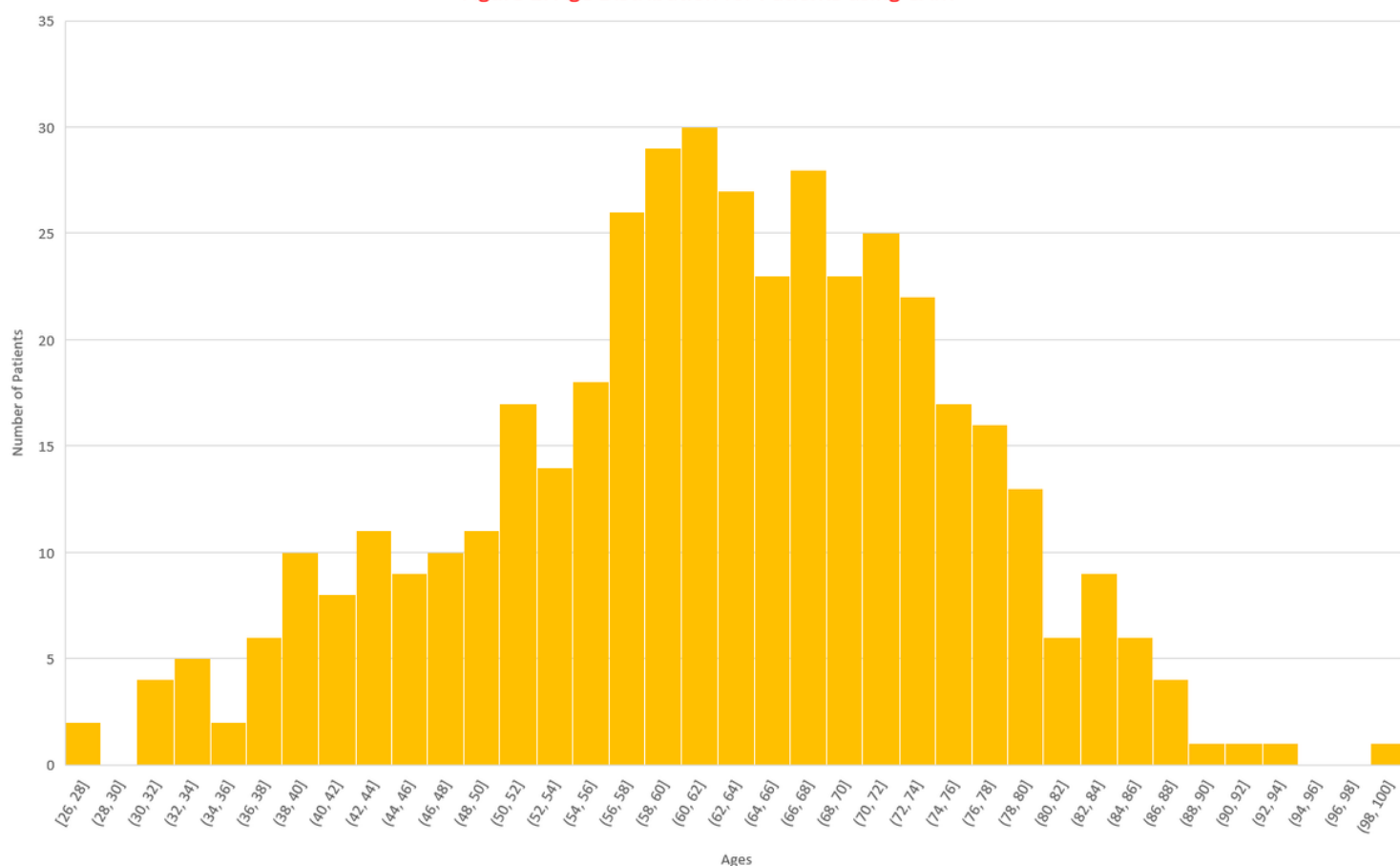


Figure 1

Please See image above for figure legend.

Figure 2. Percentage* of CAM Types Use by Race

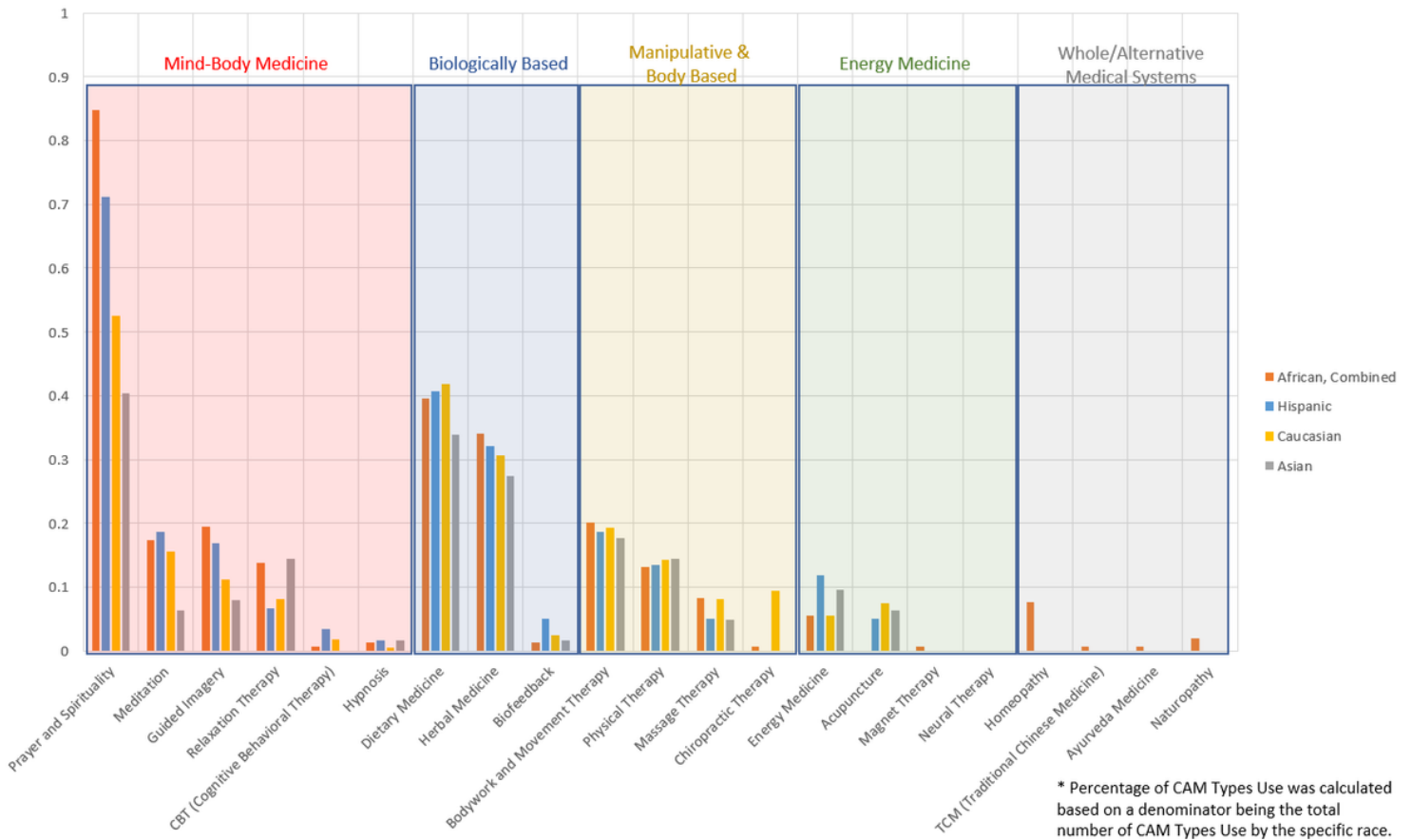


Figure 2

Please See image above for figure legend.

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