Economic Evaluation

Cost of Traditional Herbal Medicines for Noncommunicable Diseases in Rural and Urban Communities in South Africa

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A B S T R A C T

Objectives: This study assessed traditional herbal medicine (THM) and conventional medicine (CM) utilization among participants with noncommunicable disease in South Africa.

Methods: A cross-sectional study of the Prospective Urban and Rural Epidemiological study collected data through face-to-face interviews using structured questionnaires in 2014. Descriptive, bivariate, and multivariate logistic regression were used to determine the effect of sociodemographic and economic factors on THM and CM use. All statistical analyses were conducted using the statistical computing and graphics language "R."

Results: Of the total 417 randomly selected participants in this study, 85% were females, 95% with no health insurance, and 81% with monthly incomes of <2000 rand (R) ($137 equivalent) per month. Moreover, 73% spend <R100 per month (6.85 US dollar conversion) on THM compared with 46% of families spending <R100 on CM last year; 7% spent >5% of their income on THM, and 10% say they are willing to pay >R500 per year on THM to feel better. Age was significantly associated with different spending patterns after controlling for other demographic factors, given that older adults were 82% (odds ratio 0.18; 95% confidence interval 0.02-0.93) less likely to pay >R100 for THM whereas younger adults were 59% (odds ratio 0.41; 95% confidence interval 0.17-0.97) less likely to pay for CM.

Conclusions: The cost of using THM and CM largely differed by age. The economic insight into this study reveals individuals more willing to pay for THM to payors, which can ultimately clue payors into areas for medication optimization from potential drug-drug interactions and adverse events and, therefore, reduce healthcare costs.

Keywords: complementary and alternative medicine, cost analysis, economic evaluation, integrative medicine, noncommunicable diseases, South Africa, Sub-Saharan Africa, willingness to pay.

Introduction

Chronic, noncommunicable diseases (NCDs) have in recent years become a quickly growing public health concern. These diseases represent 60% of deaths worldwide and include diabetes, respiratory diseases, hypertension, and certain cancers, among others.[1] In low- and middle-income countries, the death rate is even higher, and it is expected to continue to rise in the coming years. Factors that led to the increased burden of chronic NCDs in low- and middle-income countries include decreased physical activity, increased consumption of unhealthy food, and tobacco use.[1] Many of these factors are the result of urbanization.[1]

South Africa is one such area in which the burden of chronic NCD is continually growing. Although healthcare workers have focused on controlling and treating communicable diseases such as tuberculosis and human immunodeficiency virus, NCDs have increased substantially and now pose a similar threat.[1] Due to the socioeconomic imbalance in the country, the bulk of those with

uncontrolled chronic NCD are the urban poor.[2] Treating chronic NCDs is not a simple task. Many with these diseases depend on not only western medicine but also traditional herbal medicine (THM). Both socioeconomic factors and cultural norms and practices account for this reliance on 2 distinct types of medication. Western medicine is usually considered very expensive, and modern healthcare practitioners are few and far between. In contrast, THM is not only more accessible and affordable, but generally accepted as effective in South African communities and other settings.[2,3]

Internationally, THM has largely replaced conventional medicines (CMs) for the treatments of fever, joint pain, urinary tract infection, cancer, diabetes, and other disease conditions in rural areas of Nepal.[4] In another developing country, Ghana, factors such as perceived effectiveness, personal preference, perceived ineffectiveness of western medicine, and integration of spirituality in herbal medicine facilitate THM use, whereas a lack of credible vendors and cost of herbal products increase negative perceptions of THM in Ghana,[5]

Table 1. THM use by demographic and clinical characteristics.

Characteristics	All NCDs (N = 417)	THM use	
		Yes	No
Sex			
Male	64 (15.3)	51 (79.7)	13 (20.3)
Female	353 (84.7)	261 (73.9)	92 (26.1)
Age, years			
30-49	92 (22.1)	71 (77.2)	21 (22.8)
50-69	266 (63.9)	196 (73.7)	70 (26.3)
70-89	58 (13.9)	45 (77.6)	13 (22.4)
Marital status			
Never married	162 (39.5)	138 (85.2)	24 (14.8)
Married/cohabitating	128 (32.2)	84 (65.6)	44 (34.4)
Widowed/divorce/separated	120 (29.3)	84 (70.0)	36 (30.0)
Education level			
None or primary	153 (37.0)	100 (65.4)	53 (34.6)
Secondary	229 (55.4)	185 (80.8)	44 (19.2)
Tertiary	31 (7.5)	23 (74.2)	8 (25.8)
Employment status			
Employed	57 (14.3)	42 (73.7)	15 (26.3)
Unemployed	201 (50.4)	107 (75.9)	34 (24.1)
Retired	141 (35.3)	148 (26.4)	53 (73.6)
Religion			
Christian	395 (96.3)		
Other	15 (3.7)		
Monthly household income			
<R2000 PM	338 (81.3)		
R2000-R5000 PM	67 (16.1)		
R5000-R10 000 PM	11 (2.6)		
Health insurance			
Yes	18 (4.5)		
No	381 (95.5)		
Smoking history			
Current smoker	72 (18.0)		
Never smoked	291 (72.9)		
Past smoker	25 (6.3)		
Casual smoker	11 (2.8)		
Alcohol history			
Current drinker	73 (18.3)		
Never drank	253 (63.6)		
Past drinker	33 (8.3)		
Casual drinker	39 (9.8)		
General health			
Excellent	14 (3.5)		
Very good	43 (10.8)		
Good	162 (40.5)		
Fair	104 (26.0)		
Poor	77 (19.3)		
Health compared with last year			
About the same	89 (21.9)		
Better	233 (57.4)		
High blood pressure			
Yes	319 (79.4)	245 (76.8)	74 (23.2)
No	83 (20.6)	65 (78.3)	18 (21.7)
Diabetes			
Yes	105 (28.8)	85 (81.0)	20 (19.0)
No	260 (71.2)	217 (83.5)	43 (16.5)
Rheumatoid arthritis			
Yes	72 (19.1)	61 (84.7)	11 (15.3)
No	305 (80.9)	245 (80.3)	60 (19.7)

Table 1. Continued

Characteristics	All NCDs (N = 417)	THM use	
		Yes	No
Cancer			
Yes	8 (2.1)	5 (62.5)	3 (37.5)
No	366 (97.9)	299 (81.7)	67 (18.3)
Cardiovascular disease			
Yes	10 (2.7)	6 (60.0)	4 (40.0)
No	362 (97.3)	297 (82.0)	65 (18.0)
Heart diseases			
Yes	12 (3.2)	10 (83.3)	2 (16.7)
No	361 (96.8)	293 (81.2)	68 (18.8)
Stroke			
Yes	8 (2.2)	8 (100.0)	0 (0.0)
No	363 (97.8)	295 (81.3)	68 (18.7)
Depression			
Yes	19 (5.1)	17 (89.5)	2 (10.5)
No	352 (94.9)	286 (81.2)	66 (18.8)
Hypercholesteremia			
Yes	12 (3.2)	12 (100.0)	0 (0.0)
No	359 (96.8)	291 (81.1)	68 (18.9)
Asthma			
Yes	18 (4.9)	17 (94.4)	1 (5.6)
No	353 (95.1)	286 (81.0)	67 (19.0)
CM use for chronic condition			
Yes	378 (90.9)		
No	38 (9.1)		
Length of CM use			
<3 months	99 (25.6)		
3-6 months	29 (7.5)		
6 months to 1 year	11 (2.8)		
>1 year	15 (3.9)		
Several years	219 (56.7)		
Unsure	13 (3.4)		
Frequency of HCP consult			
Never	109 (28.0)		
Rarely	65 (16.7)		
Sometimes	146 (37.5)		

Note. Values are presented as number (%).
CM indicates conventional medicine; HCP, healthcare provider; NCD, noncommunicable disease; PM, per month; R, rand; THM, traditional herbal medicine.

whereas in South Korea, a developed country, issues with adverse events are perceived as more of a problem in a largely younger and female population that regularly uses THM.[6] Therefore, THM type and practices can vary because of socioeconomic status, cultural differences, availability of health insurance, and national health policies.[7] South Africa is largely diverse both culturally and socioeconomically and therefore also vary in THM practices.

Several studies have looked into various aspects of both chronic NCD and THM, both separately and together. Nevertheless, although much has been studied about the prevalence of both topics and the correlation between them, very little has been studied about their pharmacoeconomic impact. It was discovered overall that most of these studies explored the prevalence and reasons behind THM use for NCD. The majority of research in these studies took place in Sub-Saharan Africa, in both urban and rural locations. Of the 5 studies, one focused on how THM usage would affect the possibility of creating universal health coverage but did not otherwise delve into any pharmacoeconomic research.[3]

Another study explored the reasons that participants choose herbal medications for chronic diseases and interviewed herbal practitioners on why the community depends on them, finding that it largely had to do with cost.[8] Ndhlala et al[9] (2011) identified several different types of herbals and determined their effect on economic trade. This study concluded that South Africa could establish itself as a pharmaceutical leader in herbal resources.[9] The last study was a systematic review that analyzed research in THM across Sub-Saharan Africa for prevalence, timing, effects, and reasons for THM use.[10] These studies, although similar in both methods and focus on THM used for NCD, differed from this present research because none focused specifically on the pharmacoeconomic impact of THM use in this setting.

Based on these findings, it was determined that research focused on the cost and utilization of THM use for NCDs is highly needed. Using a sample of participants from the Prospective Urban and Rural Epidemiological (PURE) study in South Africa, demographic and economic data were drawn.

Table 2. Overall THM utilization.

THM utilization	All NCDs (417)
THM use	312 (74.8)
Length of THM use	
<3 months	88 (28.1)
3-6 months	202 (64.5)
6 months to 1 year	2 (0.6)
>1 year	3 (1.0)
Several years	11 (3.8)
Unsure	6 (1.9)
THM use influences	
Friends	32 (29.9)
Partner	14 (13.1)
Family/relatives	44 (41.1)
Self	6 (5.6)
THP	6 (5.6)
Advertisement	3 (2.8)
Healthcare providers	2 (1.9)
Reason for THM use	
Family history	
Yes	47 (42.7)
Cultural beliefs	
Yes	33 (30.0)
Low cost	
Yes	20 (18.2)
Accessibility	
Yes	16 (14.7)
Positive recommendation	
Yes	23 (21.5)
Failure of CM	
Yes	1 (0.9)
Curing disease	
Yes	8 (7.4)
Treating side effects	
Yes	3 (2.8)
Delay in medical care	
Yes	2 (1.9)
Recommendation by HCP	
Yes	13 (11.6)
Treat condition	
Yes	37 (33.9)
Manage condition	
Yes	10 (10.2)
Use of THM in combination with CM	44 (51.2)
Use of THP	27 (31.0)
Inform HCP of THM use	15 (18.5)
Disclosure of CM use to THP	19 (20.9)
HCP enquires about their THM use	27 (22.1)

Note. Values are presented as number (%).
CM indicates conventional medicine; HCP, healthcare provider; NCD, noncommunicable disease; THM, traditional herbal medicine; THP, traditional health practitioner.

Methods

Study Design and Research Plan

The comprehensive methodology used for this study has previously been published.[2] Briefly, this cross-sectional descriptive study performed economic analyses on THM use as an extension of the PURE study in South Africa. The PURE study is a population-based cohort study enrolling 150 000 adults from 17 low-, middle-, and high-income countries globally. The primary aim of the PURE study is to examine the relationship among societal influences, the prevalence of risk factors, incidence of chronic NCD, and changes in risk factor rates in the population over time. Data on baseline demographic characteristics, clinical-medical history, socioeconomic status, and lifestyle behaviors were collected[11] from interviews with the participants. Using the preexisting PURE study questionnaire, we obtained additional information at the individual, household, and community level on the expenditure and utilization of THM for chronic NCD.

Study Setting and Sampling

The current investigation was conducted in an urban black South African township, Langa, located in Cape Town in the Western Cape Province.

The sampling frame for the current study included 1030 participants who were recruited from the urban township in the original South African PURE study. An administrative spreadsheet used to capture participants' information throughout the PURE follow-up period will be used to randomly select a sample of 417 participants from the urban site. To facilitate the data collection process, their names, contact details, and residential addresses were noted.

Data Collection

Previous appointments were made with participants on the PURE data base to collect data on the epidemiology of THM use for chronic conditions. All the data were collected between October 2013 and August 2014 by using preexisting PURE study structured questionnaires. The face-to-face interviews were conducted by trained data collectors in the preferred language of the respondent (English or Xhosa). Respondents' demographic characteristics' (age, sex, education, marital and employment status), clinical/medical history, and THM usage (duration of use, condition for use, dosage, and form) were recorded.

Additional information at the individual, household, and community level on the expenditure and utilization of THM for chronic NCD were also collected. The additional economic questions have been reported in our concept article.[2] The questions included are as follows:

1. How much do you spend (South African rand [R], ZAR) on herbal remedies monthly/yearly?
2. How much did you/your family pay (ZAR) for herbal remedies last year?
3. What percent of your income/family income have you spent on herbal remedies last year/last month?
4. How much are you willing to pay (ZAR) for herbal remedies to feel better?
5. How much are you/your family member willing to pay (ZAR) for herbal remedies per year?

An economic evaluation was conducted to assess how family structure, socioeconomic status, and healthcare utilization are influenced by THM use. The "willingness to pay" method was used to measure cost-benefit analysis and to determine how much they are willing to pay for THM for perceived improvements in health.

The quality of data collected is maintained by using standardized protocols and centralized training. The Senate Research Ethics Committee of the University of the Western Cape, South Africa, approved the study protocol.
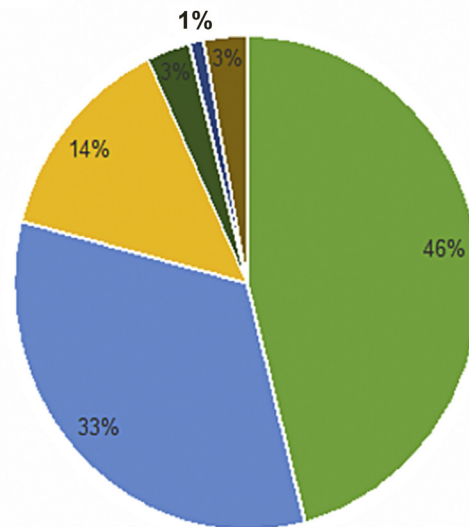
Statistical Methods

For this descriptive study, we present frequencies and percent along with cross tabulation tables and Fisher's exact

Figure 1. Economics of THM usage. (A) This graph depicts the breakdown of participant responses to the question, "How much did you/your family pay (in R) for herbal remedies last year?" Approximately 56% of participants spend <R100 per year, whereas 2.6% spend >R1000 each year on THM. (B) The graph shows the breakdown of participant responses to the question, "How much did you/your family pay (in R) for conventional medicine last year?" Notably, 46% of participants spent <R100 each year on CM, followed by 33% of participants who spent R200 to R250. (C) The graph reveals the breakdown of participant responses to the question, "How much have you/your family spent (in R) on both herbal and conventional medicine in the last year?" Notably, 39% of participants reported spending between R751 and R1000, followed by 26% who report <R100 in spending of CM and THM in the last year.
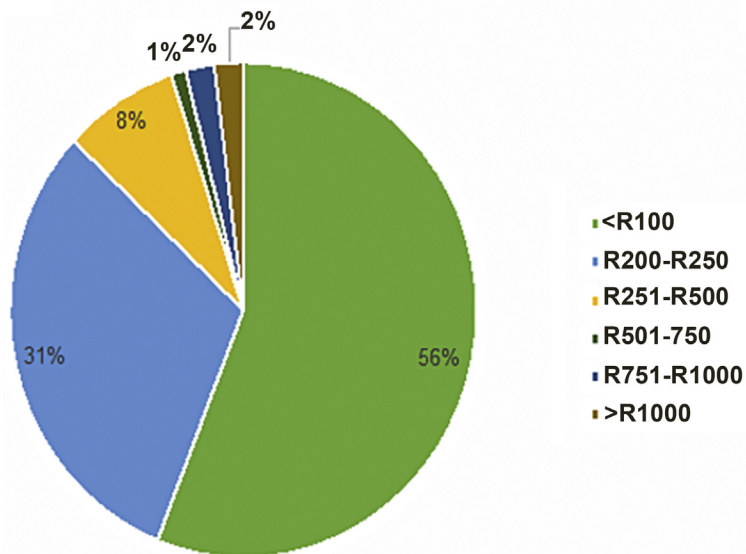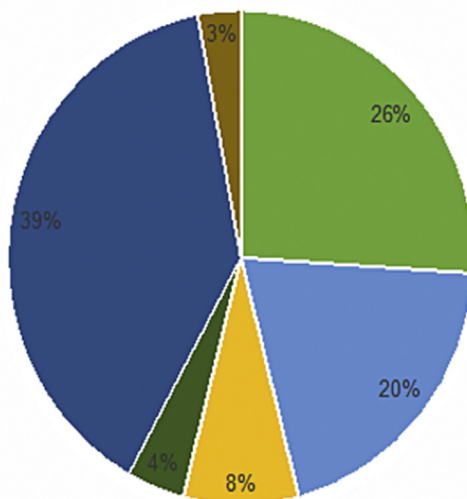

CM indicates conventional medicine; R, rand; THM, traditional herbal medicine.

tests to investigate statistical significance. Costs are reported in descriptive statistics. We also used bivariate logistic regression to examine simple relationships and calculated odds ratios (ORs) and 95% confidence intervals (CIs). In addition, multivariable logistic regression was used to examine the social and demographic impact on costs and utilization. All bivariate and multivariable analyses used list-wise deletion to address missing data. All statistical analyses were conducted using the statistical computing and graphics language "R."

Results

Notably, 85% of these 417 participants with NCD were female, 64% were middle aged (ages 50-69 years), and 32% were married or cohabitating (Table 1). More than 33% had only primary education or no education, only 14% were employed, and 81% had monthly incomes <R2000 per month. Greater than 50% of participants rated their health status as "good to excellent," 73% reported that they never smoked, and 64% reported that they

Table 3. Annual family herbal medicine spend by sociodemographic characteristics.

How much did you/your family pay (in rands) for medicine last year?	THM		CM	
	<100 rand	≥100 rand	<100 rand	≥100 rand
Sex				
Male	9 (64.3)	5 (35.7)	9 (40.9)	13 (59.1)
Female	55 (54.5)	46 (45.5)	57 (46.7)	65 (53.3)
Age, years				
30-49	17 (65.4)	9 (34.6)	21 (61.8)	13 (38.2)
50-69	37 (48.7)	39 (51.3)	35 (38.9)	55 (61.1)
70-89	10 (76.9)	3 (23.1)	10 (50.0)	10 (50.0)
Education				
None/primary	24 (50.0)	24 (50.0)	27 (44.3)	34 (57.0)
Secondary	34 (60.7)	22 (39.3)	31 (44.9)	38 (55.1)
Tertiary	6 (54.5)	5 (45.5)	7 (53.8)	6 (46.2)
Employment				
Retired	17 (54.8)	14 (45.2)	13 (50.0)	13 (50.0)
Unemployed	35 (62.5)	21 (37.5)	18 (40.9)	26 (59.1)
Employed	10 (45.5)	12 (54.5)	31 (47.7)	34 (52.3)
Marital status				
Never married	22 (61.1)	14 (38.9)	15 (32.6)	31 (67.4)
Divorced/widowed/separated	21 (58.3)	15 (41.7)	26 (55.3)	21 (44.7)
Married/cohabiting	18 (45.0)	22 (55.0)	23 (46.9)	26 (53.1)

Note. Values are presented as number (%).
CM indicates conventional medicine; THM, traditional herbal medicine.

never drank alcohol. Moreover, 21% reported their health had gotten worse than last year, and >95% had no form of health insurance.

Hypertension was the most common chronic disease among these participants (79%), followed by diabetes (29%) and rheumatoid arthritis (19%) (Table 2). Notably, 91% of the participants used CM to treat their chronic condition and more than half (57%) reported using these medicines for several years. Participants who reported being diagnosed of any of these 3 most prevalent NCD were about as likely to use THM as those not diagnosed (Table 1). The prevalence of THM use for the most prevalent chronic disease ranged from 77% (hypertension) to 85% (rheumatoid arthritis) (Table 1).

Approximately 75% of the participants used THM, and most (93%) reported using them for less than 6 months (Table 2). Family and relatives were most likely to influence THM use (41%), followed by friends (30%) and partners (13%). Family history (43%), the belief that THM was appropriate to treat health conditions (34%), cultural beliefs (30%), positive recommendations (22%), and low cost (18%) were the most reported reasons for participants' use of THM. More than half of the participants (51%) reported using THM in combination with CMs, yet only 19% told their healthcare provider (HCP) that they were using THM and only 21% told their traditional health practitioner that they were using CMs.

Approximately 80% of male participants (51 of 64) were THM users and 74% of females participants (261 of 353) were THM users (Table 1). The middle aged (ages 50-69 years) were slightly less likely (74% reported using THM) to use THM than younger adults (ages 30-49 years) and older adults (ages 70-89 years). Those with secondary education were more likely to use THM than those with tertiary educations (74%) and primary or no education (65%). The retired (76%) and employed (74%) were much more likely to use THM than the unemployed (26%), and those who were never married (85%) were more likely to use THM than those who were married, divorced, or widowed.

The economics of THM are presented in Figure 1 and Table 3. Figure 1A shows the annual breakdown of familial spending on THM, whereas Figure 1B shows the annual breakdown of familial spending on CM. Figure 1C shows the costs of herbal and conventional medications in the last year. Notably, 73% of participants spend <R100 per month on herbal remedies and another 17% spend <R250 per month (Table 3). Moreover, 56% of families were reported as spending <R100 per year on herbal remedies, and an additional 31% spent <R250 per year. In comparison, 46% of families were reported as spending <R100 on CM last year, and another 33% reported spending <R250; 7% spent >5% of their income on herbal remedies, and 10% say they are willing to pay >R500 per year on herbal remedies to feel better.

Female participants were likely to report paying >R100 for herbal remedies compared with male participants (45% vs 36%) (Table 3). The youngest age group reported higher amounts than the oldest (35% vs 23%), although the middle age group reported paying >R100 most often (51%). Those with only primary or no education paid >R100 most often than more educated groups, the employed paid more than the unemployed, and the married paid more than the unmarried. Differences exist when asking this question about one's willingness to pay for CMs. Males are more likely to report paying >R100, the oldest ages report higher amounts than the youngest, and the unemployed report high amounts than the employed (Table 3). None of these bivariate relationships were statistically significant at the 95% confidence level using Fisher's exact tests.

We also regressed social and demographic variables (sex, age, education, employment status, and marital status) on the probability of paying >R100 per year on (1) THMs and (2) CMs (Table 4). The multivariable model in Table 4 shows that the oldest age group (ages 70-89 years) were significantly less likely to pay >R100 per year on THM than the middle age group (ages 50-69 years) controlling for sex, education, employment status, and marital status (OR 0.18; 95% CI 0.02-0.93). In comparison, the multivariable model in Table 4 shows that the young age group

Table 4. Logistic regression results of sociodemographic characteristics' influence on annual THM and CM spending (>100 rand spent for herbal remedies last year).

Variables	Characteristics	THM		CM	
		Bivariate results	Multivariable results	Bivariate results	Multivariable results
Sex	Male	0.91 (0.69-1.20)	0.57 (0.14-2.13)	1.06 (0.84-1.33)	1.23 (0.43-3.75)
	Female	—	—	—	—
Age, years	30-49	0.85 (0.68-1.05)	0.57 (0.20-1.52)	0.80 (0.65-0.97)*	0.41 (0.17-0.97)*
	50-69	—	—	0.89 (0.70-1.14)	0.53 (0.15-1.81)
	70-89	0.75 (0.56-1.01)	0.18 (0.02-0.93)*	—	—
Education	None/primary	—	—	0.99 (0.84-1.18)	1.29 (0.61-2.75)
	Secondary	0.90 (0.74-1.09)	0.87 (0.37-2.03)	0.91 (0.67-1.23)	1.26 (0.31-5.17)
	Tertiary	0.96 (0.69-1.33)	1.25 (0.26-6.26)	—	—
Employment	Retired	0.91 (0.69-1.19)	1.05 (0.28-4.03)	1.10 (0.86-1.40)	1.53 (0.48-5.16)
	Unemployed	0.84 (0.66-1.08)	0.45 (0.14-1.42)	1.02 (0.81-1.29)	1.43(0.49-4.21)
	Employed	—	—	—	—
Marital status	Never married	0.85 (0.68-1.07)	0.70 (0.25-1.94)	0.80 (0.65-0.97)	0.52 (0.20-1.34)
	Divorced/widowed/separated	0.88 (0.70-1.10)	0.61 (0.21-1.72)	0.87 (0.71-1.06)	0.72 (0.28-1.84)
	Married/cohabiting	—	—	—	—

Note. Values are presented as odds ratio (95% confidence interval).
CM indicates conventional medicine; THM, traditional herbal medicine.
*Odds ratio was significant at 95% confidence level

(ages 30-49 years) are significantly less likely to pay >R100 per year for CMs controlling for sex, education, employment status, and marital status (OR 0.41; 95% CI 0.17-0.97).

Discussion

Most of our general survey participants were female; aged 50 to 69 years; had chronic NCDs such as hypertension, diabetes, and rheumatoid arthritis; were unemployed with a monthly household income of R2000; had little to no medical aid; and graduated from high school. These findings are not surprising because socioeconomic status and aging can contribute to a higher prevalence of chronic NCDs.[11,12] It is interesting to also note that most participants have never smoked or drank alcohol and reported generally good or excellent health status despite a large portion of respondents who had multiple comorbidities. This information was used to further establish the prevalence and usage of THM in the area to create a much more detailed and useful picture for further evaluation of comparative usage patterns.
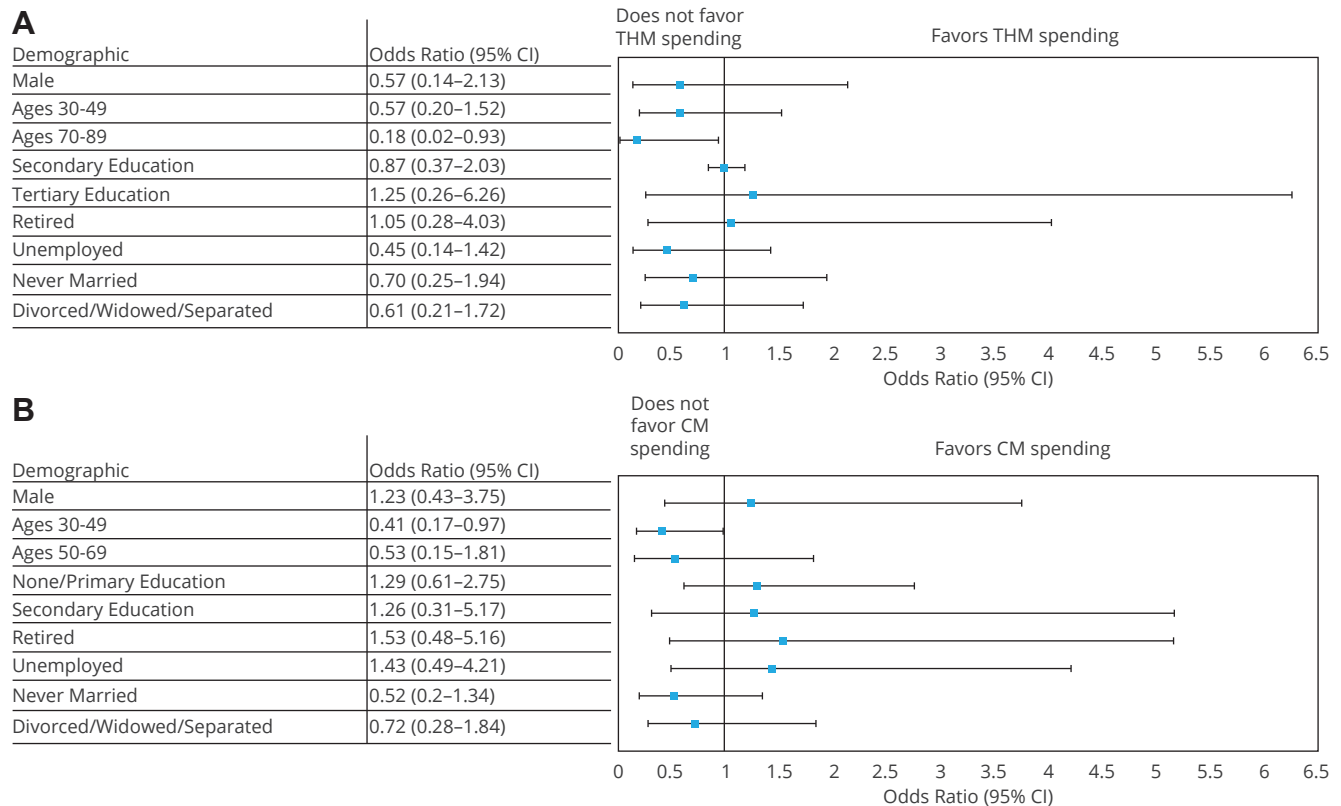
Characteristics associated with more THM usage include males, ages 70 to 89 years, secondary education, retirement, and never been married. The chronic disease conditions associated with higher THM utilization include high blood pressure, rheumatoid arthritis, cardiovascular disease, heart disease, and stroke. THM utilization in chronic diseases is common worldwide, but surprisingly, our study shows a higher prevalence of THM use in older age than studies in South Korea, Thailand, Taiwan, and Nigeria where younger individuals are more likely to use THM.[6,13-16] THM type and practices can vary because of socioeconomic status, cultural differences, availability of health insurance, and national health policies, and South Africa has one of the most diverse populations both culturally and economically.[7] Moreover, these studies focused on THM use in particular disease states, whereas our study explores THM use in the township, an urban area in South African. A similar study using the PURE data in an urban area of South Africa has found similar trends of THM use in chronic conditions but found age, sex, education, and marital status to be insignificant predictors of THM use.[1] This may be due to differences in the study population. A preliminary study focused on hypertensive patients using the PURE survey data found age, marital, and employment status to be significant factors associated with THM use.[17] Similarly, a systematic review of hypertensive patients in Sub-Saharan Africa report findings that correspond to our findings, as males and increasing age were significantly associated with a higher THM use.[10] Both of these studies align with our findings, possibly because hypertension and THM use in hypertension are prevalent in our study population as well. Family history, cultural beliefs, and low cost were reported reasons for THM use, which is also similar to other findings.[1,7,10,14,17,18]

Despite that nearly 75% of the participants used THM, >90% of the participants have overwhelmingly been using CMs for their chronic conditions for several years. This shows that most participants concomitantly use THM and CM to treat disease conditions. More than half report using THM in combination with CM, and very few disclose their use of THM to HCP. This is concerning because of the possible drug-drug and drug-disease interactions that could occur without proper provider prescribing and supervision.[19-21] These findings highlight a need for disclosure of THM use and practice to HCPs and to possibly engage more HCPs in assessing comprehensive THM use when identifying and evaluating medication history especially considering the large percent of users in South Africa.

Given that cost was cited as a reason for THM use, we further evaluated the economic factors associated with THM use in certain

Figure 2. Multivariate analysis of sociodemographic characteristics' influence on annual THM and CM spending forest plot. (A) This represents a forest plot showing the odds ratio and corresponding confidence intervals of THM spending between different demographics of interest. Older patients (ages 70-89 years) were the only significant demographic factor that had an 82% reduced likelihood of spending >100R on THM. (B) This is a forest plot showing the odds ratio and corresponding confidence intervals for CM spending. The only demographic factor that was significant for CM spending was ages 30 to 49 years, given that ages 30 to 49 years were 59% less likely to spend on CM.

A

Demographic	Odds Ratio (95% CI)
Male	0.57 (0.14–2.13)
Ages 30-49	0.57 (0.20–1.52)
Ages 70-89	0.18 (0.02–0.93)
Secondary Education	0.87 (0.37–2.03)
Tertiary Education	1.25 (0.26–6.26)
Retired	1.05 (0.28–4.03)
Unemployed	0.45 (0.14–1.42)
Never Married	0.70 (0.25–1.94)
Divorced/Widowed/Separated	0.61 (0.21–1.72)

B

Demographic	Odds Ratio (95% CI)
Male	1.23 (0.43–3.75)
Ages 30-49	0.41 (0.17–0.97)
Ages 50-69	0.53 (0.15–1.81)
None/Primary Education	1.29 (0.61–2.75)
Secondary Education	1.26 (0.31–5.17)
Retired	1.53 (0.48–5.16)
Unemployed	1.43 (0.49–4.21)
Never Married	0.52 (0.2–1.34)
Divorced/Widowed/Separated	0.72 (0.28–1.84)

CI indicates confidence interval; CM, conventional medicine; R, rand; THM, traditional herbal medicine.

populations and found a striking, although not wholly unsurprising, pattern.[5,8,9] Most participants do not seem willing to invest very much money into THM or medication at all, which is similar to previous studies.[5] The large majority of participants in the study stated that they spend little to nothing on THM each month. Given that most participants in this study were poor and without medical aid, this may explain why they would ultimately not be willing to part with much of their income for medications.

We further broke down our economic data based on participant demographics and how they spent their money on THM on a monthly and yearly basis (Tables 3 and 4). Participants who spent <R100 on THM yearly were elderly, had a high school level education, were retired, and never married. This is reasonable, considering that these particular populations have lower or no income or medical aid compared with other populations. Although there was no difference in males and females that spent <R100 on THM, females were more likely to estimate that they spent ≥R100 on herbal remedies monthly. In contrast, participants who spent ≥R100 were more likely to be highly educated, employed, and divorced, widowed, or separated. This accounted for both spending in the last year and money spent monthly. Participants who were married also spent ≥R100 on THM monthly. Nevertheless, trends in this area differed based on age. Middle-aged participants (age 50-69 years) were more likely to have spent ≥R100 on THM in the past year, whereas younger

participants (age 30-49 years) estimated that they spent more money monthly. This may be due to different spending habits and annual income between older and younger participants, because this trend was opposite for CM spending (Table 4). Even when controlling for all other demographic factors, age seems to be independently and significantly associated with THM spending, because younger individuals were more likely to spend money on THM than older individuals (Fig. 2A, B). This may be due to the larger percent of comorbidities and severe illness seen in the older population, higher income in the younger population, and more willingness to pay for CMs in the older population, because other studies have shown that perception and insights of herbal medicine differ by age. Although the older population believes promoting health and mild to moderate disease were appropriate uses for THM, younger individuals think less of preventive medication and THM to treat an illness.[5,13,18,21-24] This is comparable with our findings that show our survey participants prefer THM to treat health conditions followed by cultural beliefs and may explain why we see subsequent spending differences and economic burden based on age.

There were some limitations to this study. First, our data are limited to the participants that were surveyed, which was in a predominantly urban area of a township. Second, our data were confined to the year 2014, and perceptions and economic costs may have changed throughout the years. Third, the study design

makes it difficult to pinpoint causality and associations. Finally, the validity of our findings may be subjective, depending on the participants' ability to recall accurate information with respect to their THM use. Therefore, we asked for both monthly and yearly spending habits to help remediate this.

Conclusions

THM use is prevalent in South Africa in combination with CMs with family history, belief about the appropriateness of use, cultural beliefs, and costs as the most cited reasons for use. This is accompanied by a lack of disclosure to traditional health practitioners and HCPs, which may exacerbate issues in the continuity of care, increase adverse events and toxicity through drug-drug and drug-disease interactions, and promote morbidity and mortality. Future studies will focus on whether THM use is associated with a lack of care continuity and increased drug toxicity-related outcomes in South Africa. In South Africa, there seems to be an interesting trend of males, older adults (age 70-89 years), secondary education, single, and employed using THM, and economic cost-benefit analysis seems to be a huge contributor because many especially older adults are unwilling to use large portions of their income on THM. Seemingly, older individuals are more likely to spend money on CMs, whereas younger individuals are willing to spend more on THM, a difference that may be due to perceptions on THM use and purpose. This study provides novel insight into health disparities seen in THM use in South Africa with a focus on economic perspectives and willingness to pay. This information can be used by policy makers to recognize gaps in education and understanding of THM and provide educational interventions for at-risk populations more likely to use THM and CMs together. Even though this study did not focus on adverse outcomes, it is of important public health interest to make HCPs aware of patients' THM use and the clinical significance of THM-drug and THM-disease interactions. Such awareness can urge providers to ask about THM utilization with their patients, encourage honest and culturally appropriate discussions about THM, and emphasize the proper use of THM. Finally, the economic insight into this study reveals THM costs, true cost-benefit analysis of THM, and individuals more willing to pay for THM to payors, which can ultimately clue payors into areas of improvement for medication optimization and, therefore, reduce healthcare costs.

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