



# The effects of utility evaluations, biomedical knowledge and modernization on intention to exclusively use biomedical health facilities among rural households in Mozambique



Abraham Mukolo<sup>a, c, \*</sup>, Bruce Cooil<sup>b</sup>, Bart Victor<sup>b</sup>

<sup>a</sup> Vanderbilt Institute for Global Health, Vanderbilt University School of Medicine, 2525 West End Avenue, Nashville, TN 37203, USA

<sup>b</sup> Owen Graduate School of Management, Vanderbilt University, Nashville, TN 37201, USA

<sup>c</sup> Mental Health America of Middle Tennessee, 295 Plus Park Boulevard, Nashville, TN 37217, USA

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## ABSTRACT

In resource-limited settings, the choice between utilizing biomedical health services and/or traditional healers is critical to the success of the public health mission. In the literature, this choice has been predicted to be influenced by three major factors: knowledge about biomedical etiologies; cultural modernization; and rational choice. The current study investigated all three of these predicted determinants, applying data from a general household survey conducted in 2010 in Zambézia Province of Mozambique involving 1045 randomly sampled rural households. Overall, more respondents (N = 802) intended to continue to supplement their biomedical healthcare with traditional healer services in comparison with those intending to utilize biomedical care exclusively (N = 243). The findings strongly supported the predicted association between rational utility (measured as satisfaction with the quality of service and results from past care) with the future intention to continue to supplement or utilize biomedical care exclusively. Odds of moving away from supplementation increase by a factor of 2.5 if the respondent reported seeing their condition improve under government/private biomedical care. Odds of staying with supplementation increase by a factor 3.1 if the respondent was satisfied with traditional care and a factor of 16 if the condition had improved under traditional care. Modernization variables (education, income, religion, and Portuguese language skills) were relevant and provided a significant component of the best scientific model. Amount of biomedical knowledge was not a significant predictor of choice. There was a small effect on choice from knowing the limitations of biomedical care. The findings have implications for public healthcare promotion activities in areas where biomedical care is introduced as an alternative to traditional healing.

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## 1. Introduction

At the core of the developed world's response to problems of disease and poverty in developing countries is the provision of biomedical healthcare. This is nowhere more the case than in highly impoverished areas such as rural Mozambique. Vital biomedical services are being introduced in areas where previously the only healthcare services accessible were traditional healers. As a consequence, today people in remote areas now have choices

regarding where they will seek healthcare. Thus, the challenge is to understand factors that influence the choice of care in a pluralistic healthcare system.

In developing countries, public health practitioners recognize that utilization is not simply affected by the choice to seek biomedical healthcare or not, but more precisely, the choice individuals make among available providers – traditional and/or biomedical (Campbell-Hall et al., 2010; Ernst, 2000; Littlewood and Venable, 2011; Sato, 2012; Su and Li, 2011; Tabi et al., 2006). Modern, often government sponsored/endorsed health services are competing with traditional healers/medicines and self-care (Russo et al., 2014). It is estimated that about 70% of the population in Sub-Saharan Africa will use traditional medicines at some point in their life (Mills et al., 2006).

\* Corresponding author. Mental Health America of Middle Tennessee, 295 Plus Park Boulevard, Suite 201, Nashville, TN 37217, USA.

E-mail addresses: [amukolo@mhamt.org](mailto:amukolo@mhamt.org), [abraham.mukolo@vanderbilt.edu](mailto:abraham.mukolo@vanderbilt.edu) (A. Mukolo).

When provided the choice of seeking healthcare from biomedical providers, many individuals opt for such care. However, not all individuals with that choice will seek care at all or exclusively from biomedical providers (Herbert et al., 2012; Moshabela et al., 2011; Su and Li, 2011). In a community survey conducted in Zambézia Province, Mozambique, 83% of the participants reported seeking care from traditional healers and of these 56% also consulted government health facilities (Audet et al., 2012).

Some governments are ambivalent about the role of traditional healers and/or medicines (Audet et al., 2012; Banda et al., 2007; Sorsdahl et al., 2009; Tsai et al., 2013) and official recognition of plurality in healthcare provision and use differs widely among countries (Littlewood and Vanable, 2011), hence the relative scarcity of empirical examinations of provider selection in pluralistic health systems. Ignoring traditional medicines underestimates healthcare utilization, particularly in rural, bio-medically underserved communities, and leads to partial understanding of predictors of provider preference (Sato, 2012). This paper uses data from a general household survey in rural Mozambique to examine factors proposed as significantly influencing provider choice decisions in pluralistic healthcare systems.

Traditional healers have existed in Mozambique long before colonization and continue to far outnumber biomedical doctors. In 2012, there were no more than 1000 biomedically trained doctors in Mozambique for a total population of 24.5 million (Audet et al., 2012). For many decades (following independence in 1975) traditional healer services were legally banned in Mozambique (Audet et al., 2012), although this law was neither enforced by Mozambican authorities nor observed by about 80% of the population (Kale, 1995). In the last decade traditional healers have become increasingly recognized as key to the government-backed public health response to the HIV and TB epidemics, however there is still no clear policy position on what that role is and how traditional healers should interface with the biomedical health system (Audet et al., 2012). As elsewhere in Southern Africa, traditional healers offer services on a fee-for-service basis, with prices varying widely by type of healer and procedure (Kale, 1995; Audet et al., 2012) and offer payment terms that are relatively flexible and convenient (Lindelow, 2002). In contrast, use of government health facilities is mostly free of charge, although some health facilities might charge a nominal fee for some consultations on relatively inflexible terms (Lindelow, 2002). These government health facilities do not provide or endorse traditional medicine. A market-based private pharmacy/doctor system is only recently emerging as a source of healthcare in Mozambique but has very limited coverage, particularly in rural areas and small towns, and offers mainly biomedical products (Russo et al., 2014). Therefore, households in rural Mozambique can feasibly choose among traditional healers and government-backed biomedical providers.

### 1.1. Healthcare seeking choices

Perhaps the dominant view in public health has assumed that increasing education and income will be associated with greater use of biomedicines in developing countries (Sato, 2012). This theory describes a sequential pathway in which the substitution of traditional with biomedical healthcare is the norm of a modernizing community (Moshabela et al., 2011; Schwartz, 1969). At the core of the modernizing hypothesis are the propositions that adherence to traditional culture or religious beliefs are associated with the choice to use traditional or biomedical healthcare. Schwartz (1969) distinguished acculturative from counter-acculturative health seeking behavior in non-Western societies where biomedicine was being scaled-up. In Schwartz's classification, acculturative behavior occurred when biomedicine was

chosen first and traditional medicine second during an illness episode, the opposite order of preference being counter-acculturative. Consistent with this viewpoint, public health literature about healthcare search behavior tends to focus on the decision to use the biomedical health system (dosReis et al., 2007; Herbert et al., 2012; Peltzer, 2009; Pescosolido et al., 1998; Sorsdahl et al., 2009). From this literature, it is clear that when provided the opportunity, many individuals do indeed seek healthcare from biomedical providers. For example, Peltzer (2009) found some evidence that over the last 13 years, traditional healer use has declined in South Africa. However, 6%–39% of persons surveyed at biomedical health facilities were also using traditional medicine (Peltzer, 2009). Thus, we can propose that levels of formal education and income will be associated with the preference for biomedical healthcare, while adherence to cultural practices and traditional religion will be associated with the preference for traditional healers.

However, recent literature on HIV care seeking has indicated a pattern of persistent multi-system use (Audet et al., 2012; Littlewood and Vanable, 2011; Moshabela et al., 2011). Concurrent multi-system use has long been observed in qualitative literature, e.g., in the anthropology literature about syncretism (Kleinman, 1986; Schwartz, 1969) and about responses to malaria illness (Hausmann-Muela et al., 2002; Kizito et al., 2012). Other recent studies reveal a complex picture that describes increasingly pluralistic healthcare systems in which persons choose amongst diverse healthcare/healing traditions (Herbert et al., 2012; Russo et al., 2014).

Research about concurrent use of traditional and biomedical healthcare has conceptualized health system choice as a rational, utility-maximizing behavior (Sato, 2012; Moshabela et al., 2011). These studies have investigated doctor/healer shopping (de Graft Aikins, 2005), order of preference (Bhatia and Cleland, 2001; Moses et al., 1994), and bypassing behavior (Akin and Hutchinson, 1999) in which distant providers are chosen over local providers (Sato, 2012). Moshabela et al. (2011) and Pescosolido et al. (1998) modeled health search behavior as an optimizing information search, with an initial trial and error phase of concurrent use followed by fidelity to one health system. Some studies have highlighted quality of care as a factor driving preference for traditional over biomedical healthcare (Kizito et al., 2012; Littlewood and Vanable, 2011; Sato, 2012). Examples of quality dimensions reported in qualitative studies include poor coordination of referrals between outreach biomedical services and hospital-based services, and limited patient-centered care from biomedical providers (Campbell-Hall et al., 2010; Kizito et al., 2012).

Weighing quality and cost factors, rational choice theory proposes that the individual will choose the utility maximizing provider/s. Assuming that the utility maximizing choice is not necessarily always associated with one type of provider, this proposition would predict a pattern of single-system and multi-system use, depending on the relative utilities associated with each provider.

Traditional healer preference over biomedical care is also characterized as driven by lack of knowledge about biomedical etiologies of diseases (Audet et al., 2012; Subedi and Subedi, 1993). Additionally, uncertainty about causes of illness and its treatment has been shown to encourage integrative/complex health seeking strategies (Alvesson et al., 2013; Mayxay et al., 2013; Schaetti et al., 2013). Thus, increasing knowledge of biomedicine should generally be associated with the choice of biomedical services. However, knowledge of the limitations of biomedicine should be associated with concurrent use of traditional and biomedical services.

While there is some evidence for the influence of each of these

categories of factors, culture/modernization, utility evaluations and knowledge of biomedical science, there is little research that studies these factors simultaneously (Herbert et al., 2012; Sato, 2012). To build a better understanding of the choices that people in pluralistic health systems make regarding their healthcare, this paper investigates both the nature of the choice (i.e., the choice to substitute or supplement one source of healthcare with another) and the multiple factors predicated to influence such choices.

## 2. Materials and methods

The association between past use and intention to switch health systems at the next occurrence of a given illness event was examined using cross-sectional data from a general household survey. While behavioral intentions are different from actual behavior, both might be driven by a common set of predictable factors. Household level data enables one to observe generic (illness-neutral) choice making, i.e., the general proclivity to choose one health system over another and/or preference for integrative use.

### 2.1. Survey background and design

The population-based survey called the *Ogumaniha*-SCIP survey was conducted in late 2010 among 3749 female heads of household in 259 randomly selected enumeration areas across 14 districts of Zambézia Province, Mozambique (Victor et al., 2013), using cluster survey methodology often used by the World Health Organization (Lwanga et al., 2005). The survey's primary purpose was to evaluate the impact of an integrated programming project funded by the United States Agency for International Development (USAID) and implemented by a consortium of partners led by World Vision, Inc. Details about sampling, data collection and management protocols have been described elsewhere (Mukolo et al., 2013; Victor et al., 2013). The survey was conducted either in Portuguese or in one of 5 native languages and covered, among others, socio-demographics, healthcare access, knowledge about health conditions and their causes and treatments, and participation in health promotion initiatives. Approximately 99.1% of all households approached agreed to participate in the survey. The survey was approved by the Mozambican national bioethics committee and the authors' institutional review board.

### 2.2. The dependent variable: healthcare provider choice

Classification of health system use was based on responses to the following questions: (1) Did you ever visit a \_\_\_ to treat a health problem? (2) How many months ago was your last visit to \_\_\_? (3) In the last 3 months, how many times has anyone in your household visited a \_\_\_ for healthcare? (4) Will you go back to \_\_\_ again if you need medical care? The sources of healthcare considered were (a) traditional healer, (b) government health facility and (c) private clinic/pharmacy. Questions 2 and 3 were combined to indicate a visit in the last 12 months. Consistent with recent studies (e.g., Sato, 2012) we distinguished between modern and traditional healthcare. In Sato's framework, modern healthcare consists of public and private hospitals, health centers/clinics, pharmacies, other licensed drugs suppliers and self-medication with modern pharmaceutical products. Traditional care includes use of traditional medicines from a variety of traditional healers and self-medication with herbal products. Data on self-care with modern or traditional medicines were unavailable from the survey. The survey only covers visits to traditional healers and government health facilities. Given the emergent nature of private (biomedical) clinics/pharmacies, any visit to a government health facility or private clinic/pharmacy was classified as using the modern health

system.

### 2.3. Baseline behavior

Based on how respondents reported contacting traditional and government/private providers, 4 main classes of baseline provider choice could be estimated (e.g., Table 1 characterizations).

Self-care is often reported in the case of uncomplicated illness such as diarrheal disease and fever. HIV/AIDS self-care has also been reported (Musheke et al., 2013), but was not captured in the *Ogumaniha*-SCIP survey.

### 2.4. Future behavior

Future behavior was classified on intention to use each healthcare system as follows: (1) *Substitution* of traditional healers with government or private (G/P) care, indicated by negative intention to seek a traditional healer in the future and positive intention to seek care from G/P providers for those who have sought traditional healer care in the past ( $n = 243$  respondents); (2) *Supplementation* of G/P only care with traditional healer, indicated by positive intention to seek a traditional healer and positive intention to seek care from a G/P provider for those who have sought G/P care in the past ( $n = 42$ ); (3) Continuation of multi-system use (i.e., *supplementation*) by those who have used both G/P and traditional healer care in the past ( $n = 759$ ) and (4) Rejection or self-care, indicated by negative intention to consult traditional healers and negative intention to seek care from G/P providers for those who had G/P care or traditional care in the past ( $n = 1$ ). This fourth option was not explored further because of insufficient data.

Consequently, as an intended future behavior, *Substitution* (with G/P care) is the primary alternative to the multi-system use that characterizes *Supplementation*. We define the dependent variable  $Y$  in terms of two options:  $Y = 1$ , future use of G/P only ( $n = 243$ ); and  $Y = 0$ , intention to use both G/P and traditional care in the future ( $n = 802$ ). Those who were planning to use only G/P in the future had all used traditional healers at some time in the past, so this group can be defined as consistent with true substitution.

### 2.5. Predictor variables

Independent variables included measures of past experience/satisfaction with the care received (i.e., utility of care), knowledge and beliefs about the efficacy of bio-medicines, and degree of modernization. *Utility* was assessed from responses to the following questions: Were you treated well by the \_\_\_ provider? Were you satisfied with the care you received? Did your medical problem get better? To be consistent with the notion of switching providers we also considered the marginal effect of responses to the question: Did you visit the local healer AFTER your visit to the health facility because you did not feel better after your visit to the health facility? An indicator variable for whether the respondent lived within 10 km of a modern healthcare facility was also used as a candidate utility predictor. *Knowledge* was assessed from responses to questions about biomedical causes/reasons, types of treatment/care and places of treatment/care for diarrheal disease, HIV/AIDS and vaccinations. These health states account for a significant portion of the burden of disease and, thus, the need for care in these rural settings.

Survey questions that provided meaningful measures of *belief about the efficacy of treatments* were about treatments for HIV/AIDS, i.e., Do you think antiretroviral (ART) treatment helps people with HIV to be healthier? Do you think alternative treatments available in the community or from traditional healers can help people with HIV? Do you think ART has helped anyone with HIV that you know?

**Table 1**  
Characterization of baseline provider choice behavior.

	Gov health center visit in last 12 months	
	Yes	No
Yes	Supplementation	Traditional healer only
No	Substitution (G/P only)	Self-care

The number of years of formal education, marital status, permanent income, understanding Portuguese well, and belief that religious organizations had helped the participant or the participant's family, were considered separately as proxies for level of *sophistication/modernization*. Religious affiliation (Christian, Muslim, Traditional, etc.) was considered separately because religion generally conditions people's beliefs and behaviors.

**Table 2**  
A contrast of participant characteristics by class of behavioral intent (n = 1045).

Participant characteristics	Units are % unless noted otherwise		Quartiles of non-indicator variables	
	Means when Y = 0: supplementation with traditional (n = 802, 77%)	Means when Y = 1: only G/P in future (n = 243, 23%)	1st quartile	3rd quartile
<b>Controls</b>				
Household size (People)	4.7	4.7	3	6
Age (Years)	40.9	42.0	25	47
Children (Indicator)	87.9	85.6		
<b>Modernization</b>				
Education (Years)	2.0	2.6 <sup>a</sup>	0	4
Portuguese	34.1	42.8 <sup>*</sup>		
Religious organization helped	36.0	35.3 <sup>†</sup>		
P_income (Percentile)	49.7	51.1	25.0	75.0
When religious org. helped <sup>b</sup>	53.1	60.1 <sup>†</sup>	29.2	81.8
Otherwise <sup>b</sup>	47.9	46.5	23.3	70.6
Widowed	5.0	8.2 <sup>†</sup>		
Single	16.3	12.4		
Divorced/separated	75.4	74.5		
Divorced/separated/widow	8.2	13.2 <sup>*</sup>		
<b>Religions</b>				
Traditional	1.3	0.9		
Muslim	11.5	11.1		
Catholic	49.6	50.4		
Evangelical/pentecostal	15.7	13.7		
Protestant mainline	8.3	8.6		
<b>Utility</b>				
Trad: satisfied	93.3	37.2 <sup>***</sup>		
Trad: condition improved	91.3	26.5 <sup>***</sup>		
G/P: satisfied	93.3	93.5		
G/P: condition improved	91.6	90.3		
Within_10 km	34.0	38.8		
<b>Knowledge</b>				
Vaccinations protect	8.8	2.5 <sup>***</sup>		
ART helped someone (ART-4)	35.5	50.0 <sup>*</sup>		
Know about HIV transmission (Correct answers)	2.6	2.9	0	4
Know about ART therapy (Correct answers)	1.3	1.4	1	2
Diarrhea: more food	17.2	14.5		

Note: These p-values are two-sided and refer to a test comparing the means of the two samples (except in the case of Education, see footnote a): <sup>†</sup>p < 0.1; <sup>\*</sup>p < 0.05; <sup>\*\*\*</sup>p < 0.001.

<sup>a</sup> The Mood median test was used, to accommodate the positively skewed distributions. (The test on comparing means is significant, p = 0.008).

<sup>b</sup> The average permanent income of these two groups is significantly different (p < 0.001).

## 2.6. Control variables

Controls included participant's age, household size and number of young children (Table 3). These variables predict need for healthcare and exposure to provider inducements to use healthcare. For example, households with young children are likely to need healthcare and to be targeted by public health agencies for vaccinations, maternal and child health services, etc.

## 2.7. Hypotheses

*Proposition 1:* The modernization model predicts the substitution of biomedical services for traditional healthcare. Higher levels of education and income will be associated with the increasing choice to use biomedical healthcare, while greater adherence to cultural practices and traditional religion should be associated with the choice to use traditional healers.

*Proposition 2:* The rational choice (i.e. utility) model predicts that the utility maximizing source of healthcare will be selected. Since the utility maximizing choice is not necessarily always associated with one type of provider, the utility model would favor the selection of exclusive G/P care when that choice is associated with the expectation of greater satisfaction.

*Proposition 3:* The knowledge of modern medicine model predicts that greater understanding of biomedicine generally should be associated with the choice of biomedical services. However, knowledge of the limitations of modern medicine should be associated with concurrent use of traditional healers and biomedical services.

## 2.8. Statistical analysis

We used a descriptive summary of the two primary groups to contrast their characteristics: those who intend to only use G/P care in the future (Y = 1) relative to those who plan to continue to use both G/P and traditional care (Y = 0). This comparison includes control variables and the three groups of candidate predictors that are associated with each proposition.

## 2.9. Complex predictors

The household's permanent income ("p\_income") was assessed using a measure developed by the World Bank (Ferguson et al., 2002) that is based on 37 asset indicators. This variable is represented in percentile units relative to our sample (N = 1045).

In addition to knowledge items taken directly from the survey, two variables were constructed to measure overall understanding of HIV. The first variable summarizes one's knowledge about HIV transmission as the number of questions answered correctly from among the following four: In what ways can one adult man or woman transmit HIV to another man or woman? In what ways can a woman with HIV pass it to her baby? How can HIV transmission from an adult man or woman to another be prevented? How can HIV transmission from mother to a child be prevented? (Generally, each of these questions has more than one correct answer but here we just tally the number of questions for which there was at least

**Table 3**

Logistic models for healthcare seeking (Odds Ratios): Y = 1, for G/P care only, versus Y = 0, for supplementation.

Predictor	Control model	Incremental value relative to controls	Best models				Incremental value relative to best overall model
			Proposition 1: modernization	Proposition 2: utility	Proposition 3: knowledge	Overall	
<b>Controls</b>							
Household size (People)	1.00		1.01	1.02	1.02	1.02	
Age (Years)	1.00		1.01 <sup>†</sup>	1.00	1.00	1.00	
Children (Indicator)	0.82		0.79	0.74	0.68	0.70	
<b>Modernization</b>							
Education		1.10***	1.10***				1.07
Portuguese		1.52**					1.29
Religious organization helped		0.96				0.15**	
P_income (Percentile) <sup>a</sup>		1.38 <sup>†</sup>					1.31
When religious org. helped		1.01 <sup>†</sup>				1.02**	
Otherwise		1.00					1.00
Widowed		1.64 <sup>†</sup>					0.74
Single		0.73					0.74
Married		0.96					1.35
Divorced/separated/widowed		1.66*				2.87***	
<b>Religions<sup>b</sup></b>							
Traditional		0.67					0.19
Muslim		0.94					1.81 <sup>†</sup>
Catholic		1.04					1.12
Evangelical/pentecostal		0.72 <sup>†</sup>					0.82
Protestant mainline		1.05					1.00
<b>Utility</b>							
Trad. care: satisfied		0.04***		0.32***		0.29***	
Trad. care: condition improved		0.03***		0.06***		0.048***	
G/P care: satisfied		1.00					1.25
G/P care: condition improved		0.85		2.53**		2.85**	
Within_10 km		1.24					1.34
<b>Knowledge</b>							
Vaccinations protect		0.25***			0.25***		0.28*
ART helped someone		1.83*					1.75
Know about HIV transmission		1.06 <sup>†</sup>					1.00
Know there is no HIV cure		1.17					1.27
Diarrhea: more food <sup>c</sup>		0.81					0.61
BIC <sup>d</sup>			1074.4	704.2	1082.3	694.1	
ROC area (%)			56	85	57	88	
Hosmer–Lemeshow (p-value) <sup>e</sup>			0.15	0.86	0.67	0.68	
Sample size	1045		1045	1001	1035	992	

Note: all p-values are two sided: <sup>†</sup>p < 0.1; \*p < 0.05; \*\*p < 0.01; \*\*\*p < 0.001.

In the best models (BIC), all variables with p &lt; 0.25 are footnoted. Sample sizes vary by model due to missing values.

<sup>a</sup> 44% of these households do not have a monetary income, but the effect of permanent income does not differ significantly between those with and without monetary incomes in the control model (p = 0.62) or in the best overall model (p = 0.92).<sup>b</sup> The organized religions not included here account for less than 5% of the sample.<sup>c</sup> This variable is available only for those with children, so children must be excluded as control when evaluating its incremental value.<sup>d</sup> BIC is calculated when the model is estimated from a common set of 983 observations.<sup>e</sup> Non-significance (e.g., p-value > 0.15) indicates that there are no serious issues with systematic bias in the model. In the case of the Modernization model, the Pearson Residual Goodness-of-Fit test (p = 0.48) and Stukel's Test (p = 0.25) both indicate no serious issues with the quality of the fit.

one correct answer.) The second variable summarizes one's knowledge about the effectiveness of antiretroviral therapy as the number of correct answers to two questions: In your understanding, is there any cure for HIV that fully eliminates the risk of infecting someone else? Do you think there is a cure for HIV/AIDS?

### 2.10. Logistic regression

Logistic regression models were used to study the three propositions, following a multi-model approach (Burnham and Anderson, 2002):

- 1) To measure the potential importance of the variables associated with each proposition, we included each individual predictor separately, along with the controls, to determine if it had any significant incremental value (relative to the control variables).
- 2) We tried to make the best possible case for each proposition by constructing the best scientific model based on predictor variables associated with that proposition.

- 3) We constructed the best scientific model from all three types of predictors.

### 2.11. Model assessment

We used best-subsets procedures to direct our search for the best main-effect models based on the predictor variables associated with each proposition and across all candidate predictors (i.e., model categories 2 and 3 above). We considered all two-way interactions of the predictors in the best main-effect models, allowing interactions only when the corresponding main effects were present. The Bayesian Information Criterion (BIC) was used to assess the scientific value of each model, and the final selection of models was made by minimizing BIC. BIC has been shown to be a consistent model selection criterion for logistic regression under relatively general conditions (Qian and Field, 2002; Schwarz, 1978). The ROC area was also used as an overall summary of model performance. For any random selection of one individual from each

group ( $Y = 1$  and  $Y = 0$ ), this area estimates the probability of correctly classifying the two individuals based on the relative size of the estimated probability for  $P[Y = 1]$  (the choice between groups is randomized whenever the estimated probability is the same for each individual).

Finally, model goodness-of-fit was assessed by the Hosmer–Lemeshow chi-square test. (In defining the Hosmer–Lemeshow categories, we used the largest number of categories possible, up to 10, subject to the constraint that all expected frequencies were at least 5, to ensure an adequate chi-square approximation.) When the Hosmer–Lemeshow test indicated a possible problem with model fit, we also used the Pearson chi-square goodness-of-fit test (based on Pearson residuals). In every case, we used Stukel's test (Stukel, 1988; Allison, 2014) to assess whether there were significant quadratic departures from linearity or significant interactions that should be added to the model. This test requires a determination of whether quadratic components are significant as the expected probability of the event approaches either 0 or 1, and we report the smaller of these two  $p$ -values when summarizing the results of this test. As with the other goodness-of-fit tests, large  $p$ -values support model adequacy.

### 3. Results

Table 2 provides a descriptive summary of the two event groups. These groups do not differ significantly in terms of the control variables. Overall, the average age is 41.5 years, the median household size is 4 (Mean: 4 and 5 people), and 87% of these households include children. Table 2 indicates that the group who intend to use only G/P care in the future ( $Y = 1$ ) are more sophisticated in several ways. They are significantly more educated (although the average levels are very low in each case, 2.6 versus 2.0 years), a significantly larger proportion are more familiar with Portuguese (43% versus 34%), and a significantly larger percentage are either divorced, separated or widowed (13% versus 8%).

Although a larger proportion of this group ( $Y = 1$ ) believe they know someone with HIV who benefitted from antiretroviral therapy (50% versus 35%), a smaller proportion gave the most accurate assessment of why it is important to vaccinate children (“to protect them from illness”). Still both percentages are very low (2.5% versus 8.8%) and because this rationale for vaccination is the least compelling of the alternatives provided, those who do not answer this way may have a slightly more sanguine (albeit less realistic) appraisal of the benefits of modern care. The most dramatic differences relate to their previous experience with traditional care. Of those intending to use G/P care exclusively, only 37% were satisfied with the care they received during their last visit to a traditional healer (versus 93% in the other group), and only 26% saw their medical condition get better after that visit, versus 91% in the other group.

Table 3 summarizes the logistic regression models that were used to study the three propositions. The third column tests the incremental value of each variable relative to the controls, and in every case, there is a significant incremental value here whenever the two group means were significantly different in Table 2. Consistent with Table 2, higher odds of moving exclusively to G/P care are associated with more education, knowledge of Portuguese, being divorced/separated/widowed, or knowing someone who was believed to be helped by antiretroviral therapy; lower odds were associated with having been satisfied with traditional care, believing the medical condition improved under traditional care, or believing vaccinations are to “protect children from illness” relative to those who answer another way (e.g., “help them grow healthy” or some other alternative).

Two additional variables have incremental value relative to the

control variables that were not highlighted in Table 2: identification with the Evangelical or Pentecostal religions and knowledge about HIV transmission. The odds of staying with supplementation are higher for those who identify with the Evangelical or Pentecostal religions, while the odds of moving exclusively to G/P care increase with greater knowledge of how HIV is transmitted.

#### 3.1. Modernization

The best model based on the modernization variables indicates that education provides the best scientific model, and the odds of moving away from supplementation to exclusive G/P care increase by a factor of 1.1 per additional year of education. The fit of this model is somewhat marginal (Hosmer–Lemeshow  $p = 0.146$ ) and it is not an accurate model (ROC Area: 56%). Nevertheless, the Pearson chi-square test ( $p = 0.44$ ) indicates that there are no serious fit issues, and Stukel's test ( $p = 0.26$ ) indicates that there are no significant quadratic departures from linearity or significant interaction effects.

#### 3.2. Utility

The best scientific model based on the utility variables (5th column, Table 3) indicates that, *ceteris paribus*, the odds of staying with supplementation increase by a factor of 3.1 (1/0.32) if one is satisfied with traditional care and a factor of 16 (1/0.061) if the condition has improved under traditional care; while the odds of moving away from supplementation increase by a factor of 2.5 if one has seen the condition improve under government or private care. This is an excellent model both in terms of accuracy and fit (ROC Area: 85%; Hosmer–Lemeshow:  $p = 0.86$ ). Stukel's test indicates that there are no significant interactions or quadratic departures from linearity ( $p = 0.40$ ).

#### 3.3. Knowledge

The best scientific model based on knowledge variables (6th column, Table 3) indicates that the odds of staying with supplementation increase by a factor of 4 (1/0.25) for an individual who believes vaccinations are to “protect children from illness” relative to those who gave less knowledgeable, but more optimistic answers (e.g., “help them grow healthy,” or “cure them”). This is not an accurate model (ROC Area: 57%) but there are no apparent problems with fit (Hosmer–Lemeshow,  $p = 0.67$ ) and Stukel's test indicates there are no significant interactions or quadratic departures from linearity ( $p = 0.18$ ).

In addition to the knowledge variables listed in Tables 2 and 3, the following knowledge variables were also considered as candidate predictors: the belief that antiretroviral therapy “helps people with HIV be healthier”; the belief that “alternative treatments available in the community or from traditional healers can help people with HIV”; separate indicators for the beliefs that the primary reason for vaccinating children is to “help them grow healthy” or to “heal them” (rather than to “protect them from illness”); the number of symptoms (0–3) that were correctly identified as indicating when a child needs immediate medical attention; knowledge that more fluid is appropriate when children have diarrhea; and the indication that they had heard of Mistura (a treatment for diarrhea). None of these variables had any significant incremental value with respect to the control model or the best overall model.

#### 3.4. Best overall model

The search for the best overall model, and the concomitant consideration of two-way interactions, showed that the effect of

permanent income was mediated by whether an individual believed that she or her family had been helped by a religious organization. The best model includes permanent income as a predictor only when this is the case. This model combines the best utility model and this permanent income predictor with two other variables from the modernization category (see the penultimate column of Table 3). Surprisingly, none of these variables are in the best modernization model, and the primary predictor in that model, education, has no incremental value in this new model.

*Ceteris paribus*, the odds of staying with supplementation increase by a factor of 6.7 (1/0.15) if one believes religious organizations have helped, 3.4 (1/0.29) if one is satisfied with traditional care, and 21 fold (1/0.048) if the condition has improved under traditional care. The odds of moving away from supplementation to exclusive G/P care increase by a factor of 1.02 per percentile increase in permanent income (when one believes religious organizations have helped), 2.9 if one is divorced, separated or widowed, and 2.8 fold if one has seen the condition improve under government or private care. This is nominally the best performing model overall (ROC Area: 88) and it minimizes BIC. There no issues with the model fit (Hosmer–Lemeshow,  $p = 0.68$ ) or any indication of significant quadratic departures from linearity or additional interaction effects (Stukel's test,  $p = 0.75$ ).

The last column of Table 3 shows that there are two other variables that have marginally significant incremental value relative to this model: the indicator for the Muslim faith and the knowledge variable indicating the most accurate assessment of why it makes sense to vaccinate children (“to protect them from illness”). The odds of moving exclusively to G/P care increases by a factor 1.8 ( $p = 0.073$ ) if one identifies with the Muslim faith. In contrast, the odds of staying with supplementation increases by a factor of 3.6 (1/0.28;  $p = 0.042$ ) for those who gave the most knowledgeable (but least optimistic) appraisal of the value of childhood vaccination.

#### 4. Discussion

In this study we focus on the challenge of a pluralistic healthcare system by asking the question; why do individuals choose to seek care from one system or another? Three major classes of propositions have been offered in the literature to address this question, i.e., the degree of “modernization”, the extent of knowledge of biomedical science, and/or rational best interest can best explain the choices made. We investigated all three of these propositions simultaneously in a study of the healthcare seeking intentions of female heads of households in rural Mozambique.

The analyses contrasted influences on the future intentions of those who plan to use only government/private healthcare (G/P care) vs. those who planned to supplement G/P care with traditional healer care. While we found some support consistent with each of the propositions, we have only found unequivocal support for the rational choice propositions, although modernization variables are also relevant and were a very significant component of the best scientific model. Nevertheless, we were not able to construct an accurate model from either modernization or knowledge variables alone, even though we did find the best combination of main effects in each case (using the best-subsets approach and minimizing BIC) and then considering all two-way interactions that provided improvement (although we only considered hierarchical models, i.e., we only allowed interactions when the corresponding main effects were present). Knowledge variables are apparently the least effective predictors, and only three of them have any incremental value relative to the control model. The choice to continue to supplement G/P care with traditional healers or not, was primarily associated with rational choice variables as will be discussed

below.

We found limited evidence that individuals with modernizing (or nontraditional) characteristics were more likely to use only G/P care. Greater wealth was associated with preference for G/P care, but this relationship was mediated by religious identification. Persons who spoke better Portuguese (as opposed to one of the local native languages), or had more education were no more likely to choose only G/P care. The findings that being of the Muslim faith and/or divorced/separated/widowed are associated with preference for G/P care might have some explanation in the modernization proposition. Preference for biomedical care among Muslims could be related to the non-indigenous ethnicity and higher socioeconomic status of most Muslims in Zambia. Similarly, middle-aged women who are divorced or separated are outside the local norm of being in either a monogamous or polygamous marriage. In previous studies of this population, women who were divorced, separated, or widowed, reported greater decision autonomy in several domains of life including the decision to seek healthcare than married women (Victor et al., 2013). Such decision autonomy is atypical in these rural settings and is likely reflective of broader freedom from traditional norms. Given such nuances, the modernization proposition, thus, needs to be investigated further, perhaps with more precise indicators. The religion variable in particular needs further investigation. We know that some religious organizations in rural Mozambique often offer healing services to believers/followers. Manglos and Trinitapoli (2011) have reported that faith healing (religious rituals and prayer) is at times preferred over biomedicines and/or traditional healers in Southern Africa, while others equate it to traditional medicines (Kale, 1995) or view it as an alternative (Sato and Costa-Font, 2014). Available data did not allow us to examine, in depth, the benefits derived from religious organizations. Therefore, future studies need to consider the option to use faith healing exclusively or concurrently with biomedical and/or traditional healers.

Knowledge of biomedicine was expected to lead to substitution of traditional care by biomedical care. We tested this view using illnesses/treatments that have been the subject of biomedical education programs in rural Mozambique, i.e., diarrheal disease, HIV/AIDS and immunizations. When contrasted with other knowledge and healthcare experiences, theoretic biomedical knowledge did not significantly explain observed provider-choice behavior. However, there was a small effect on choice from knowing the limitations of biomedical care.

Participants were most likely to intend to use only biomedical care if they reported feeling better after using biomedical care and having tangible evidence that biomedical care is efficacious. Being treated well by either a traditional healer or biomedical care provider and/or generalized affect about a care visit were significant, but not of as much importance as feeling less ill immediately after a care visit. The most significant association with choice of care then was the simple rational assessment of which care provider was most effective in relieving the specific symptom or problem. Given that those who preferred to use both traditional and biomedical providers far outnumbered, by a factor of 3.3, those who prefer only biomedical providers, future studies need to examine the complexity of users' definitions and evaluations of healthcare quality and to distinguish which health needs/user expectations can be fully met under each healthcare system.

##### 4.1. Limitations

We were unable to account for the effects of illness intensity and treatments/procedures used, so our findings could be an artifact of the health conditions considered. The efficacy of biomedical care for diarrheal disease, for example, is likely compromised by

continued re-infection at home/community following visits to district health centers. The effects of knowledge about the biomedical science of HIV transmission and treatment might be attenuated by the current absence of a cure for HIV/AIDS, negative side-effects of some HIV/AIDS medications and the fact that treatment efficacy might require an extended period of treatment.

Available data limited us to three types of care needs and scenarios (antenatal, general primary and HIV-related care). However, the observed patterns of help seeking are likely applicable to a wider variety of healthcare needs. Cross-sectional data limited our analyses to hypothetical behavior change. Longitudinal data are needed to examine actual health system switch behavior, the stability of responses to episodes of the same illness overtime and factors accounting for such temporal trends in rural settings. Despite these limitations, we identified important characteristics of the provider choice decisions of households in rural Mozambique that enhance our understanding of provider selection in pluralistic health systems.

## 5. Conclusions

Rational choice considerations might be more central to the provider choice decisions made by people in remote rural developing country settings than is generally understood in the public health and clinical world. While the scale-up of health education, general education and acculturation/modernization favor increased use of biomedical care, failure to adequately prioritize and address people's satisfaction with care and expectancy of meaningful relief from illness is likely to trump these public health initiatives. Addressing these challenges might require a better understanding of other healthcare options (e.g., traditional healer services) and of factors that are central to the choices made in an increasingly pluralistic healthcare system. A significant number of people in rural Mozambique are likely to continue consulting both traditional and biomedical care providers, and/or other sources of healing like faith healers. Biomedical care is likely to be evaluated by the extent to which it provides superior or complementary quality of care within a certain range of health needs. Government-backed healthcare promotion efforts should prioritize utility factors as much as they address accessibility, cost factors and gaps in general and biomedical knowledge. Efforts to collaborate and integrate across biomedicine and traditional/complementary medicine need to be intensified with a view to improve the overall quality of healthcare available from all providers.

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