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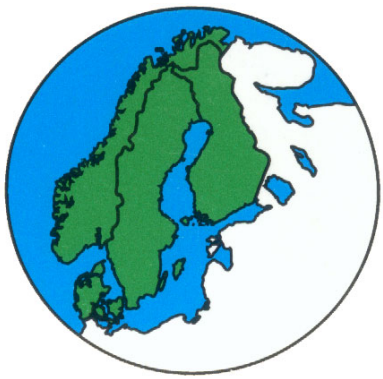

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Relying on nature's pharmacy: a case study of households' dependency on medicinal plants in Burkina Faso's central plateau

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Abstract
This paper aims at quantifying household-level use of medicinal plants and to investigate the determinants associated with the choice of traditional treatment in the central plateau of Burkina Faso. Comprehensive analysis of treatment choice was done through a bivariate analysis aiming at characterising users of medicinal plants. Preliminary results indicate that the use of medicinal plants depends on the nature of the encountered illness rather than on the economic disposition of households. Education and age also plays a significant role in the treatment seeking behaviour. Moreover, medicinal plants are more relied upon in the absence of modern health facilities.

Keywords: Treatment seeking behaviour, medicinal plants, Burkina Faso

1.1 Introduction

According to estimates from the World Health Organization, 80% of the world's population relies exclusively or principally on traditional medicines for their health care (Bannerman, 1982). More recently, Lambert et al. (1997) have speculated that more than two billion people may be heavily dependent on medicinal plants. Even though medicinal plants are recognized as an important player in the safeguarding of traditional livelihoods and well-being of an important number of people around the world, estimates on the actual number of people relying on them for their health care are outdated and uncertain. Moreover, no comprehensive study on the value of the traditional medical system to households in the developing world has been done, and very little research has been carried to find out in which ways and to whom medicinal plants are important. Most research concerning the use of medicinal plants in the developing world has focused almost entirely on recording medicinal plant species and their uses. Although the determinants of use of the modern medical system have been

empirically documented in various settings[1], an important knowledge gap remains around the use and importance of the traditional health care system. The common wisdom is that poor and marginalised people are mostly dependent on forests and other environmental resources for their health care, but reliable and recent quantitative data on the use of traditional medicine does not exist. Moreover, and perhaps as a consequence of the important worldwide use of traditional medicine, information on medicinal plant dependency is scattered across a wide range of disciplines and there is no overarching summary of the current state-of-knowledge. As a consequence, explanatory factors determining traditional medicine use and dependency remain unknown.

Nevertheless, there have been discussions of the role of traditional medicine in contributing to achieving the Millennium Development Goals (MDG) (Garrity, 2004). It is generally recognized that improving the health of the poorest in developing countries and attaining the MDGs requires the development and implementation of various health innovations (Morel et al., 2005), and the ubiquitous use of traditional medicine should be considered in this context. However, understanding the current role of traditional medicine and the factors that shape medicinal plant dependency is crucial when developing nominal and functional health policies as this allows to understand who could be affected by a policy change and in which way.

The objective of this paper is to improve our understanding of medicinal plant dependency through an analysis of treatment seeking behaviour in rural Burkina Faso. This West African country is characterized by a low access to public health care (30% in 2003[2], WHO, 2003) and a ratio of doctors (practising Western medicine) to patients of approximately 1:20,000 (WHO, 2008). Thus, inadequate provision of Western medicine combined with poverty and deeply rooted cultural practices make traditional medicine a crucial part of people's health care in Burkina Faso (Fainzang, 1986). This is acknowledged by the Government and reflected in the public health legislation (Ministère de la Santé du Burkina Faso, 2000). We will thus aim at studying the determinants that motivate the choice for treatment with medicinal plants in order to find out who is most depending on natural resources for their health care provision.

[1] See Develay et al. (1996) for a good example.

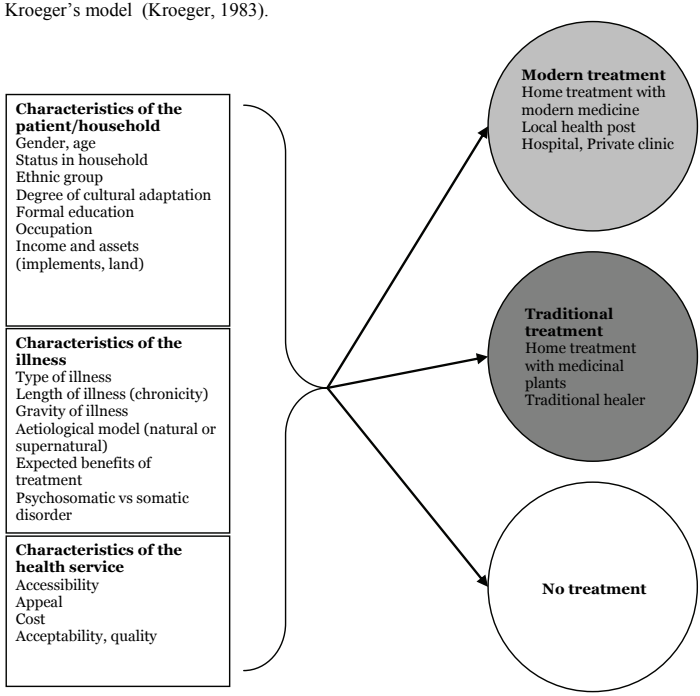
[2] Access to health care was defined as the possibility of obtaining services that helps individuals achieve an optimal state of well-being when it is needed (WHO, 2000).

1.2 Conceptual framework

Determinant model

This study employs Kroeger's determinant model (1983) approach in an attempt to identify and describe the factors associated with the use of medicinal plants (traditional treatment) in rural Burkina Faso. The adaptation of the model to the local situation in the Nobéré district of Burkina Faso led to three groups of determinants: "characteristics of the patient and household", "characteristics of the illness", and "characteristics of the health service" (Figure 1). Some of the variables presented in the model were omitted due to the very low variability in the sample. This is the case for occupation, degree of cultural adaptation, appeal, cost and acceptability of treatment.

Figure.1. Determinants influencing choice of care. Conceptual framework adapted from Kroeger's model (Kroeger, 1983).



2. Methods

2.1 Study area

Burkina Faso is a landlocked country situated in the middle of West Africa and at the border of the Sahel region. In 2008, the population was estimated at 14,252,012 inhabitants (INSD, 2008) living in an area of 274,200 km^2. Close to half of Burkina Faso's population lives below the national poverty line (UNDP, 2006) which was set to around 150 USD per capita in 2003 by the Ministry of economy and development and 82% resides in rural areas (African Development Bank, 2003) and depend strongly on natural resources as much for their nutrition and health as for their income (FAO, 2003), The adult literacy rate was estimated at 28.7% in 2007.

The data is based on a survey of 210 households in the district of Nobéré (11°30' North and 00°58' West), Zoundwéogo province, in the south-central part of Burkina Faso. Nobéré is located on the main road between Ouagadougou (140 km) and the Ghanaian border (60 km). The province's capital, Manga, is situated about 30 km away. The population of the district of Nobéré was 32,814 inhabitants in 2006 (5033 households). Although the major ethnic group residing in the area is the Mossi, a minority of Fulani, Gourounsi, Tensoba, Basloko, Kalinga and other groups also occupy the territory. The climate is dry with one rainy season (June to October) and the average rainfall over the last five years according to the weather station in Nobéré has been 920 mm per year. Rainfall drives the agricultural calendar, which shows peak activities for sowing in May and June and harvesting in October and November. People live of subsistence agriculture dominated by millet, sorghum and to some extent maize. According to the Ministry of Development some 66% of the population lives below the national poverty line in the region.

In total, 9 villages were selected in the Nobéré district based on two criteria: (i) villages had to be representative for the larger region, and (ii) there had to be variation between selected study areas along differentiating dimensions which are the most relevant locally, i.e. market access, and distance to forest in this case (Cavendish, 2000; Campbell and Luckert, 2002). Table 1 presents some of the basic characteristics of those selected villages. The villages are all situated within a distance of 20 km from the small town of Nobéré (3110 inhabitants).

Table 1. Basic information about infrastructure and market access for the 9 selected villages

Village name	Public electricity and water pipes	Distance to nearest paved road (km)	Local health station with nurse	Local market	Primary school	Number of inhabitants	Number of households selected
Séloguin	-	1.5	+	-	-	1200	10
Vohoko	-	0.7	-	-	-	1816	14
Bion	-	3.5	+	+	-	1745	27
Barcé	-	0.7	-	-	+	945	15
Soulougré	-	1.0	-	-	+	947	13
Passintinga	-	0.0	-	-	+	1872	17
Togsé	-	1.5	-	-	-	1169	17
Téwaka	-	0.0	-	-	+	1832	27
Nobéré	-	0.0	+	+	+	3110	70
TOTAL							210

There are six different types of treatment strategies available to patients from the Nobéré district: home treatment with medicinal plants, visit to a traditional healer, home treatment with modern medicine, visit to the local health post, visit to a hospital/private clinic in Ouagadougou, and the decision of waiting and not using any treatment.

2.2 Data collection

Household selection was done randomly based on a village census dating back to 1998. A first questionnaire survey including a wide variety of questions about household demographics, income and assets was used in a quarterly basis between November 2007 and November 2008. One or two adults from each household were asked to evoke all the income (in cash or consumption) that the household generated during the last 3 months, including the collection of products from the wild. In November 2009, the same households were administered another questionnaire survey including an array of questions about household demographics, health status of the household, and treatment strategy in case of illness. The recall period used for this questionnaire was 4 weeks.

Both questionnaires were tested in pilot studies and were designed specifically to extract information in the following areas:

1. Characteristics of the patient/household
   (i) Demographic characteristics of each of the members of the household (age, gender, ethnicity);

(ii) Socio-economic characteristics of the household (level of education of all members, total household income, as well as household wealth in terms of implements and land)

2. Characteristics of the illness

(i) Information about perceived illness of household members during the 4 weeks before the interview. This included a listing of perceived illnesses, as well as severity and length of illnesses. Questions were also asked about the choice of treatments sought and the order of preference of those treatments (stemming from the perceived illness), as well as the cost of care for each individual treatment strategy.

2.3 Bivariate probit model

Several empirical studies have tried to capture the influence of patient, household and illness characteristics on ill people's treatment seeking behaviour. In most cases, the use of logit or probit model is applied (DeClerque et al., 1992; Develay et al., 1996; Weller et al., 1997; Addai, 2000; Wiseman et al., 2008). In these models, ill people or their caretaker are assumed to make treatment decision based upon an objective of utility maximization. Define the medicinal plants by "*p*" and modern medicine by "*m*", where *p*,*m*=1 for use, and *p'*, *m*=0 for non-use. The underlying utility function which ranks the preference of the *i*th ill person is assumed to be function of patient, household and illness specific attributes "*X*" (Table 2) and a disturbance term having a zero mean:

$U_{i1}(X)=\beta_1 X_i+\varepsilon_{i1}$ for use and $U_{i0}(X)=\beta_0 X_i+\varepsilon_{i0}$ for non-use

Because the utilities are random, the *i*th ill person will select the alternative "use" if and only if $U_{i1} > U_{i0}$.

As a results, for the ill person *i*, the probability of use of a type of medicine is given by:

$p(1)=p(U_{i1} > U_{i0})$
$p(1)=p(\beta_1 X_i+\varepsilon_{i1} > \beta_0 X_i+\varepsilon_{i0})$
$p(1)=p(\varepsilon_{i0}- \varepsilon_{i1} < \beta_1 X_i - \beta_0 X_i)$
$p(1)=p(\varepsilon_i < \beta X_i)$
$p(1)= \Phi(\beta X_i)$

where Φ is the cumulative distribution function for ε. Assumptions made about ε will determine the functional form for Φ. When assuming a normal distribution for ε, a probit model is used. This means that, for an ill person

"*i*", the probability of use of medicinal plants and modern medicine, respectively, is given by:

$$\Phi_p(\beta X_i) = \int_{-\infty}^{\beta X_i} \frac{1}{\sqrt{2\pi}} \exp(\frac{-t^2}{2}) dt$$

$$\Phi_m(\beta X_i) = \int_{-\infty}^{\beta X_i} \frac{1}{\sqrt{2\pi}} \exp(\frac{-t^2}{2}) dt$$

It is possible to estimate the two equations by individual single probit models. However, this would lead to inefficiencies as it would ignore the correlation between the error terms ε_p and ε_m of the individual utility functions associated with use of medicinal plants and modern medicine, respectively. Thus, we will use a bivariate probit in this paper to avoid inadequacies of the single probit or logit model. The basis of the bivariate probit model is the joint distribution of two normally distributed variables and was specified a by Green (2007) as

$$f(p,m) = \frac{1}{2\pi\sigma_p\sigma_m\sqrt{1-\rho^2}} e^{-(\varepsilon_p^2+\varepsilon_m^2-2\rho\varepsilon_p\varepsilon_m/(2(1-\rho^2))}$$

$$\varepsilon_p = \frac{e-\mu_p}{\sigma_p}$$

$$\varepsilon_m = \frac{p-\mu_m}{\sigma_m}$$

where ρ is the correlation between *e* and *p*. The covariance is $\sigma_{pm}=\rho\sigma_p\sigma_m$, and the means and standard deviations of the distributions of *p* and *m* are μ_p, μ_m, ρ_p, and ρ_m. If and only if $\rho=0$, then the distributions of *p* and *m* are independent and in this case there would be no need for a bivariate probit and two single independent logit or probit models could be used.

We have also used a random effect on household due to the repetition of data taken from the same households. Through the Stata program, we used the biprobit function with clustering of errors by household.

3. Empirical model

A bivariate probit model is developed to examine the relationship between patient, household and illness characteristics and the use of medicinal plants and modern medicine, based on the conceptual framework presented above (Figure 1). The descriptive statistics of the variables included in the empirical model are given in Table 2. The dependent variable is whether or

not an ill person is using medicinal plants and/or modern medicine. For medicinal plants, the variable is given by PLANT, and for modern medicine, the variable is MODERN and each variable takes the value of 1 if the ill person is using the medicine, and otherwise 0. The ill person-specific explanatory variables are gender (SEX), and age of the ill person (BABY) and (OLD). The household-specific explanatory variables are ethnic group (ETHNIC), level of household formal education (EDUC), household income (INCOME), and presence of a modern health post in the village of residence (HPOST).

Reported illnesses were categorized into six groups following the system of the International Classification of Diseases of the World Health Organisation, 10th Revision: respiratory illnesses (23.7%), various pains (20.6%), malaria and undetermined fevers (23.2%), digestive illnesses (9.1%), and other illnesses (23.4%). In relation to this, the illness specific explanatory variables are illness types (DIG), (RESP), (MAL) and (PAINS). Moreover, we used a variable for the length of illness (CHRONIC), and one for the severity of illness (BED).

Table 2. Description of the independent variables used in the analyses

Variables	Name of variable in empirical model	Description	Continuous variables		Categorical variables	
			Mean	S.D	(Percentages)	
Female patient	SEX	Gender of the patient. 1=female, 0=male.			1=49	0=51
Baby (4 years and younger)	BABY	Dummy variable where 1=ill person is under 4 years old, 0= ill person 4 years old or above.			1=11	0=89
Elder (60 years and older)	OLD	Dummy variable where 1= ill person is above 59 years old, and 0= ill person 59 years old or below.			1=12	0=88
Ethnic group	ETHNIC	Ethnic group of the household where 1=Mossi, and 0=Other ethnic group.			1=83	0=17
Education	EDUC	Household's average level of formal education, for members above 15 years old (in number of years).	0.85	1.36		
Household income	INCOME	Log of the net total yearly income per adult	11.04	2.02		

		equivalent (CFA)		
Illness of the digestive system	DIG	1=patient has illness of the digestive system, and 0= patient has other kind of illness	1=9	0=91
Illness of the respiratory system	RESP	1=patient has illness of the respiratory system, and 0= patient has other kind of illness	1=24	0=76
Malaria and undetermined fever	MAL	1=patient has malaria or unexplained fever, and 0= patient has other kind of illness	1=23	0=77
Various pains	PAINS	1=patient has various pains, and 0= patient has other kind of illness	1=21	0=79
Length of illness	CHRONIC	Chronicity of illness where chronic is defined as an illness lasting for more than 4 weeks. 1= chornic, and 0=acute.	1=17	0=83
Severity of illness	BED	Confinement to bed used as a proxy indicator of illness severity. 1=patient confined to bed, and 0= patient not confined to bed.	1=32	0=68
Presence of health post in village	HPOST	1= presence of health post in village of residence, and 0= no health post in village of residence.	1=53	0=47

4. Preliminary results

A total of 734 illnesses were reported during the four weeks preceding the interviews. Only 3 out of the 210 households reported no illness. Table 3 presents data on the use of traditional and modern medicine when a person faces illness. Overall, 51.2% of the patients used medicinal plants in their treatment strategy, solely or in combination with modern medicine, while 45.9% chose to use only modern medicine and 2.9% decided to use no treatment at all.

Table 3. Frequency table of use of medicinal plants and modern medicine

		Modern medicine		
		User	Non-user	Total
Medicinal Plants	User	213	163	376
	Non-user	337	21	358
	Total	550	184	734

The bivariate probit regression model was used for the 734 cases of reported illness. Estimates are exhibited in Table 4. Rho was found to be significant at 1%, indicating that a bivariate probit model was more appropriate than two univariate probit models.

Eight variables have a significant relation with the decision of whether or not to use medicinal plants, and six variables have a significant relation with the use of modern medicine.

Table 4. Bivariate probit results of use of medicinal plants and modern medicine in the Nobéré area of Burkina Faso

Independent variables	Dependent variables	
	Medicinal Plants	Modern Medicine
Constant	0.04	0.55
SEX	0.04	-0.17
BABY	-0.38**	0.21
OLD	-0.01	0.16
ETHNIC	0.29*	-0.09
EDUC	-0.11**	0.11**
INCOME	0.01	-0.04
DIG	-0.07	0.43**
RESP	-0.28*	0.14
MAL	-0.55***	0.99***
PAINS	-0.39***	0.42***
CHRONIC	0.58***	0.62***
BED	0.21	0.62***
HPOST	-0.31**	0.05

* Significant at 10%
** Significant at 5%
*** Significant at 1%

The coefficient of BABY is negative at 5% in the medicinal plants submodel, indicating, as expected, that babies are less likely to consume medicinal plants when ill. Although only significant at 10%, the coefficient of ETHNIC is positive, indicating that patients belonging to the Mossi ethnic group are more likely to consume medicinal plants than people belonging to other ethnic groups. The average educational level of the household has a negative and significant relationship to the decision to use medicinal plants, and a positive and significant relationship to the use of modern medicine. Illnesses of the digestive system were found to be significantly and positively associated to the use of modern medicine, while illnesses of the respiratory system were negatively associated to the use of traditional medicine. Malaria and various pains were two types of illnesses which were very significantly (1%) negatively associated with the use of traditional medicine, and very significantly positively associated with the use of modern medicine. Reported chronic illnesses were highly significantly (1%) and positively associated with both the use of medicinal plants and modern medicine. Patient confinement to bed was positively associated with the use of modern medicine. Finally, the absence of health post was found to be significantly associated with an increased consumption of medicinal plants.

5. Conclusion

Lack of quantitative data on the use of medicinal plants at the household level in developing countries has led researchers and policy makers to rely on outdated and uncertain estimates. The recognition that forests and other environmental resources play an important role in the health service provision of households in the developing world is paramount to the achievement of the Millennium Development Goals. This paper contributes to fill in the knowledge gap surrounding the use of medicinal plants. More than half of ill people in our survey relied on medicinal plants for their recovery. Social representation of illness was a strong determinant in the use of medicinal plants. Moreover, uneducated and remote households were shown to rely more on medicinal plants than other households.

Given the current importance of medicinal plants in the treatment strategies of rural households, and the function that medicinal plants perform for certain illnesses independently of the presence of biomedically verified adequacy of modern treatments, it seems sensible to assume that the consumption of medicinal plants in rural Burkina Faso is not likely to decrease in the close future. In this context, it is imperative that traditional medicine be included in public health policy. Although medicinal plants have natural origins, a study by Mills et al. (2005) showed that the use of herbal medicine in Africa might put patients at risk for drug toxicity, treatment failure and viral resistance. Given that medicinal plants are

mostly consumed as a home treatment in rural Burkina Faso, information on use, dosage, storage and preparation of herbal medicines should be made available to rural households through extension services.

Our preliminary results also point to the need to look at the resource base of the herbal health-care system in Burkina Faso and elsewhere in sub-Saharan Africa. As wild population of medicinal plants remain the principal source of supply, it is imperative to assess the impact of climate change and habitat loss and degradation on the medicinal plant resource.

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