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DETERMINANTS OF ANTENATAL CARE USE IN GHANA

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Abstract

We investigate the determinants of antenatal care use in Ghana using a large-scale living standard survey. Most previous studies on the subject have used surveys that focus on demography and fertility, and have used approximate indicators of economic variables such as income and cost of consultation. This leads to an overestimation of effects when explanatory factors pick up the effect of underlying economic conditions. We describe antenatal care demand as a three level nested multinomial logit model that includes more appropriate economic explanatory variables. The estimation results show that indeed income, cost of consultation and in particular travel distance to the health care facility are significantly associated with the demand for antenatal care. Use of sufficient antenatal care can thus be promoted effectively by extending the supply of antenatal care services in the rural area. In addition, education of the mother is positively associated to choice for sufficient antenatal care, while women having more pregnancy experience tend to underutilize antenatal care. This suggests that campaigns to promote sufficient antenatal care should pay special attention to education and to women who already gave birth. The results further indicate that, in contrast to findings elsewhere, a special targeting of antenatal care according to religion seems unwarranted.

Preface

Relevance to food security: Expectant mothers who obtain sufficient antenatal care generally have better pregnancy outcomes than those who lack such care, both in terms of their own health condition and that of their babies. In turn, better maternal health has a favorable impact on household food security. Not only will a better maternal health increase babies' access to breastfeeding, it will also increase the access to nutritious food of household members in general, due to the predominant role of (expectant) mothers in the production, marketing and preparation of food. These immediate and indirect consequences of antenatal care for food security are particularly relevant in sub-Saharan Africa, where fertility rates are high and women often bear the sole responsibility for food security. For this reason, the current study investigates the determinants of the use of antenatal care in Ghana, where 40% of the expectant mothers still lack sufficient antenatal care. In particular, we investigate how economic factors such as income, cost of consultation and distance to providers affect the choice for antenatal care and restrict the number of visits below the recommended number of four.

1. Introduction ¹

Women in developing countries often face serious health risks during pregnancy, either for herself or her child. In Africa, pregnancy related health risks caused about a quarter of the burden of disease in 1990 for women in the age group of 15 to 44 years (Murray and Lopez, 1996). Maternal mortality is high in Africa, with an estimated lifetime risk of maternal death of 1 to 16 and a maternal mortality ratio of about 1000 deaths per 100,000 live births (WHO, 2001). Within Africa, Ghana ranks relatively favorably with a maternal mortality ratio of 590 (World Bank, 2002). According to national estimates of the maternal mortality ratio in Ghana, which are considerably lower, it was more than halved in the past decade, from 500 in 1990 to 214 in 1999 (MoH, 2000). Still, even such level is rather high when compared to 21 deaths per 100,000 live births for the developed countries.

Complications of unsafe abortion, pregnancy and childbirth, such as hemorrhage, obstructed labor or infection, are major causes of death for women of reproductive age in Ghana (MoH, 1999a). In addition they can cause severe pain or disabilities if not treated properly. Contributing to the risks of pregnancies are other health hazards such as anemia and undernutrition. Anemia is widespread in the country and is particularly serious among pregnant women. In 1991, 8% of pregnant women were severely anemic at the time of registration at an antenatal clinic and over 60% were moderately anemic. In most cases anemia is caused by inadequate iron intake in conjunction with malaria, hookworm, bilharzias, or hemoglobin disorders (sickle cell). Nutritional problems in the country are associated with a low birth weight of over 20 percent of the babies in Ghana (MoH, 1999b).

Ghana has implemented a number of policies and strategies to achieve an improvement in the health of pregnant women and their babies and a reduction of maternal mortality (MoH, 1999b), which include policies on maternal health services. In 1987 the Ghana Safe Motherhood Programme was introduced as a pilot programme and later expanded to cover the whole country. In addition, the Ministry of Health of Ghana completed in November 1997 its comprehensive National Reproductive Health Service Policy and Standards. The main components of this policy are prevention and management of reproductive tract infections, post abortion care, family planning and safe motherhood, the latter including specific policies about antenatal care during pregnancy.

According to the Ghana National Reproductive Health Services Protocols (MoH, 1999a), the objectives of antenatal care are:

- To promote and maintain the physical, mental and social health of mother and baby by providing education on nutrition, rest, sleep and personal hygiene.
- To detect and treat high-risk health conditions arising during pregnancy, whether medical, surgical or obstetric.

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- To help prepare the mother to breast feed successfully, experience a normal recovery after delivery and take good care of the child, psychologically and socially.

To achieve these objectives, the antenatal care policy document spells out the routine management of pregnancy and the number of visits to antenatal care services a client is supposed to make. The World Health Organization nowadays recommends at least four such visits in the course of the pregnancy (WHO, 1994), since recent empirical evidence has shown that four visits suffice for uncomplicated pregnancies, and more visits are only recommended in case of complications (Villar et al., 2001). The standard recommended number of antenatal visits in Ghana is still according to previous protocols and concern monthly visits up to 28th week of pregnancy, followed by bi-weekly visits to the 36th week of pregnancy, and weekly visits afterwards to delivery. If for any reason the woman can not make the recommended number of visits, then a minimum of four visits are to be made at the 10th, 20th, 30th, and 36th week of pregnancy. Apart from these routine visits, the policy recommends that a pregnant woman report to the clinic anytime she feels unwell or has any complication. The first antenatal visit should be made as early as possible, as soon as the woman thinks she is pregnant (MoH, 1999a). During the antenatal care visits the development of the pregnancy is to be monitored, health advice given, health hazards such as anemia, hypertension and infection are to be screened for and if necessary treated, and tetanus vaccinations should be administered.

Through antenatal care and supervised delivery, the risks of maternal and prenatal complications can be reduced and the health of mother and child enhanced (an overview of the effectiveness of antenatal care is given in Carroli, Rooney and Villar, 2001; see also Afari et al., 1995 for a case study in Ghana). Health agencies across the world have identified under-utilization of maternal and child health services as the major factor in the maternal mortality in the developing countries (Raghupathy, 1996).

The use of antenatal care among pregnant women is already high in Ghana in recent years, at around 85 percent (MoH, 2000). However, according to a recent survey only 60 percent of the women attended the minimum number of four visits (see Table 1). 14 Percent did not attend antenatal care at all, while 26 percent attended less than the recommended minimum of four visits. Pregnant women in urban areas make more often at least 4 antenatal visits than women in rural areas (73 vs. 55 percent). This may be due to a better proximity to health care facilities and to higher incomes in urban area, because distance and price were mentioned by women as reasons for not making any antenatal visits (by 9 and 39 percent respectively).

Table 1. Antenatal care visits by women whose pregnancy ended during the past year, Ghana, 1998/99 (in percent)

| | Rural | Urban | Country |
|------------------|-------|-------|---------|
| No visits | 15.1 | 10.9 | 13.8 |
| 1 – 3 visits | 30.4 | 16.0 | 25.9 |
| 4 or more visits | 54.5 | 73.2 | 60.3 |

Source: derived from GLSS4

Almost all antenatal care in Ghana is received from modern health care providers, such as midwives, nurses, medical assistants, or doctors, see Table 2. Traditional health practitioners play only a minor role in antenatal care (1 percent only), according to these survey data. Though according to official fee schedules antenatal care is to be provided free of charge except for hospital care and catering, in practice local fees are applied (Nyonator and Kutzin, 1999) and only two percent of the women in our sample received antenatal care from a modern health care provider free of charge. Doctors are the most expensive provider of antenatal care according to the price they charge for a first visit, but also the other modern providers charge a significant price for antenatal care, which may restrain the demand for sufficient antenatal care in Ghana. It is remarkable that midwives have a larger market share than nurses or medical assistants despite their higher prices.

Table 2. Share of providers in antenatal care supply and their average price of a first visit

| | Share | Price (cedi) | Price (US dollar) |
|----------------------------|-------|--------------|-------------------|
| Doctor | 27.5 | 8625 | 3.59 |
| Nurse or medical assistant | 30.4 | 5351 | 2.23 |
| Midwife | 41.0 | 7115 | 2.96 |
| Traditional provider | 1.1 | 3000 | 1.25 |

Source: derived from GLSS4

In rural area the distance to modern antenatal care providers can be considerable. Table 3 shows that more than one-third of the rural women have to travel more than 5 km to a modern health care provider that typically provides antenatal care, whereby nurses or medical assistants are most often available within 5 km and doctors are least available. One out of nine women even have to travel more than 15 km to such a provider. Time and travel costs for repeated antenatal care visits would thus be large for these women, which might restrain their demand for antenatal care.

Table 3. Availability of modern health care providers in rural Ghana, 1998/99, in percent

| | Within 5 km | More than 15 km away |
|----------------------------|-------------|----------------------|
| Doctor | 33.5 | 35.4 |
| Nurse or medical assistant | 61.5 | 12.5 |
| Midwife | 54.0 | 18.6 |
| Any of the above | 63.5 | 11.2 |

The distance to doctors, medical assistants or nurses equals the distance to a facility where such health care provider can be consulted, even when only part of the time.

Source: Derived from GLSS4

The effectiveness of antenatal care on pregnancy outcomes in Ghana cannot be established from these survey data, due to insufficient information. However, use of antenatal care during a recent pregnancy is correlated with lower mortality among previous children, which decreases from 13 percent for women who did not seek antenatal care to 9 percent for women with at least 4 antenatal visits.

This paper investigates the determinants of the use of antenatal care in Ghana. In particular we will investigate how economic factors such as living standard, consultation fees, or distance to providers influence the choice of antenatal care provider and restrict the number of visits below the recommended number of four. Therefore we have used a data source that contains information on costs of antenatal care as well as on income. Section 2 deals with the theoretical framework of the determinants of antenatal care. Section 3 discusses the data used in the analysis, and results of estimations are presented in section 4. The final section discusses the results and concludes.

2. The theoretical framework

2.1 The variables

The theoretical framework of this paper is an economic choice model, in which a pregnant woman decides on the use of antenatal care, weighing its costs against the utility gain she expects from it, given her living standard and other personal features. The expected utility gain will depend on her knowledge of the availability of modern health care and on how to use it, on the perceived quality of offered antenatal care and on her perceived need for it. Costs of antenatal care include in general any expenses made for the antenatal care and related travel, as well as the time costs of travel, waiting and treatment.

In the following we discuss the main determinants as found in recent studies on antenatal care use, focusing on studies using large-scale representative surveys. Almost all of these surveys concentrate on demography and fertility topics, such as the Demographic and Health Surveys (DHS). Recent DHS-based studies on the use of antenatal care are available for rural Ghana (Addai, 2000), Kenya (Magadi, Madise and Rodrigues, 2000), Peru (Elo, 1992) and Thailand (Raghupathy, 1996). Similar surveys focusing on demography and fertility are used recently in studies on the use of antenatal care in Jamaica (McCaw-Binns et al., 1995), Nepal (Acharya and Cleland, 2000), and the Metro Cebu area in the Philippines (Becker et al., 1993). The DHS and similar surveys are rich in detail on demography and fertility, but less detailed in economic factors such as costs for antenatal care and household living standard. A somewhat older study on antenatal care use based on a survey that covered both demographic as economic topics concerns also the Metro Cebu area in the Philippines (Wong et al., 1987).

In our analysis we use the Ghana Living Standard Survey, Round 4 (GLSS4) of 1998/99, a large-scale representative survey that contains information on use and prices of antenatal care, next to detailed information on household income and expenditures (GSS, 2000). Using this data

source, we expect to estimate the effects of economic factors such as costs and income more precise than when approximations of living standard are used which are based on household amenities and durable goods, as in the studies using DHS or similar surveys. To the extent that these approximations do not fully cover the effect of the living standard, estimations for related variables such as parental education level might become upward biased. By using more precise information on income level and antenatal care costs, our estimations for the effects of these other factors will be less biased.

Parental education

The level of education of the pregnant woman and her husband often shows a significant positive association with the use of antenatal care. Elo (1992), Raghupathy (1996) and Becker et al. (1993) report a positive effect of the education of both parents, while Addai (2000), McCaw-Binns et al., (1995) and Wong et al. (1987) report a positive effect of education of the mother on use of antenatal care. Since in these studies, except in Wong et al. (1987), the household living standard is only approximated, the positive association with the level of education may partly reflect an effect of the household living standard on use of antenatal care.

A higher maternal education is mentioned in the literature to promote the use of antenatal care in several ways. For instance, Elo (1992) mentions that more education might lead to more decision-making power for the mother within her household. It might also increase her knowledge of modern health care and its effectiveness and of how to apply it. Education might further lead to a higher living standard because of increased earnings of herself or because of a wealthier husband. The level of education of the mother might thus be correlated with several other factors that can be assumed to influence the use of antenatal care. Indeed, both Elo (1992) and Raghupathy (1996) find that the bi-variate correlation between antenatal care use and the mother's education level is considerably confounded by several factors, including indicators for household living standard and access to health care facilities. However, after controlling for such factors they still find a significant positive association between the mother's level of education and the use of (modern) antenatal care.

Living standard

Most studies mentioned above use approximations for the household living standard, because the survey data do not include full information on household income and/or expenses. These approximate indicators differ by study and can include the occupation of the pregnant women, her husband's education level and his occupation, the ownership of durable goods, and household amenities such as water source and toilet facility. Addai (2000) only includes the occupation of the pregnant woman in his analysis and finds no significant effect. Becker et al. (1993) use several indicators but only find a significant association with the husband's education level and the ownership of a radio or television. They argue that both variables might not only indicate household living standard, but also the access to information and the capacity to use it beneficially. In contrast, Elo (1992) finds positive and significant associations between antenatal care use and several living standard indicators including the husband's education level and his

occupation, the use of piped water and ownership of several household durables. Similarly, Raghupathy (1996) reports a positive association with the husband's education level and the ownership of durable goods, while Magadi, Madise and Rodrigues (2000) report a positive association with an index of household amenities and durables. McCaw-Binns et al. (1995) also report positive associations between antenatal care use and the occupation of the woman and of the main wage earner in the household, and the level of weekly food expenses. Wong et al. (1987) is the only study with full information on household income and wealth, but reports only some small positive effects of household wealth and the income of other household members on modern antenatal care use. Thus, though the household living standard might be expected to promote the use of antenatal care, empirical evidence from surveys is mixed.

Proximity, quality and costs of antenatal care

According to the economic model a perceived lower quality and higher costs of antenatal care, including both time and financial costs of treatment and travel, would reduce its use. Indeed, Acharya and Cleland (2000), Magadi, Madise and Rodrigues (2000) and Raghupathy (1996) report a negative effect of distance and/or travel time to antenatal care on its use, while Acharya and Cleland (2000), McCaw-Binns et al. (1995) and Wong et al. (1987) report a positive association with quality of antenatal care. Again, the latter study is most detailed by including treatment costs, waiting time and travel time in the analysis, but its results are somewhat confusing and do not show systematic effects of costs. However, insurance coverage of antenatal care, which lowers its use costs, is significantly associated with more visits.

Need for antenatal care

Pregnancy is a natural process and women with some experience might consider antenatal care less necessary. Accordingly, Elo (1992) and Raghupathy (1996) report that a higher number of previous pregnancies is associated with less use of antenatal care, while Magadi, Madise and Rodrigues (2000) and McCaw-Binns, La Grenade and Ashley (1995) report a negative association between a higher number of previous pregnancies and early attendance to antenatal care. However, the latter also report that complications experienced during earlier pregnancies have a positive association with early attendance to antenatal care, suggesting that earlier problems with pregnancies make women more aware of the need for antenatal care.

Other personal features

Religion and ethnicity may influence the attitude of women towards pregnancy and modern health care, and thus have an effect on their use of antenatal care. Addai (2000) reports for Ghana a positive association between being Catholic and the use of antenatal care, and a negative with having a traditional religion, while ethnicity showed no significant effect. However, his study does not include economic variables to explain the use of antenatal care, and religion might well be correlated with living standard and thus pick up the effect of this excluded variable. Raghupathy (1996) reports a negative effect of being Muslim on antenatal care use in Thailand.

Several other personal features are included in the above-mentioned studies, some of which showing a significant association with antenatal care use. Remarkably, Magadi, Madise and Rodrigues (2000), McCaw-Binns, La Grenade and Ashley (1995) and Raghupathy (1996) report a negative association of a pregnancy being unwanted or mistimed with the use of antenatal care. Apparently, these women were less aware of their pregnancy or tried to ignore it for some time, or were actually in circumstances that were less favorable for a pregnancy and for attending antenatal care.

2.2 The model

The choice model

Demand for antenatal care is modeled as a discrete choice model, in which the pregnant woman chooses between discrete care alternatives and selects the alternative that will give the highest utility. Such models are commonly used in health economics to explain discrete choices made in the utilization of health care (see, for example, the survey by Jones, 2000). Three choice levels are modeled: first the pregnant woman decides whether or not to demand antenatal care from a modern health care provider, then she decides on what type of provider she will visit, and finally she decides on how often she will go for antenatal care. Three types of health care provider are distinguished (doctors, nurses or medical assistants, midwives), which are supposed to give care of different quality, where at one end doctors have had the highest medical education, while midwives are specialized in pregnancy related health care. The number of visits is grouped in two options: either insufficient visits (one to three) or sufficient visits (four or more). The model thus distinguishes seven elemental antenatal care alternatives: two for each provider type plus the option of no modern antenatal care.

Let the alternatives be indexed by j . For each antenatal care alternative the utility U_j of a pregnant woman presumably depends on her consumption C_j of goods and services besides antenatal care, on her health H_j , on the time spend on antenatal care T_j , and on personal characteristics z . This relation is represented by a utility function u .

$$U_j = u(C_j, H_j, T_j, z) \quad (1)$$

We assume that the time cost of antenatal care mainly go at the expense of leisure time (see Sauerborn et al., 1996), and T_j will thus negatively affect the utility level of the alternative. Now let m be the living standard of the woman's household, which defines her consumption C_j after payment of the cost c_j of treatment j .

$$C_j = m - c_j \quad (2)$$

Suppose further that the woman's health H_j depends on the volume of antenatal care received, and on personal characteristics z such as age, parity of pregnancy, and education level. The care volume is assumed to be proportional to its costs, which presumes that the health care market in Ghana functions well enough to have price differences between providers reflect quality differences.

$$H_j = h(c_j, z) \quad (3)$$

Thus, one can define conditional indirect utility functions $V_j = u(C_j, H_j, T_j, z)$, and a pregnant woman will choose the antenatal care type j with the highest value for V_j , $j = 1, 2, 3, 4, 5, 6, 7$.

$$\max \{V_1, V_2, V_3, V_4, V_5, V_6, V_7\} \quad (4)$$

Note that the personal characteristics in the utility and the health function may overlap. For instance, education may change the preferences for antenatal care as well as increase the effectiveness of the care on health. These preference and productivity effects of personal characteristics cannot be separately identified. In the presence of the personal characteristics, which are independent of the type of care, discrete choice models like (4) can only identify relative propensities of choosing one of the alternatives, and consequently a normalization rule is needed.

The econometric model

In the application, we employ simple semi-logarithmic forms for the utility and the health production function of equation (1) and (3), which are linear in the parameters. The time spent on a care alternative is taken proportional to the covered distance d to the provider. The possible effects of these individual characteristics are introduced at each decision level, indexed by n . Adding the subscript i for individuals where appropriate, and adding a disturbance term ε_{ij} , the indirect utilities based on (1)-(3) are specified as follows, where the $\hat{\alpha}$'s are parameters to be estimated:

$$V_{ij} = \beta_C \log[1 + (m_i - c_j)] + \beta_H \log(1 + c_j) + \beta_D d_{ij} + \hat{\alpha}_n \beta_{nj} z_i + \varepsilon_{ij} \quad (5)$$

Accordingly, the propensity for a pregnant woman i to choose the antenatal care type k is described through the probability Π_{ik} that the utility V_{ik} exceeds the utility V_{ij} of any of the alternative treatments j . Clearly, this probability depends on the assumption on the distribution of the disturbance ε_{ij} . Here a Tree Extreme Value distribution is assumed, as discussed by McFadden (1981), resulting in a Nested Multinomial Logit model of three levels.

Most studies discussed in section 2.1 use the simpler Multinomial Logit model, which has the feature that the relative preference for any couple of alternatives is independent of the characteristics of the remaining alternatives (Independence of Irrelevant Alternatives). This

feature is less attractive in our application, as one could expect that the substitution effect of a change in the utility of an alternative might differ between the other alternative for the same provider and the alternatives with other providers, as well as between the alternative of no care and the treatment by other providers. Hence we have opted for a nested multinomial model that incorporates these possible differences in substitution, and which is a generalization of the simple multinomial logit model. By imposing restrictions on the parameters of the nested multinomial logit model, it can be reduced to the simpler model, and the applicability of the latter in our case can thus be tested. Earlier, Acharya and Cleland (2000) have used a three-level nested multinomial logit model for estimating the demand for antenatal care in rural Nepal, while Lavy and Quiqley (1993) have used a similar model for estimating the demand for health care in Ghana.

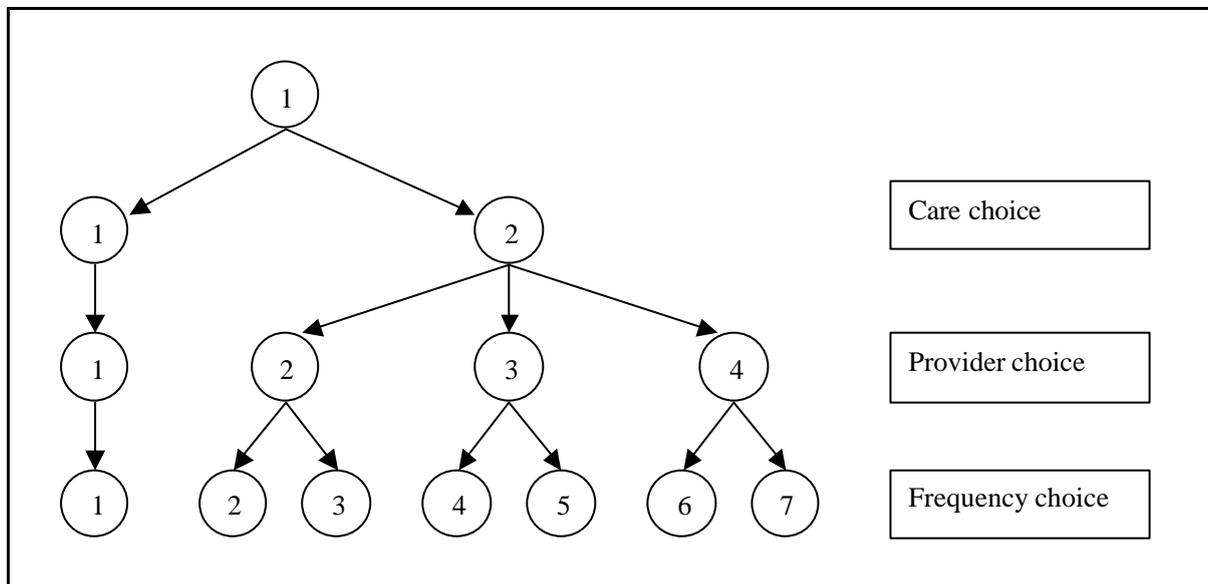


Figure 1. Three level decision tree for antenatal care

The lowest level ($n=1$) of the decision tree in Figure 1 consists of the seven elemental alternatives: 1 indicates the no modern care alternative, 2 indicates insufficient antenatal care visits to a doctor, and 3 indicates sufficient antenatal care visits to a doctor. Similarly alternatives 4 and 5 indicate insufficient and sufficient visits to a nurse or medical assistant, while alternatives 6 and 7 concern the antenatal care alternatives by a midwife. At the next decision tree level ($n=2$) the three types of provider alternatives are listed (2 = doctor, 3 = nurse or medical assistant, 4 = midwife). At the following tree level ($n=3$), 1 still indicates the no modern care alternative, while 2 indicates antenatal care from a modern health care provider.

The probability of choosing alternative j can be formulated as product of transition probabilities along the levels of the decision tree (McFadden, 1981). Let B_{nk} be the set of choices of node k at level n of the tree, where B_{1j} is the elemental alternative j and B_4 the total choice set.

Further let $P(B_{nk}|B_{n+1, \cdot})$ be the transition probability that alternative k at level n is chosen from the choice set of node \cdot at level $n+1$. Let j , k , and \cdot indicate corresponding alternatives at ascending levels of the decision tree, then the probability of choosing elemental alternative j can be written as:

$$P(j) = P(B_{1j}|B_{2k}).P(B_{2k}|B_3 \cdot).P(B_3 |B_4) \quad (6)$$

If the utility level V is also split according to decision tree level, $V_j = V_{1j} + V_{2j} + V_{3j} + \epsilon_j$, suppressing the individual index i for simplicity of notation, the transition probabilities can be formulated recursively as follows:

$$P(B_{nk}/B_{n+1,\ell}) = \exp(V_{nk} + \theta_{nk}y_{nk})^{1/\theta_{n+1,\ell}} / \exp(y_{n+1,\ell}) \quad (7)$$

where the θ 's are dissimilarity parameters and the y 's are Inclusive Values, which are recursively defined as

$$y_{n+1,\ell} = \log(\sum_{m \in B_{n+1,\ell}} \exp(V_{nm} + \theta_{nm}y_{nm})^{1/\theta_{n+1,\ell}}) \quad (8)$$

At the lowest level of the decision tree, the Inclusive Values are zero ($y_{1j}=0$), while at the highest tree level the dissimilarity parameters equal one ($\theta_3 =1$).

The following normalization is used to identify the parameters of the individual characteristics: at the lowest level the parameters of the insufficient care alternatives are set to zero, at the next level the parameters of the alternative of antenatal care by a doctor are set to zero, while at the highest level the parameters of the no care alternative are set to zero. Equivalently, the corresponding variables are deleted from the estimated econometric choice model.

3. The data

The data we use for the estimation of the demand for antenatal care in Ghana are derived from the Ghana Living Standard Survey Round 4, a large-scale representative survey held in 1998/99. Of the almost 26 thousand people included in the survey, 766 women had a pregnancy ended in the preceding 12 months and were included in the analysis. The variables used in the estimations are listed in Table 4.

The household living standard is set at the yearly expenditures per adult equivalent, expressed in 1000 cedi, and do not differ by alternative. The costs of antenatal care differ by type of care, but are assumed to be equal over individuals since antenatal care is a rather standardized service. Price differences between types of antenatal care are thus assumed only to indicate

Table 4. Description and summary statistics of variables

| Variable | Description | Mean | Std Dev |
|-----------------------|--|---------|---------|
| Antenatal care types | | | |
| j=1 | No antenatal care or traditional practitioner | 0.15 | |
| j=2 | Antenatal care from doctor, 1-3 visits | 0.06 | |
| j=3 | Antenatal care from doctor, 4 or more visits | 0.18 | |
| j=4 | Antenatal care from nurse etc. , 1-3 visits | 0.09 | |
| j=5 | Antenatal care from nurse etc. , 4 or more visits | 0.17 | |
| j=6 | Antenatal care from midwife, 1-3 visits | 0.11 | |
| j=7 | Antenatal care from midwife, 4 or more visits | 0.25 | |
| Explanatory variables | | | |
| m ₁ | Yearly expenditures per adult equivalent | 1302.75 | 1106.66 |
| c ₁ | Costs of traditional or no antenatal care | 0.06 | |
| c ₂ | Costs of 1-3 antenatal care visits to doctor | 19.88 | |
| c ₃ | Costs of 4 or more antenatal care visits to doctor | 63.42 | |
| c ₄ | Costs of 1-3 antenatal care visits to nurse etc. | 12.22 | |
| c ₅ | Costs of 4 or more antenatal care visits to nurse etc. | 34.30 | |
| c ₆ | Costs of 1-3 antenatal care visits to midwife | 16.46 | |
| c ₇ | Costs of 4 or more antenatal care visits to midwife | 50.68 | |
| d ₁ | Distance to traditional or no antenatal care | 0.00 | 0 |
| d ₂ | Distance for 1-3 antenatal care visits to doctor | 28.61 | 42.85 |
| d ₃ | Distance for 4 or more antenatal care visits to doctor | 91.30 | 136.72 |
| d ₄ | Distance for 1-3 antenatal care visits to nurse etc. | 12.69 | 25.80 |
| d ₅ | Distance for 4 or more antenatal care visits to nurse etc. | 35.63 | 72.42 |
| d ₆ | Distance for 1-3 antenatal care visits to midwife | 18.28 | 34.18 |
| d ₇ | Distance for 4 or more antenatal care visits to midwife | 56.29 | 105.25 |
| age | Age in years | 29.34 | 6.75 |
| par | Parity of pregnancy | 3.65 | 2.29 |
| edu | Years of schooling | 4.51 | 4.03 |
| isl | Islamic religion (1=Yes, 0=No) | 0.12 | 0.32 |
| tra | Traditional religion (1=Yes, 0=No) | 0.07 | 0.25 |

Income and costs expressed in 1000 cedi, distance in km.

Source: derived from GLSS4

quality differences between providers and quantity differences with respect to the number of visits. Consequently, antenatal care costs are for each alternative computed by multiplying the average number of visits with the average cost of the first visit by type of provider.

The data on distance to providers have been collected in the survey for rural communities only. Since in urban area health care providers are relatively well available (GSS, 1998), distance to antenatal care providers is set to zero for urban women. For rural women, the distance covered to receive antenatal care is for each alternative computed by multiplying the average number of visits with the distance (in km) to a health facility where the health care provider can be consulted, possibly only part of the time. This explanatory variable mainly stands for the travel time costs made for antenatal care visits, but may in the estimation also pick up of the related financial travel costs. Data on time spend on the care itself and relate waiting are not available.

Finally, as regards to characteristics of pregnant women that do not vary with the type of antenatal care, we include age, parity of the recent pregnancy, years of schooling and religion as explanatory variables. To allow for a diminishing effect of age, a squared age term is also included in the estimations (variable ags). Religion is incorporated by two dummy variables, one

for the Islamic religion and one for a traditional religion. These latter two variables reflect mainly preference effects, whereas the other characteristics may concern both preference as well as health productivity effects.

4. Estimation and simulation

In the estimation of the nested multinomial logit model the parameters of the Inclusive Values are restricted to the $[0,1]$ interval for consistency with random utility maximization (see McFadden, 1981). The variables for individual characteristics that are redundant due to normalization have been omitted from the estimated model.

The estimated parameters and their P-values are listed in the annex. These estimation results show that economic factors such as the distance to providers and the consumption level are significantly associated with the choice between antenatal care alternatives, whereby the latter variable covers the net effect of living standard and financial antenatal care costs. The signs of the estimated parameters are as can be expected, with a larger distance and higher financial costs negatively affecting the choice for sufficient antenatal care, while a higher living standard has a positive association.

Of the personal characteristics of the mother especially her education is positively associated with the demand for antenatal care, in particular for sufficient care from each provider type. The parity of the pregnancy is correlated with antenatal care by a nurse or medical assistant, but in particular with insufficient antenatal care visits to such provider. This may indicate that women with more pregnancy experience are more inclined to bring only a few antenatal care visits to a nurse or medical assistant, the cheapest care alternative. The woman's age by itself does not seem to affect the choice for antenatal care as no significant correlation is found. Also her religion does not seem to play a major role, since only a weak correlation is found between having a traditional religion and sufficient antenatal care by a nurse or medical assistant.

The three level nesting structure of the model has been tested by restricting the parameters of the inclusive values to one, because in that case the nesting structure reduces to a simple flat multinomial structure. The three level multinomial model as presented here shows a significantly higher log-likelihood than two level nested multinomial models or a simple multinomial logit model. In particular the inclusive value parameters between providers at the second tree level and between care alternatives for a midwife at the lowest level differ significantly from one.

To illustrate the magnitude of the effects of changes in the determinants of antenatal care we have performed some simple simulations with the estimated model, of which the results are shown in Table 5. The first column shows the shares of the antenatal care alternatives for the survey data as used in the estimation, which are quite close to the actual values reported earlier. In the second column the effects of attaining nine years of basic education for everyone is simulated, a major education policy goal in Ghana, in the third column the effect of free antenatal care according to the official national fee schedule, and in the fourth column the effect of antenatal care supply within everyone's neighborhood. The differences with the base scenario

shown in the table indicate that the largest effects are related to more education and to less travel distance, while the simulated effects of free care on the demand for antenatal care are very small. However, even when the effects of all three scenarios is combined, still just 75 percent of the women receives sufficient antenatal care, while 9 percent receives no antenatal care at all. Obviously, according to these simulations other factors than education, costs and travel distance restrain the demand for sufficient antenatal care in Ghana.

Table 5. Simulated differences in shares of antenatal care demand in Ghana, in percent

| | Base | More education | Free care | No travel | Better health care access | More midwives |
|--------------|------|----------------|-----------|-----------|---------------------------|---------------|
| No care | 14.7 | -5.0 | -0.0 | -0.4 | -0.2 | -0.0 |
| Doctor, 1-3 | 5.9 | -1.0 | 0.0 | 0.3 | 0.2 | -0.1 |
| Doctor, 4 + | 17.8 | 3.8 | 0.3 | 5.1 | 1.3 | -0.1 |
| Nurse, 1-3 | 8.8 | -4.6 | -0.1 | -1.1 | -0.4 | -0.1 |
| Nurse, 4 + | 17.3 | 0.4 | 0.1 | 0.3 | 0.6 | -0.1 |
| Midwife, 1-3 | 10.9 | -0.4 | -0.2 | -3.3 | -2.1 | -1.2 |
| Midwife, 4 + | 24.5 | 6.7 | -0.0 | -0.8 | 0.6 | 1.6 |
| Sufficient | 59.6 | 10.9 | 0.3 | 4.6 | 2.5 | 1.4 |

Source: own calculations

About half of the overall effect of general basic education comes from an increase in women demanding any antenatal care, while the results also show a significant reduction in the insufficient demand for care from a nurse or medical assistant. The largest increases are shown in the demand for sufficient antenatal care from doctors or midwives. More education thus increases the demand for sufficient antenatal care in general and shifts it to doctors and midwives. Eliminating the travel distance to antenatal care also increases in particular the demand for sufficient care from doctors, but now this effect is mostly as the expense of the demand for insufficient care from midwives, and the overall effect on the demand for any antenatal care is only modest.

The first three simulations show the order of magnitude of changes in antenatal care demand that can be expected according to the estimated model, but are somewhat heroic in their assumptions. The last two simulations show the effects of two more realistic policy scenarios to increase the access to antenatal care in the rural area of Ghana. The first, shown in the fifth column under the heading 'Better health care access', assumes an extension of health facilities in the rural area such that a nurse or a midwife can be consulted within 5 km from the home, while a doctor can be consulted within a 15 km radius. This means that a nurse or midwife is at most one hour away one foot, while a doctor is available for referral in a not-too-distant clinic or hospital. The effect of such a general improvement in rural health care access is somewhat more than half of the simulation in which antenatal care was available within the own neighborhood. The largest positive effect is shown for sufficient care for doctors, with smaller positive effects for nurses and midwives. The last simulation is a more modest increase in access to antenatal care in rural area, by increasing the number of midwives such that all pregnant women can consult a modern health

care provider within a 5 km radius of their home. The effect on demand for sufficient care is now almost a third of the simulation with complete access. Since in this simulation in particular the access to midwives is improved, the main shift is towards sufficient antenatal care by midwives, with only minor effects of antenatal care by other providers.

5. Discussion

Considering the total fertility rate of 4.6 births per women (GSS and MI, 1996), pregnancies play an important role in the lives of most Ghanaian women, and favorable pregnancy outcomes are thus in their interest, as well as in the interest of the next generation of Ghanaians. It is fortunate that already 85 percent of the women seek antenatal care from modern health care providers such as doctors, medical assistants, nurses or midwives. However, a considerable share does not make the minimal number of four antenatal care visits as recommended by the World Health Organization.

The demand for antenatal care from modern health care providers appears, according to our analysis, significantly determined by economic factors such as the household living standard, the costs for the antenatal care and in particular the costs related to the distance to health care facilities. To increase the use of sufficient antenatal care in Ghana, improving access to antenatal care in rural area seems the most effective policy instrument that directly affects the choices pregnant women make in this respect. Currently more than a third of the rural women have to travel more than 5 km to the nearest modern provider of antenatal care. Pregnant women in Ghana show a preference for antenatal care by a doctor, but this is the most expensive care alternative. As far as government funds are involved, a general improvement of access of health care in rural area or a specific increase in the number of rural midwives seem more efficient. For the latter purpose it may be an option to give resident traditional birth attendants additional training in modern antenatal care provision. Accessibility of antenatal care may also be promoted by improving transport and telecommunication facilities at health centers where such care is provided, as experience in rural Uganda shows (Musoke, 2002).

Women's attitude to antenatal care seems to be influenced by their schooling, since more years of education of a pregnant woman is associated with a choice for sufficient antenatal care. Hence, in the longer term a significant effect can be expected from the ongoing increase in education of pregnant women in Ghana. Its education policy to provide all children with at least nine years of basic education might according to our analysis considerably improve future antenatal care use.

The positive effect of education also suggests that through information campaigns women in Ghana can be made more aware of the importance of sufficient antenatal care for their health and that of their newborn children. On their first visit pregnant women could be advised to make at least four visits as recommended by WHO. Special attention is warranted for women with more pregnancy experience, who tend to use insufficient antenatal care. To increase efficiency in

antenatal care provision and prevent redundant antenatal care visits, Ghana could update its official guidelines for antenatal care according to the new standards promoted by WHO.

Addai (2000) reports a significant effect of religion on antenatal care use in the rural area of Ghana. However, his analysis does not include major economic factors such as living standard and costs as possible determinants, and his estimates might thus be biased. His finding of an association of religion with antenatal care use might be confounded by differences in living standard between religious groups, as for example people with a traditional belief can be expected to be less economically developed and have a lower living standard. We find few effects of religion, and a special targeting of specific religious group to promote antenatal care use does not seem necessary.

The effect of income and care prices on the demand for antenatal care is rather modest according to our findings. This suggests that further subsidizing antenatal care visits might not be the most effective policy to increase antenatal care use. It also implies that economic growth will only modestly stimulate the coverage of sufficient antenatal care among pregnant women.

A favorable side effect of sufficient antenatal care for pregnant women could be that it promotes supervised delivery (Carroli *et al.*, 2001). Another favorable side effect can be that issues of fertility and sexual behavior could become more easily discussed between the woman and her health care provider. Use of family planning and antenatal care can mutually stimulate each other (Ahmed and Mosley, 2002). Given the still high rate of population growth, as well as the threat of a fast spread of sexually transmitted diseases such as AIDS/HIV, the importance of beneficial effects on family planning and healthy sexual behavior cannot easily be underestimated.

References

- Acharya, L.B. and J. Cleland (2000), 'Maternal and child health services in rural Nepal: does access or quality matter more?', *Health Policy and Planning*, 15: 223-229.
- Addai, I. (2000), 'Determinants of use of maternal-child health services in rural Ghana'. *Journal of Biosocial Science*, 32: 1-15.
- Afari, E.A., F.K. Nkrumah, T. Nakana, H. Sakatoku, H. Hori and F. Binka (1995), 'Impact of primary health care on child morbidity and mortality in rural Ghana: the Gomoa experience (corrected)'. *Central African Journal of Medicine*, 41:148-53 and 335.
- Ahmed, S. and W.H. Mosley (2002), 'Simultaneity in the use of Maternal-Child Health care and contraceptives: evidence from developing countries', *Demography*, 39: 7 5-93.
- Becker S., D.H. Peters, R.H. Gray, C. Gultiano, R.E. Black (1993) ' The determinants of use of maternal and child health services in Metro Cebu, the Philippines', *Health Transition Review*, 3: 77-89.
- Carroli, G, C. Rooney, J. Villar (2001), 'How effective is antenatal care in preventing maternal mortality and serious morbidity? An overview of the evidence'. *Paediatric & Perinatal Epidemiology*, 15 Suppl 1:1-42.
- Elo, I.T. (1992), 'Utilization of maternal health-care services in Peru: the role of women's education'. *Health Transition Review*, 2: 49-69.
- GSS (1998), Core Welfare Indicators Questionnaire (CWIQ) Survey 1977. Main Report. Accra: Ghana Statistical Service.
- GSS (2000), Ghana Living Standards Survey: Report on the Fourth Round, April 1998 - March 1999. Accra: Ghana Statistical Service.
- Ghana Statistical Services (GSS) and Macro International Inc. (MI) (1999), Ghana Demographic and Health Survey 1998. Calverton, Maryland: GSS and MI.
- Jones, A.M. (2000) 'Health econometrics'. In: A.J. Culyer and J.P. Newhouse (eds) *Handbook of Health Economics*. Amsterdam, Elsevier.
- Lavy, V. and J.M. Quigley (1993), 'Willingness to Pay for the Quality and Intensity of Medical Care, Low-income Households in Ghana', Living Standards Measurement Study Working Paper no. 94, Washington D.C.: World Bank.
- Magadi, M.A., N.J. Madise, R.N. Rodrigues (2000), 'Frequency and timing of antenatal care in Kenya: explaining the variations between women in different communities'. *Social Science and Medicine*, 51: 551-561.
- McCaw-Binns, A., J. La Grenade and D. Ashley (1995), 'Under-users of antenatal care: a comparison of non-attenders and late attenders for antenatal care, with early attenders'. *Social Science and Medicine*, 40: 1003-1012.
- McFadden, D.L. (1981), 'Econometric Models of Probabilistic Choice', in Manski, C.F. and McFadden D.L. (eds.), *Structural Analysis of Discrete Data with Econometric Applications*. Cambridge: MIT Press.
- MoH (1999a), National reproductive health service protocols. Accra, Ministry of Health.
- MoH (1999b), Medium term health strategy towards vision 2020. Accra, Ministry of Health.
- MoH (2000), Annual Report 2000. Accra, Ministry of Health.
- Murray, C.J.L. and A.D. Lopez (1996), *The global burden of disease*. Harvard: Harvard University Press.
- Musoke, M.G.N. (2002), 'Maternal Health Care in Rural Uganda'. IK Notes no. 40. World Bank at World Wide Web.

- Nyonator, F and J. Kutzin (1999), 'Health for some? The effects of user fees in the Volta Region of Ghana'. *Health Policy and Planning*, 14: 329-341.
- Powers, D.A. and Y. Xie (2000) *Statistical Methods for Categorical Data Analysis*. San Diego: Academic Press.
- Raghupathy, S. (1996), 'Education and the use of maternal health care in Thailand'. *Social Science and Medicine*, 43: 459-471.
- Sauerborn, R., A. Adams and M. Hien (1996), 'Household strategies to cope with the economic costs of illness', *Social Science and Medicine*, 43: 291-301.
- Villar, J. H. Ba'aqeel, G. Piaggio, P. Lumbiganon, J.M. Belizán, U. Farnot, Y Al-Mazrou, G. Carroli, A. Pinol, A. Donner, A. Langer, G. Nigenda, M. Mugford, J. Fax-Rushby, G. Hutton, P. Bergsjö, L. Bakketeig, H. Berendes (2001), 'WHO antenatal care randomised trial for the evaluation of a new model of routine antenatal care'. *The Lancet*, 357: 1551-64.
- WHO (1994), Antenatal care, Report of a Technical Working Group, WHO/FRH/MSM/96.8. Geneva: World Health Organization.
- WHO (2001), Maternal mortality in 1995: Estimates developed by WHO, UNICEF, UNFPA, WHO/RHR01.9. Geneva: World Health Organization.
- Wong, E.L., B.M. Popkin, D.K. Guilkey and J.S. Akin (1987), 'Accessibility, quality of care and prenatal care use in the Philippines'. *Social Science and Medicine*, 24: 927-944.
- World Bank (2002), *World Development Indicators 2002*. Washington D.C.: World Bank.

Annex A. Estimation results for three level Nested Multinomial Logit model of demand for antenatal care in Ghana

| Explanatory variable | Parameter estimate | P-value |
|----------------------|--------------------|---------|
| <i>General</i> | | |
| Other consumption | 0.3742 | 0.0678 |
| Care volume | -1.0642 | 0.4317 |
| Distance | -0.007144 | <.0001 |
| <i>First level</i> | | |
| Age_3 | 0.1575 | 0.1351 |
| Ags_3 | -0.002672 | 0.1240 |
| Par_3 | -0.0447 | 0.6847 |
| Edu_3 | 0.0977 | 0.0736 |
| Isl_3 | 0.2220 | 0.7063 |
| Tra_3 | -0.2835 | 0.8095 |
| Age_5 | 0.1443 | 0.1348 |
| Ags_5 | -0.001851 | 0.3011 |
| Par_5 | -0.3094 | 0.0076 |
| Edu_5 | 0.1296 | 0.0103 |
| Isl_5 | 0.0784 | 0.8630 |
| Tra_5 | 0.8955 | 0.0910 |
| Age_7 | 0.1156 | 0.2409 |
| Ags_7 | -0.001598 | 0.3046 |
| Par_7 | 0.006416 | 0.9504 |
| Edu_7 | 0.0697 | 0.1027 |
| Isl_7 | 0.8649 | 0.1561 |
| Tra_7 | -0.6815 | 0.2117 |
| <i>Second level</i> | | |
| Age_3 | 0.0506 | 0.7004 |
| Ags_3 | -0.002551 | 0.2364 |
| Par_3 | 0.2514 | 0.0578 |
| Edu_3 | -0.0565 | 0.4068 |
| Isl_3 | 0.2496 | 0.6666 |
| Tra_3 | 0.6875 | 0.5300 |
| Age_4 | 0.0497 | 0.6846 |
| Ags_4 | -0.001566 | 0.4137 |
| Par_4 | 0.0858 | 0.4240 |
| Edu_4 | 0.0673 | 0.2322 |
| Isl_4 | -0.2281 | 0.6928 |
| Tra_4 | 0.1328 | 0.8996 |
| Y_22 | 1.0000 | . |
| Y_23 | 0.6563 | 0.0162 |
| Y_24 | 0.1351 | 0.5812 |
| <i>Third level</i> | | |
| Age_2 | 0.009759 | 0.9411 |
| Ags_2 | -0.000551 | 0.7991 |
| Par_2 | 0.0958 | 0.1367 |
| Edu_2 | 0.0843 | 0.0428 |
| Isl_2 | 0.5964 | 0.1082 |
| Tra_2 | -0.0679 | 0.8875 |
| Y_31 | 1.0000 | . |
| Y_32 | 0.1983 | 0.5761 |
| Log Likelihood | -1337 | |

Abbreviations of variables as in Table 4, where *_k* indicates the *k*-th alternative as indicated in the text of section 2.2; Y's are Inclusive Values

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