UNIVERSITY OF CAPE COAST

DISCRIMINANT ANLYSIS OF BIRTH REGISTRATION IN GHANA

STEPHEN KWAKU AMOAH

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BY

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Dissertation submitted to the department of Mathematics & Statistics of the School of Physical Sciences, in partial fulfillment of the requirement for the award of Master of Science Degree in Statistics

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DECLARATION

Candidate's Declaration

I hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere

Candidate's signature: ………………………………………………………….

Data:…………………………….

Candidate's name: STEPHEN KWAKU AMOAH

Supervisor's Declaration

I hereby declare that the preparation and presentation of the dissertation were supervised in accordance with the guidelines on supervision of dissertation laid down by the University of Cape Coast

Supervisor's signature: …………………………………………………………

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ABSTRACT

The objective of this study is to present empirical evidence obtained through household survey in order to understand which factors are associated with children who obtain a birth certificate, and thus realize their right to a name and legal identity.

Discriminate analysis was used to determine the factors that explain the differences between households who register their children and those who do not. 13 independent variables were analyzed against two levels of the dependent variable using responses from 3465 households sampled over Ghana.

The investigation revealed that the variables; child in household has a vaccination card, level of education attained by household head, location of household, whether household is located in rural or urban community, level of education of mother in household, household's access to radio and TV imparted on a household's decision to register a child's birth or not. The variable, wealth index quintile of household in which a child lives stood out as the most powerful factor that determined whether the child would be registered or not.

The evidence from this study indicates that children who have not been registered tend to be in households who are poor and live in rural areas. Such children are likely to have been born by mothers who have low levels of formal education and are less likely to have adequate access to the media.

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To my colleges who urged me on in difficult times, many thanks.

DEDICATION

To my Uncle

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CHAPTER ONE

INTRODUCTION

Background to the study

The Birth of a baby is celebrated with much fanfare among all communities of the world, it is acclaimed to be the bundle of joy to its parents; more than all it is regarded as a miracle of nature. Yet this much-celebrated event seems to go unrecorded in a number of communities. This unsettling fact has prompted governments and child right organization to step up efforts towards ensuring that each child has the right and privilege of being registered.

Birth registration is the process by which a child's birth is recorded in the civil register by the applicable government authority. This process provides the first legal recognition of the child and is generally required for the child to obtain a birth certificate and consequently any other legal documents and rights. Registration at birth is significant because the child receives a birth certificate, and subsequent proof of permanent, official and visible evidence of a state's legal recognition of the child's existence as a member of society hinges on the certificate acquired after registration at birth.

Birth registration means more than exercising one's right to an identity and a nationality. It can mean the difference between being forced into marriage at an early age, and therefore a fundamental element of the protective environment where children are protected from violence, insecurity, exploitation, and forced labour. It also opens up a world of possibilities to children as they grow, allowing them to get an education, to access health services, to open a bank account, to get a passport, to vote, and to travel more freely.

All around the world, registration at birth is a fundamental right and key to ensuring the fulfillment of other rights of children. Article 7 of the Convention on the Rights of the Child, ratified by 191 Countries across the world, gives every child the right to be registered at birth by the State. The Child Rights Convention states that “The Child shall be registered immediately after birth and shall have the right from birth to a name, right to acquire a Nationality and as far as possible, the right to know and be cared for by his or her parents”. This provision is very fundamental in creating a caring and protective environment for children as it provides for their recognition and respect before the law.

Unfortunately, not many children worldwide are able to have the right to registration upon birth. Around 51 million births go unregistered every year in developing countries. These unregistered children are almost always from poor, marginalized or displaced families or from countries where systems of registration are not in place or functional. Sub-Saharan Africa has the lowest rate of birth registration; only one out of every three children in West and Central Africa is registered at birth. There is an urgent need to change the trend so that many children will not be denied their basic entitlements for reasons of not having a birth certificate (UNICEF, 1998).

Most countries have a legal provision for registering births of children within a prescribed period. These laws however, are often not comprehensive enough, are not enforced or do not function. There are also practical problems such as births which take place in isolated rural locations or away from medical facilities. Sometimes, there may be a deliberate lack of birth registration, with particular groups excluded. Discriminatory policies intended to minimize the official size of ethnic minorities directly affect the provision of assistance to immigrants. In addition to issues relating to protection, a functioning system of birth and civil registration ensures that the country has an up-to-date and reliable database for planning. This is as useful for national level planning as it is for local government bodies that are responsible for maintaining education, health and other social services for the community

In Ghana, the Births and Deaths Registry was established by Act 301 of 1965 within the then Ministry of Local Government and Rural Development to handle and develop the births and deaths registration system in Ghana. Its main purpose is to provide accurate and reliable information on all births and deaths accruing within Ghana, through registration and certification, for socio-economic development of the country. This is done at the national, regional, district and community levels and is often followed with the issuance of a birth certificate. The birth of every child is registered in the district where the birth occurred. It is the duty of the parents (father, mother or both) to register the birth of the child. The informant should produce evidence of birth, such as a Child Health Record (Weighing card). The birth must be registered within 12 months of occurrence. Registration outside this period attracts a penalty (Births and Deaths Registry, 2007).

Ghana was the first country to ratify the UN Convention on the Rights of the Child at the First World Summit on Children in 1990, a commitment in line with its ideals on the welfare of children. However, there are many

Ghanaian children who do not have certificates either because their parents could not register them at birth or within the first twelve months when registration of birth is free. Parents who fail to take advantage of registration within this period will have to pay a fee for late registration. Registration within the first year is meant to encourage parents to register their children in a timely manner.

Birth registration, an important component in the vital registration system, is yet to have wide scale practice in most parts of Ghana. National coverage has shown wide fluctuations over the years. For example, in 2000 the national coverage estimated at 31% dropped to 27% in 2001, and dipped further to 17% in 2002. In 2003, a slight increase to 29% was recorded, rising further to 51% in 2004. In 2005, an all time high of 67% was recorded but could not be sustained in 2006 when coverage dropped to 54%. The 2007 coverage showed an increased trend to 62%, but fell below the 80% target set for the year (Births and Deaths Registry, 2007).

Concerns have been raised by several relevant bodies especially child right organizations about the poor state of birth registration in Ghana. Inadequate personnel and logistics remain central to the department’s challenges and consequent achievements (Bentil, 2008; Daily Graphic, July 2008). These are partly responsible for the fluctuating coverage in birth registration and certification in Ghana.

Objectives of the study

The main aim of this study is to determine the factors that motivate or influence families or households:

i) to register the birth of their children.

ii) that do not register the birth of their children.

using discriminant analysis, and to come out with strategies based on the findings to reach out to households who are likely to default on birth registration

Research questions

The study will try to find out whether Parents' choices and decisions about birth registration depended on their circumstances. Can households or families in terms of birth registration be differentiated by:

i. Sex of head of household?

ii. Highest level of school attended by head of household?

iii. Religion of head of household?

iv. Mother tongue of head of household?

v. Mother in household's education?

vi. Major ethnic group of head of household?

vii. Location of household (urban or rural)?

viii. Region of household?

ix. Household's access to Radio?

x. Household's access to TV?

xi. Wealth index quintile of Household?

xii. Participation in national immunization day programmes?

xiii. Child in household has vaccination card?

Data

To achieve the objectives of the study secondary data on birth registration were obtained from the 2006 Multiple Indicator Cluster Survey (MICS, 2006) conducted by the Ghana Statistical Service.

The MICS 2006 used a two-stage stratified sample design. At the first stage of sampling, 300 census enumeration areas (124 urban and 176 rural enumeration areas) nationwide were selected. The clusters in each region were selected by systematic sampling with probability proportional to size. A household listing exercise covering the selected enumeration areas was conducted. The second stage of sampling used the systematic sampling technique to select the listed households.

Four sets of questionnaires were used in the Survey:

- A household questionnaire which was used to collect information on all *de jure* household members and household characteristics.
- A women's questionnaire administered on each household to all women aged 15- 49 years
- A men's questionnaire administered in every third selected household to all men aged 15-49 years
- An under five questionnaire, consisting of questions on birth registration, child labour and discipline etc was administered to mothers or caretakers of all children under 5 years living in household.

The data for the study was put into two categories to form the dependable variables. This was done based on whether the household registered the birth of their children or household did not register the birth of their children.

Literature review

It is estimated that, in 2003, the births of 48 million children constituting about 36 per cent of total births that year, went unregistered. Having their existence and identity officially registered is a fundamental human right of every child as stipulated by Article 7 of the Convention on the

Rights of the Child. Although most countries have mechanisms for registering births, the number of births actually registered varies from country to country based on administrative capacity, available funds, access to the population and technology for data management. Other factors that influence birth registration levels include the existence of an adequate legislative framework; enforcement of existing legislation on birth registration; sufficient infrastructure to support the logistical aspects of registration; and the barriers that families encounter during registration.

The value of birth registration is often overlooked due to the continuing lack of awareness that registration is a critical measure to secure the recognition of every person before the law, to safeguard their rights and to ensure that any violation of these rights does not go unnoticed. Registration may not be seen as important by society at large, by a government facing severe economic difficulties, by a country at war, or by families struggling with day-to-day survival. It is often considered to be no more than a legal formality, unrelated to child development, health, education or protection.

According to the latest UNICEF estimates, on average over half of births taking place every year in the developing world (excluding China) go unregistered, a proportion that rises to 62 per cent in sub-Saharan Africa. In South Asia the share is higher still at 70 per cent, which means that almost half of the children in the world who are denied their right to a legal identity at birth live in this region.

Unregistered births can serve as an indicator of other forms of social marginalization and disparity within countries or territories. Unregistered children are more likely to be the children of the poor. According to a household survey in the United Republic of Tanzania for 2003, children born into families in the richest 20 per cent of the population are over 10 times more likely to be registered than those living in the poorest 20 per cent of households.

Location is also an important constraint on registration. Rural children are more likely to be unregistered than their urban peers. Other factors that contribute to disparities in birth registration include mother's education, loss of parents, religion and ethnicity. There is the assertion that people living in urban areas are better informed on birth registration issues than rural dwellers. In most cases, it is believed that the educated are much more informed than the uneducated.

Also, low registration rates have been attributed to lack of awareness of legislation and of the importance of birth registration, limited number of registration centres, limited financial resources and a lack of effective registration infrastructures (UN, 2006).

An investigation into how unmarried parents make choices and decisions about sole or joint birth registration revealed a wide range of factors that affect parents' decisions. These include reactions to the pregnancy, the nature of the parents' relationship, how much they understood about the implications of birth registration and what would be best for the child. It also came out that Parents did not always understand the financial and legal implication of birth registration.

How these factors interacted in individual cases depended on the circumstances of each parent and the level of involvement expected from the other parent. Some parents were not aware that a father's presence on the birth certificate gives him legal parental rights and can help if there is a need to secure child support payments. Another important finding was that providing more information and advice about registering births is likely to increase joint registration where this is perceived as in the child's best interests.

One of the requirements to secure a child support payment (paying and receiving maintenance) in some developed countries is evidence or provision of a birth registration. It is important to understand that many victims of domestic violence do not want to establish paternity in order to pursue child support because of the dangers this poses to them and their children.

For example, a study undertaken by Jaffe et al. (2002) found that women decided not to pursue child support because they knew such action would enrage their former partner and cause more problems for them and their children. This was because disputes about proper support payments became a source of arguments and renewed threats by the violent ex-partner. A number of women also discussed how their former partners told them that if they pursued child support, then they would demand joint custody so they would not have to pay.

Where women do pursue child support, evidence suggests that domestic violence perpetrators will often retaliate by waging 'financial warfare' – emptying joint bank accounts and prolonging divorce or custody proceedings to increase the victim's legal costs. Indeed many women see a father's refusal to meet their child support obligations as a continuation of the intimidation that is part of the pattern of violence.

Recent evidence suggest that mothers who conceived their child during a sexual assault, those who have been exposed to domestic violence or those who are aware that the non-resident parent has abused other children do not wish for joint birth registration. Also ‘single’ registration of children as a result of exemptions could become stigmatizing and potentially discriminating. In cases where only one parent’s name appears on the birth certificate, children will be clearly identified as the sons and daughters of ‘dangerous men’ including rapists, abusers or men who have committed incest.

Surveys have shown that the decision about whether or not to register a birth depends on the perceived benefit to the individual (Sharp, 2005). Since research on birth registration indicates that factors such as ‘social stigma’ and ‘fear of discrimination’ may deter a parent from registering their child, Refuge urges the Government not to create any disincentives for birth registration.

For sometime now, a serried of innovative strategies adopted by UNICEF in collaboration with PLAN, UNFPA and other partners are spreading information about the necessity for birth registration, and the immense benefits derived from such registration (UNICEF, UNFPA, Plan I., 2005). Indeed, the Pan-African Film and Television Festival of Ouagadougou (FESPACO) in 2005, a children’s version of the festival, called FESPACO Junior, was initiated to enable actors, filmmakers and journalists promote birth registration as an important social obligation.

A very important source of population statistics, consists of continuous and permanent registration of vital events, particularly births and deaths. In any modern state, this is considered a principal activity because of the number of uses to which statistics generated from vital registration can be put. A complete birth and death registration system is the surest way to generate reliable information on various demographic indicators like birth and death, infant mortality rate, maternal mortality rate, child sex ratio, at district and sub-district levels.

In most countries Civil Registration System (CRS) is taken as the basic tool for registration of birth. Generally, the maintenance of civil registration needs both the trust and willing participation of citizens, ongoing political backing and commitment to long-term funding. In the CRS the local governance institutes are entitled to ensure the registration of birth at the grass root level.

Although the United Nation defines civil registration to cover registration of live births, deaths, foetal deaths, marriages and divorces, the reality in Ghana, is that registration of vital events is limited to the registration of births, deaths and foetal deaths. (Ghana Birth and Death Registration Act 301 of 1965). After a series of memoranda, recommendations and publications had been made, in which the need for the establishment of an efficient births and deaths registration system had been advocated, due to the legal importance of the registration system for legal and administration purposes, demographic estimates, medical research and public health planning, the Births and Death Registry was established in 1965, within the Ministry of local Government, to handle and develop the births and deaths registration system in the country (Ghana Birth and Death Registry, 2007).

In accordance with the provision in the Births and Deaths Registration Act, 1965, the Vital Registration System of Ghana was initiated to coordinate its activities from a national headquarters, referred to as the Central Registry

Office. As a means of ensuring an effective functioning of the registration system, the entire country was thereafter divided into Registration Regions, which coincide with the ten (10) political and administrative regions of the country with each having Regional Registration Offices located in the Regional Capitals. Additionally, the Registry has offices in all 138 districts supported with a network of local Registration Offices, 391 in all, located in various towns and communities across the length and breadth of the country (Ghana Births and Deaths Registry, 2007).

Registration of birth benefits individuals, governments and the society at large. Civil registration is the only means of establishing and protecting identities, citizenship, and property rights. Legal documents that prove identity and citizenship not only provide access to state services or entitlements, but can also be a defense against exploitation (UNICEF, 2002). Although, birth registration provides all these benefits, it is however not clear whether people in both rural and urban areas have adequate knowledge of these benefits.

According to the United Nations Children's Fund, if the issue is to become a priority at the policy making level, and acknowledged as an important and fundamental right of each citizen, the benefits to the economic and social development planning and overall good governance of the country must be demonstrated (UNICEF, 2002). Where there is no demonstration of such benefits, people's motivation to register such events will be greatly affected.

One other area which influences the smooth functioning of civil registration is the implementation of effective education programmes. Chalapati, Debbie and Colin (2005) indicated that active public participation is essential in the process of civil registration. They were of the view that active public participation can be increased by making the public aware of the basic purposes of civil registration, and the responsibilities of the citizen and the government towards it.

Although, Chalapati, Debbie and Colin suggests that active public participation could increase awareness of citizens and governments responsibilities towards civil registration, the reality is that little is being done by governments to promote such participation. In many countries, mass media campaigns use newspapers, radio and television to promote public awareness of citizens' rights and responsibilities towards registration of births and deaths (Chalapati, Debbie and Colin, 2005). Unfortunately, such innovative approaches as implemented in other countries are lacking with Ghana's Birth and Death Registry System. In spite of the Registry's success with a decentralized administration across the nation from a regional to a district level after its inception in 1965, the system is yet to achieve a complete universal registration of vital events.

Outline of dissertation

This section considers the outline of the content of the five chapters of the dissertation, and presents a brief description of them. The first chapter deals with the introduction and considers the background to the study, the objectives, the research questions, data, literature review and outline of the dissertation.

Chapter Two discusses the general procedure of discriminant analysis with emphasis on objectives, assumption, types of discriminant analysis, definition of some technical terms, the significance of the discrimant function, interpretation and validation of results.

In Chapter Three, exploratory techniques are used to preview the data to identify the main statistical technique for further analysis.

Chapter Four provides analysis of the data using Discriminant Analysis and Chapter Five summarizes and discusses results of both the preliminary and further analysis. The chapter also provides conclusions and recommendations based on the results of the analysis.

CHAPTER TWO

REVIEW OF METHOD

Introduction

Chapter Two discusses the general procedure of discriminant analysis with emphasis on objectives, assumption, types of discriminant analysis, definition of some technical terms, the significance of the discrimant function, interpretation and validation of results.

Discriminate analysis

Discriminant analysis is a multivariate statistical technique commonly used to build a predictive or descriptive model of group discrimination based on observed independent variables and to classify each observation into one of the groups. In other words, the technique is used to model the value of a dependent categorical variable based on its relationship to one or more predictors.

Given a set of independent variables, also called discriminant variables, discriminant analysis attempts to find linear combinations of those variables that best separate the groups of cases. These combinations are called discriminant functions and have the form:

$$D = b_1X_1 + b_2X_2 + \ldots + b_nX_n + c$$

where

D = discriminant function;

X_i=discriminating functions;

b_i= discriminant coefficients;

c= constant

The procedure automatically chooses a first function that will separate the groups as much as possible. It then chooses a second function that is both uncorrelated with the first function and provides as much further separation as possible. The procedure continues adding functions in this way until reaching the maximum number of functions as determined by the number of predictors and categories in the dependent variable (George, 1984)

Objectives of discriminant analysis

The common objectives of discriminant analysis are:

i. to investigate differences between groups,
ii. to identify important discriminating variables,
iii. to perform hypothesis testing on the differences between the expected groupings, and
iv. to classify new observations into pre-existing groups.

Assumptions

The discriminant analysis model has the following assumptions:

- Normality of multivariate distributions – the predictor variables must have normal multivariate distributions.
- Homogeneity of variances (homoscedasticity) – within each group of the grouping variable, the variance of each independent variable must be the same. That is, the independent variables may have different variances between them but for the same independent variable, the variances and group means must be equal. The absence of variances homogeneity can indicate the presence of outliers in one or several groups.

- Absence of perfect multi-co-linearity – if one of the independent variables is strongly correlated with another independent variable or one of the independent variables is a function (e.g., a sum) of other independent variables, then the tolerance value for that variable will be close to 0 and the matrix will have no unique discriminant solution. The tolerance value is computed as *1 minus R-square* ($1-R^2$) of the respective variable with all other variables included in the current model. Thus, it is the proportion of variance that is unique to the respective variable.

The model has a linear combination of the form:

$$d = \sum b_i x_i$$

where x_i = discriminant variables and b_i = discriminant coefficients or weights determined such that the groups differ on the values of the discriminant function d. This occurs at the maximum of the ratio

$$\lambda = \frac{\text{Sum of Squares between groups } (\text{SS}_\text{b})}{\text{Sum of Squares within groups } (\text{SS}_\text{w})}$$

Types of discriminant analysis

There are basically three types of discriminant analysis: Direct, Hierarchical and Stepwise. In direct discriminant analysis, all the variables enter at once; in hierarchical discriminant analysis, the order of variable entry is determined by the researcher; and in stepwise discriminant analysis, statistical criteria alone determine the order of entry. The analysis of this study will concentrate on when all variables are entered at once.

The following technical terms used in this study are defined and explained for easy understanding of the analysis.

Canonical correlation

Canonical correlation measures the extent of association between the discriminant scores and the groups. It is a measure of association between the single discriminant function and the set of dummy variables that define the group.

Centroid

The centroid is the mean values of the discriminant scores for a particular group. There are as many centroids as there are groups, as there is one for each group.

Classification matrix

Also called confusion or prediction matrix, it contains the number of correctly classified and misclassified cases. The correctly classified cases appear on the diagonal, because the predicted and actual groups are the same. The off-diagonal elements represent cases that have been incorrectly classified. The sum of the diagonal elements divided by the total number of cases represents the *hit ratio.*

Discriminant function coefficients

The discriminant function coefficients (unstandardized) are the multipliers of variables, when the variables are in the original units of measurement.

Discriminant scores

The unstandardized coefficients are multiplied by the values of the variables. These products are summed up and added to the constant term to obtain the discriminant scores.

Eigenvalue

For each discriminant function, the eigenvalue is the ratio of between-group to within-group sums of squares. Large eigenvalues imply superior functions.

F values and their significance

These are calculated from a one-way ANOVA, with the grouping variable serving as the categorical independent variable. Each predictor, in turn, serves as the metric dependent variable in the ANOVA.

Pooled within-group correlation matrix

The pooled within-group correlation matrix is computed by averaging the separate covariance matrices for all the groups.

Standardized discriminant function coefficients

These are the discriminant function coefficients and are used as the multipliers when the variables have been standardized to a mean of 0 and a variance of 1.

Structure correlations

Also referred to as discriminant loadings, they represent the simple correlations between the predictors and the discriminant function.

Wilks' λ

The ratio of the within-group sum of squares to the total sum of squares. Its value varies between 0 and 1. Large values of λ (near 1) indicate that group means do not seem to be different. Small values of λ (near 0) indicate that the group means seem to be different.

The significance of the discriminant function

The significance of the estimated discriminant function is based on the value of Wilks' λ. The null hypothesis that, in the population, the means of all discriminant functions in all groups are equal can statistically be tested based on the Wilks' λ.

For each discriminant variable we test

$$H_o : U_1 = U_2 \text{ against } \quad H_1 : U_1 \neq U_2$$

The test statistic is the Wilk's lambda (Λ) given by

$$\Lambda = \frac{SS_w}{SS_t}$$

The smaller the value of Λ, the greater the probability that H_o is rejected.

The significance of Λ, is assessed by an F- ratio transformation

$$F = \left(\frac{1-\Lambda}{\Lambda}\right)\left(\frac{n_1 + n_2 - p - 1}{p}\right)$$

For a univariate test where we compare one variable from each group, $p = 1$ with $n_1 + n_2 - p - 1$ degrees of freedom, the distribution of F is given as $F \sim f_{p, n_1 + n_2 - p - 1}$ where if $F_{cal} > F_{(\alpha)}$, we reject H_o and conclude that the means are not equal in the two groups.

If several functions are tested simultaneously (as in the case of multiple discriminant analysis), The Wilks' λ statistic is the product of the univariate λ for each function. The significance level is estimated based on a chi-square transformation of the statistic.

The test statistic in the generalized Wilk's lambda Λ is given by

$$\Lambda = \frac{|SSCP_w|}{|SSCP_t|}$$

This can be approximated as

$$\chi^2 = -\left[\frac{n-1-(P+G)}{2}\right]\ln\Lambda$$

for two group discriminant analysis

where $\chi^2 \sim \chi^2_{P(G-1)(\alpha)}$

P = number of variables in the groups

G = number of groups.

Interpretation of the results

The interpretation of the discriminant weights or coefficients for a particular predictor depends on the other predictors included in the discriminant function. The signs of the coefficients are arbitrary, but they indicate which variable values result in large and small function values and associate them with particular groups.

Given the multicollinearity in the predictor variables, one can obtain some idea of the relative importance of the variables by examining the absolute magnitude of the standardized discriminant function coefficients. Generally, predictors with relatively large standardized coefficients contribute more to the discriminating power of the function, and are therefore, more important.

The relative importance of the predictors can also be obtained by examining the structure correlations, also called canonical loadings or discriminant loadings. The observed correlations between each predictor and the discriminant function represent the variance that the predictor shares with the function. The greater the magnitude of a structure correlation, the more important is the corresponding predictor (Grimm, 1995)

The validity of the discrminant analysis

The validity of the discriminate analysis will be done using two groups of samples, the analysis sample and validation or holdout sample. The analysis sample is used for estimating the discriminant function, whilst the validation sample is used for developing the classification matrix. The discriminating weights, estimated by using the analysis sample, are multiplied by the values of the predictor variables in the holdout sample to generate discriminant scores for the cases in the holdout sample. The cases are then assigned to groups based on their discriminant scores and appropriate decision rule. The hit ratio, or the percentage of cases correctly classified, can then be determined by summing the diagonal elements and dividing by the total number of cases.

CHAPTER THREE

PRELIMINARY ANALYSIS

Introduction

The data was first explored to observe the characteristics of the households. The tools used in the exploration include percentage distribution of the independent or discriminating variables and cross tabulation to assess the variables influence on registration behaviour of households. In all, there were 3,545 households successfully interviewed but 3,465 households were used in the analysis as 80 households had no response for the dependent variable. The software used for the analysis is Statistical package for social scientist version 11.5 (SPSS 11.5).

Percentage distribution of variables

Tables 24 to 37, in the Appendix, show the percentage distribution of the discriminating variables in the households. Table 24 shows the distribution of birth registration in the households surveyed. The table indicates that about half of the households (50.3 %) interviewed had registered the birth of their children. The distribution of highest level of school attended by household heads is shown in Table 25 which indicates that 50% of household heads have middle/JSS as the highest level of school attended with 12.2 % going beyond this level.

Table 26 indicates the distribution of the households' participation in national day immunization programmes. It is apparent from this table that about 72% of the households who participated in the national immunization day programmes had already registered the birth of their children. Table 27 shows that about a third (29.2%) of the households in the survey was sampled from urban communities. The rest (70.8%) were from rural communities. The regional distribution of the households (Table 28) show that with the exception of Central (7.6%), Volta (6.8%) and Brong Ahafo (7.0%) regions, the other regions contributed about 10 % each to the sample frame with Northern region contributing 17 %, Ashanti 12% and the Upper East 11%. The distribution of the religion of head of household is shown in Table 29.

Most of the household heads were Pentecostal Charismatic (23.2%) followed by Moslem household heads (22.8%). Tables 31 and 34 indicate that about three in every four households (74.7%) interviewed had access to a radio set with one in every four (25.4%) having access to a TV set. Table 32 shows most of the mothers (48.6%) in the households have no education. A quarter of them (25%) have up to middle or JSS education, 19 percent had primary education and 6 percent had beyond secondary education. Table 33 shows the Wealth index quintile of the households in the study. The table shows that nearly three quarters (74.6%) of the households lie in the poorest to middle quintile with the remaining quarter in the fourth to richest quintile.

Cross tabulation of variables and birth registration

Table 1 shows the highest level of school attended by household head and the likelihood of registering the birth of their children.

Table 1: Educational level of household head and birth registration

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✋⑥	🗔🗌 🗐🗌	🗌🗋🗐 🖶	🗔🗌🗐🗑	🗍🖭🗐🗔
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For households whose heads have had secondary education and beyond, as high as 81 % of them had registered their children. Household heads with primary as the highest level of education, 1.6% of them did not know (DK) whether the children in the household were registered or not. What is interesting in this table is that for household heads who have no formal education quite a sizeable percentage (60%) had registered their children. This finding is unexpected because from secondary+ education down to primary education, there is a consistent pattern of decreasing registration with lower level of education.

Table 2 shows the percentages of households who participated in national day immunization programmes and birth registration. These programmes are designed by the Ministry of Heath to provide immunization services to children who might have missed normal sessions. On such occasions children are brought out to receive the service at no cost.

Table 2: Participation in national immunization day programme and birth registration.

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The table shows that children in households who participate in such programmes (53.6%) are more likely to be registered compared to their peers in households who do not participate (42.1%) in such programmes.

Gender is an important variable associated with a great many attitudes and behaviours. The role of gender of household head and the likelihood of birth registration is show in Table 3.

Table 3: Gender of household head and birth registration

✌🙘⑩ 🙜🙚⓪③🙟⍰⑩ 🙝⓪⑨⓿🙚 🙝🙞 🙞⑤ ⑨🙞🙙⓪⑩⓿🙞⑨🙞🙟☞	☒🙞❹ ⑥🙙 🙚⑥❶⑩🙞🙚⑥③ 🙟 🙚🙞🙘🙟 ✆✂🗋	
	☟🙘③🙞	☝🙞④🙘③🙞
🙐🙞⑩	▢🗍🗐🗔	🗔🖭🗐📋
✋⑥	🗔🖷🗐⊙	🗔🖭🗐🖶
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Table 3 shows that male headed households are more likely to register the birth of their children (51.4%) compared to female headed households (49.2%). The effect of location of household and birth registration is shown in Table 4. The table shows that households located in urban areas are more likely to register their children (70.4%) compared to households in rural areas (42.1%).

Table 4: Location of household and birth registration.

✌🙘⑩ 🙜🙚⓪③🙟⍰⑩ 🙝⓪⑨⓿🙚 🙝🙞 🙞⑤ ⑨🙞🙙⓪⑩⓿🙞⑨🙞🙟☞	☒🙞❹ ⑥🙙 🙚⑥❶⑩🙞🙚⑥③ 🙟 🙚🙞🙘🙟 ✆✂🗋	
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Table 5 shows the regional location of households interviewed in the study and birth registration of the households.

Table 5: Regional location of household and birth registration.

♦♋⑩ ♊ ♌⓪③♋'⑩ ♊⓪⑨⓿ ♌ ♊♌♌ ⑤ ⑨♌♎⓪⑩ ⓿♌⑨♌♋ ☞	⊘♌⑩⓿♌⑨⑤	♌♌⑤⓿⑨♋③	☜▤⓿☛♊⑨♋	⊗⑥③⓿♋	☛♋⑩⓿♌⑨⑤	☛⑩♌♋⑤⓿⓪	♌⑨⑥⑤♌☛♌♋♌⑥	♌⑥⑨⓿♌	⊗⑦⑦♌⑨☛♋⑩⓿	⊗⑦⑦♌⑨⊘♌⑩⓿
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	🗐	🗐	🖶	🗐			🗐	🗐	🗍	🗍
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	▯🗐	🖷	🗐	▭	🗐🗍	🗐▭	🗍	▯🗐	🖷	🗒🗐
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		⊙	🗐	🗐			⊙	📼	🗐🗑	▢
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	▯🗐	▯🗐	▯🗐	▯🗐	🗐▯	🗐▯	▯🗐	▯🗐	▯🗐	▯🗐

Across the regions, (Table 5) children in households in Greater Accra have a greater chance of their birth being registered (70.6%) compared to children in all other regions. That is, for every 10 children in Greater Accra, 7 of them stand the chance of their birth being registered. The chances of registration for children in the Ashanti region are 6 out of every 10 children

(56.7%). Children in the Central (51.5%) and the Upper East (51.0%) regions are more likely to be registered than not. However, children in households in the Eastern, (35%) and the Volta (44.1%) regions do not have a brighter chance of being registered compared to their counterparts in the other regions.

Table 38 in Appendix shows the number of cases in each of the two categories of the dependent variable; their mean, standard deviation and mean difference. The table is quite revealing in several ways. First it shows the two categories are more widely separated in terms mother tongue of household head (6.0) followed by highest level of school attended by head of household (3.74), Wealth index quintiles (0.87) and religion of household head (2.24) than the other variables. Secondly, the standard deviations of these variables are also quite large. Finally, the difference between the two categories on access to radio is small (0.09) and in terms of sex of household head (0.02) there appears to be no difference at all.

Religion often has a powerful impact on ones attitude or behaviour. Table 39 in the Appendix shows the religion of the head of household and the registration status of children in the household. From the table, children in households headed by Jehovah witness and 'other religion' have a 7 to 3 (71% - yes to 28.6% - no) chances of being registered followed by children of Moslem parents (59%) and Deeper life (58.3%) faith. On the other hand, children in households headed by traditionalist (33.4%) and where the head has no religion (33.3%) are less likely to be registered.

Table 40 in the Appendix shows the mother tongue or the language spoken by the head of household and registration of children in the household. From the table it appears that households where the head speaks Ga (74%) are more likely to register their children than the others languages. This is followed by Dagbani (67.3%) and Mamprusi (65.8%) speaking household heads in that order. The table also shows Sefwi (18.8%) speaking household heads are less likely to register the birth of their children.

Table 6 shows the impact of ethnic affiliation of the head of households in determining whether or not the birth of children in that household will be registered.

Table 6: Major ethnic group of household and birth registration

Has child's birth been registered?	Major ethnic group (%)							
	Akan	Ga/Dangme	Ewe	Guan	Gruma	Mole Dagbani	Grusi	Other ethnic groups
Yes	54.8	50.3	45.6	55.5	52.8	53.1	47.3	32.4
No	44.4	47.2	52.9	43.4	47.2	46.1	52.7	66.8
DK	0.9	2.6	1.6	1.2	0.0	0.8	0.0	0.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

From Table 6 it appears that children in households of Ewe tradition (45.6%), Grusi (47.3%) and other minority groups (32.4%) have a less than 50-50 chance of their birth being registered. However, this cannot be said of children in households of Guan (55.5%), Akan (54.8%), Mole Dagbani (53.1%) and Gruma (52.8%) traditions.

Radio and TV are two of the primary means by which information is delivered to the public. Tables 7 and 8 show children in households that have access to radio (53.1%) and TV (71.5%) have a greater chance of being registered compared to their counterparts from households that do not have access to radio (42.1%) and TV (43.2%).

Table 7: Household's access to radio and birth registration.

[illegible]	[illegible]	
	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Table 8: Household's access to TV and birth registration

[illegible]	[illegible]	
	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

Table 9 shows the educational level of the mother in the household and whether children in the household are registered.

Table 9: Educational level of mother in household and birth registration

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It can be seen from Table 9 that households with mothers who have secondary and beyond education about 81% registered their children. In other words children born to such households have about 8 to 2 chances that their births will be registered. However, Children in households whose mothers have primary or no education have less than a 50-50 chance of their birth being registered. Clearly, it can be seen that there is a consistent pattern of increasing registration with higher level of education.

Wealth index is a common component of social class. Table 10 presents the wealth index quintile of the households and their birth registration behaviour.

Table 10: Wealth index quintile and birth registration

Was child's birth been registered?	Wealth index quintile (%)				
	Poorest	Second	Middle	Fourth	Richest
Yes	34.8	40.5	57.7	65.0	81.3
No	64.3	58.3	41.0	34.0	18.2
DK	0.9	1.2	1.2	1.0	0.5
Total	100.0	100.0	100.0	100.0	100.0

The Table 10 shows a clear trend of increasing registration of birth with higher wealth index quintile. Where as only 34.8% of households in the poorest quintile registered their children, as high as 81.3% of households in the richest quintile registered their children.

Summary

In general about half of the households interviewed had registered their children. The educational background of the household heads show about half of them had middle/JSS as the highest level of school attended. Nearly three quarters of the households in the study participated in national immunization day programmes. Most of the households (70.8%) in the study were located in rural areas. In terms of religion, Pentecostal Charismatic household heads were in the majority (23.2%) followed by Moslem headed households

(22.8%). About three quarters of the households interviewed had access to radio with only one quarter having access to a TV set. A little over half of the mothers in the households surveyed had no education with just six percent going beyond the secondary school level. The two categories appear to be widely separated in terms of mother tongue of household head, than any of the other variables

Cross tabulation of the registration behaviour of the households and the predictor variables revealed a number of interesting results. Household heads with more than secondary education show a greater tendency to register the birth of their children than household heads with no education. Children in households who participate in national day immunization programmes have more than fifty percent chance of their birth being registered than children in households who do not participate in such programmes. Male headed households have a slight edge over their female counterparts in the registration of their children's birth.

Households in urban communities were more likely to register their children than those in rural communities. Children in households in Greater Accra have the highest chance of their birth being registered with those in Eastern and Volta regions having the least chance. Children in households headed by Jehovah witness faith have a greater chance of being registered than households whose heads have no religion or are traditionalist. Household heads who speak the Ga language have a greater tendency to register their children than those who speak Sefwi.

Households with access to Radio and TV tend to register their children than households who do not have such access. The higher the educational level of the mother of the household, the greater the chances of children in that household to be registered. The higher a household is on the wealth index quintile the greater the chances of children in the household to be registered.

CHAPTER FOUR

FURTHER ANALYSIS

Introduction

From the preliminary analysis it was realized that a number of variables have impact on whether or not a household will register the birth of their children. In chapter 4 we will accumulate them in a composite measure using discriminant analysis to establish the most powerful differences between the identified groups of the dependent variable. In other words, to determine which variables are best predictors of a household’s behaviour in terms of birth registration. SPSS was used for the analysis. The outputs of the analysis after applying discriminant analysis are as follows:

Table 11 shows the test of F for Wilks’s Lambda and F ratios with their significant values. The tests of equality of group means measure each independent variable’s potential before being put together to create the model.

From Table 11, the test statistic F is significant ($F < 0.05$) for 9 out of the 13 independent variables. The significant variables are; Vaccination Card for child (X_1), Highest level of school attended by head of household (X_3), Location of household (X_4), Religion of head of household (X_6), Household's access to Radio (X_9), Household's access to TV (X_{10}), Mother in household's Education (X_{11}), Wealth index quintile of Household (X_{12}) and Participation in national immunization day programme (X_{13}). This means that these variables have a high potential of contributing to the model or when considered individually, they significantly differentiate between the registration behaviour of the households interviewed.

Table 11: Tests of equality of group means

Independent Variables	Wilks' Lambda	F ratio	df1	df2	Sig.
(X_1) Vaccination Card for child	0.984	29.54	1	1770	.000*
(X_2) Sex of head	1.000	0.57	1	1770	.452
(X_3) Highest level of school by head	0.963	68.89	1	1770	.000*
(X_4) Location of household (rural or urban)	0.939	115.64	1	1770	.000*
(X_5) Region	1.000	0.25	1	1770	.621
(X_6) Religion of head	0.997	5.45	1	1770	.020*
(X_7) Mother tongue of head	1.000	0.67	1	1770	.415
(X_8) Major ethnic group of head	1.000	0.29	1	1770	.589
(X_9) Access to Radio by household	0.988	21.46	1	1770	.000*
(X_{10}) Access to Television by household	0.949	95.42	1	1770	.000*
(X_{11}) Mother's education	0.957	80.05	1	1770	.000*
(X_{12}) Wealth index quintiles	0.894	209.17	1	1770	.000*
(X_{13}) Participation in national immunization day programme	0.996	7.78	1	1770	.005*

*significant values

The F ratios of the variables Sex of head of household (X_2), Region of household (X_5) Mother tongue of head (X_7) and Major ethnic group of head

(X_8) however, show that they are not significant, that is they do not contribute substantially to the model and therefore should be eliminated from the model.

Wilks' lambda is another measure of a variable's potential at discriminating between groups. Smaller values indicate the variable is better at discriminating between groups or categories. From Table 11, the variable Wealth Index quintile of household (0.894) is the best in discriminating between the groups because it has the smallest Wilks' lambda value. This is followed by Area or location of household (0.939), then household's Access to TV (0.949), Mother's education (0.957) and Highest school of household head (0.963) in that order.

A key assumption of discriminant analysis is that the independent variables should not be highly correlated. Table 12 (Correlation matrix) shows the pooled within-group correlation matrix between the independent variables. Generally, the inter-correlations are low for most of the variables except for the variable Education of mother in household and highest level of education of head of household (0.893), Major ethnic group and Mother tongue of head of household (0.813) which are quite high. A possible explanation is, if the mother in household happens to be the head of household then there will be high relationship between these two variables. Apart from these variables multicollinearity in general is not likely to be a problem. There is also quite a strong negative relationship between Wealth index quintile of household and area of location of household (-0.631) and Wealth index quintile of household and Access to TV of household (-0.602).

Table 12: Correlation matrix (Pooled Within-Groups Matrices)

Independent Variables	Vaccination card for child	Sex of head	Highest school by head	Location (rural or urban)	Region	Religion of head	Mother tongue	Major Ethnic group	Access to Radio	Access to TV	Mother’s Education	Wealth Index quintile	Participation in immunization day programs
Vaccination card for child	1.000	-0.017	-0.021	0.004	-0.015	0.017	-0.008	0.002	0.033	0.043	-0.039	-0.046	0.046
Sex of head	-0.017	1.000	-0.014	0.015	-0.011	0.014	0.013	-0.002	-0.011	0.045	-0.005	-0.019	0.010
Highest level of school by Head	-0.021	-0.014	1.000	-0.206	-0.027	-0.133	-0.057	-0.062	-0.104	-0.254	**0.893**	0.360	-0.022
Area	0.004	0.015	-0.206	1.000	0.103	0.083	0.077	0.093	0.073	0.412	-0.198	**-0.631**	0.072
Region	-0.015	-0.011	-0.027	0.103	1.000	0.027	0.321	0.474	0.042	0.066	-0.049	-0.178	-0.044
Religion of head	0.017	0.014	-0.133	0.083	0.027	1.000	0.056	0.067	0.036	0.138	-0.139	-0.152	0.036
Mother tongue of head	-0.008	0.013	-0.057	0.077	0.321	0.056	1.000	**0.813**	0.020	0.059	-0.091	-0.158	-0.005
Major ethnic group	0.002	-0.002	-0.062	0.093	0.474	0.067	**0.813**	1.000	0.007	0.046	-0.091	-0.168	-0.023
Access to Radio	0.033	-0.011	-0.104	0.073	0.042	0.036	0.020	0.007	1.000	0.219	-0.097	-0.223	-0.005
Access to TV	0.043	0.045	-0.254	0.412	0.066	0.138	0.059	0.046	0.219	1.000	-0.247	**-0.602**	0.041
Mother's education	-0.039	-0.005	**0.893**	-0.198	-0.049	-0.139	-0.091	-0.091	-0.097	-0.247	1.000	0.354	-0.004
Wealth index quintiles	-0.046	-0.019	0.360	**-0.631**	-0.178	-0.152	-0.158	-0.168	-0.223	**-0.602**	0.354	1.000	-0.065
Participation in immunization day programs	0.046	0.010	-0.022	0.072	-0.044	0.036	-0.005	-0.023	-0.005	0.041	-0.004	-0.065	1.000

The test of equality of covariance across the groups indicated a significant Box *M* (Table 43 in Appendix). This means an unequal covariance exits across the groups. Such a result leads to over classification in the groups with a large covariance. In such a case running a second analysis is a good check to determine whether using 'separate-groups' option covariance matrix gives radically different classification results. Tables 13 and 14 show the classification results of the analysis using 'within groups' and 'separate groups' options.

Table 13: Classification Results for 'within groups' option

Has child's birth been registered?		Predicted Group Membership		
		Yes	No	Total
Original Count	Yes	732	1012	1744
	No	256	1431	1687
	Ungrouped cases	5	29	34
%	Yes	42.0	58.0	100.0
	No	15.2	84.8	100.0
	Ungrouped cases	14.7	85.3	100.0

Table 13 shows the results of the first run of the analysis selecting 'within group' option. The table indicates a hit ratio, or the percentage of cases correctly classified as [(732+1431) / 3431] * 100 = 63.0%.

Table 14 shows the re-run of the analysis selecting 'separate groups' option. The hit ratio in the re-run is [(705 +1444) / 3431] * 100 = 62.6%

The first (Table 13) and second (Table 14) runs of the analysis showed that the classification results did not changed much. With such results the assumption of equality of covariance across the groups can still be maintained. The test of null hypothesis of equal population covariance matrices, Box *M*, can be overly sensitive to especially large data files, which is likely to have happened in this instance.

Table 14: Classification results for 'separate groups' option

Has child's birth been registered?		Predicted Group Membership		
		Yes	No	Total
Original Count	Yes	705	1039	1744
	No	243	1444	1687
	Ungrouped cases	4	30	34
%	Yes	40.4	59.6	100.0
	No	14.4	85.6	100.0
	Ungrouped cases	11.8	88.2	100.0

Classification function coefficients

The next set of tables further discusses the combination of the independent variables which best discriminate between the categories of the dependent variable groups. The calculated score on the unstandardized canonical discriminant function coefficients (Table 15) is as shown.

Table 15: Canonical discriminant function coefficients

Independent Variables	Function 1
(X_1) Vaccination card for child	-0.499
(X_2) Sex of head	-0.059
(X_3) Highest level of school by household head	-0.009
(X_4) Area	-0.403
(X_5) Region	0.037
(X_6) Religion of head	0.002
(X_7) Mother tongue of head	-0.006
(X_8) Ethnic group	0.067
(X_9) Access to Radio	-0.211
(X_{10}) Access to Television	-0.070
(X_{11}) Mother's education	0.528
(X_{12}) Wealth index quintiles	0.507
(X_{13}) Participation in national immunization day	-0.075
(Constant)	-2.035

Unstandardized coefficients

The unstandardized coefficients are multiplied by the values of the variables. These products are summed and added to the constant term to obtain the discriminant scores.

$$\text{Discriminant score} = -2.035 - 0.499(X_1) - 0.059(X_2) - 0.009(X_3) - 0.403(X_4) + 0.037(X_5) + 0.002(X_6) - 0.006(X_7) + 0.067(X_8) - 0.211(X_9) - 0.070(X_{10}) + 0.528(X_{11}) + 0.507(X_{12}) - 0.075(X_{13})$$

Table 43 (Appendix) shows the mean of the discriminant score for each group. Group 1 (household registered their children) has a positive value of 0.341, whereas Group 2 (household did not register their children) a negative value of -0.453. With the assignment of the Predicted Group membership, a new variable Dis1_1 was created which assigned discriminant scores greater or equal to 0 to Group1 and negative scores to Group 2.

For a two-group analysis, only one function is needed to discriminate, thus one eigenvalue which will explain 100% of the variance. The Canonical correlation (Table 44 in Appendix) measures the association between the discriminant scores and the groups. It gives an indication on how well the discriminant model discriminates between the groups; a high value (near 1) shows that the function discriminates well. Table 44 in the Appendix, shows a canonical correlation of 0.366. The square of this correlation $(0.366)^2 = 0.134$, indicates that 13% of the variance in the dependent variance is explained or accounted for by this model. This is consistent with Wilk's lambda value in Table 44 in the Appendix which shows the proportion of the total variance (87%) in the discriminant scores not explained by differences among groups.

A small lambda value (near 0) indicates that the group's mean discriminant scores differ indicating a greater discriminatory ability of the function. The confirmation of the discriminatory ability depends on how significant is the follow up Chi-square test. Table 45 in the Appendix shows a Chi-square test with *p*-value of 0.000 indicating a high significant difference between the groups' centroids. This is a necessary condition for the interpretation of the analysis.

To determine the impact of each independent variable on the discriminant function, the different units of the independent variables are first standardized by converting them to the same units. Table 16 shows the impact of each variable on the discriminant function after 'standardising' Generally, variables with relatively large standardized coefficients contribute more to the discriminating power of the function, as compared with variables with smaller coefficients, and are, therefore more important. In other words, coefficients with large absolute values correspond to variables with greater discriminating ability. Given the low inter-correlation between the variables we can safely use the magnitudes of the standardized coefficients to suggest that Wealth index quintile of Household (0.650) has the greatest impact followed by mother's education (0.342) and vaccination card for child (0.279).

Table 17 is a structure matrix and its shows the correlation (in order of importance) of each independent variable with the discriminant function. It is pooled within-groups correlation between the discriminating variables and the standardized canonical discriminant function. In this instance the location of household was identified as the second most important variable based on the structure correlations. However, it is not the second most important variable based on the absolute magnitude of the standardized discriminant function coefficient. This anomaly could be attributed to multicollinearity.

Table 16: Standardized canonical discriminant function coefficients

Independent Variables	Function 1
Vaccination card for child	0.279
Sex of head	-0.029
Highest school attended by household head	-0.085
Area	-0.192
Region	0.093
Religion of head	0.016
Mother tongue of head	-0.152
Major ethnic group	0.268
Access to Radio	-0.084
Access to Television	-0.037
Mother's education	0.342
Wealth index quintiles	0.650
Participation in national immunization day programme	-0.092

Table 17: Correlation of each variable to the discriminant function

Independent Variables	Function 1
Wealth index quintiles	0.874
Area	-0.650
Access to Television	-0.590
Mother's education	0.541
Highest school attended by household head	0.501
Vaccination card for child	-0.328
Access to Radio	-0.280
Participation in national immunization day programme	-0.169
Religion of head	-0.141
Mother tongue of head	-0.049
Sex of head	-0.045
Major ethnic group	0.033
Region	0.030

Classification results

Classification results are a simple summary of the number of and percent of subjects classified correctly and incorrectly. A case is considered to be classified correctly if, by the discriminant function score, it is included in the group to which it actually belongs. Table 18 shows there is an improvement in the accuracy of classification of the model with all 13 variables (62.8%) compared to 59.8% accuracy in Table 19 when only one variable (highest level of school attended by head of household) was considered. This however, does not suggest that as more variables are included in discriminant analysis the accuracy automatically improves. The calculation of these percentages is obtained by summing the diagonal elements divided by the total number of cases. For example in Table 18 the sum of the diagonal elements is 722 +1433. This is then divided by the number of cases and multiplied by 100 to obtain 62.8 %.[(722+1433) / 3431]*100 = 62.8%.

Table 18: Classification results for all 13 independent variables

Has child's birth been registered?		Predicted Group Membership		
		Yes	No	Total
Original Count	Yes	722	1022	1744
	No	254	1433	1687
	Ungrouped cases	4	30	34
%	Yes	41.4	58.6	100.0
	No	15.1	84.9	100.0
	Ungrouped cases	11.8	88.2	100.0

Table 19: Classification Results for one variable (Highest school by head of household)

Has child's birth been registered?		Predicted Group Membership		
		Yes	No	Total
Original Count	Yes	706	310	1016
	No	405	356	761
	Ungrouped cases	6	11	17
%	Yes	69.5	30.5	100.0
	No	53.2	46.8	100.0
	Ungrouped cases	35.3	64.7	100.0

Percentage of original grouped cases correctly classified. [(706+356) / 1777]*100 =59.8%

To determine whether the discriminatory power was just by chance (50% assignment) or statistically better, a Binomial test with p=0.5 was performed to assess the accuracy obtained. This involved comparing the 62.8% (Table 18) success to a 50% chance assignment. To perform the analysis, a new variable to specify whether the classification was correct for that case was first created. Table 20 shows the Binomial test results indicating that the accuracy of 63 % is statistically different from a 50-50 % chance of classification. In other words using the discriminant analysis model, a significantly better classification of the households was achieved than by a purely random process.

Table 20: Binomial Test

CORRECT	Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
Group 1	0	1293	0.37	0.50	0.000(a)
Group 2	1	2163	0.63		
Total		3456	1.00		

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Validation of results

The results so far obtained are applicable to the sample used. To test whether the discriminant model has both external and internal validity a cross-validation check on the tendency to inflate the accuracy if only the sample is used was conducted. Cross validation is done only for those cases in the analysis. In cross validation, each case is classified by the functions derived from all cases other than that case. Table 21 provides a ‘leave-one-out’ classification as a cross-validation check for group cases correctly classified as 62.6%. This was calculated as [(729 + 1413) / 3422]*100 = 62.6% (Lancaster, B.P. 1999).

Compared to Table 18, the accuracy of classification was found to be about the same (62.8%). The table also shows that 63.2% of original grouped cases were correctly classified. [(742 +1421) / 3422] *100 = 63.2%

Table 21: Classification results for leave-one-out cross-validation

Has child's birth been registered		Predicted Group Membership		
		Yes	No	Total
Original Count	Yes	742	994	1736
	No	265	1421	1686
	Ungrouped cases	4	30	34
%	Yes	42.7	57.3	100.0
	No	15.7	84.3	100.0
	Ungrouped cases	11.8	88.2	100.0
Cross-validated Count	Yes	729	1007	1736
	No	273	1413	1686
%	Yes	42.0	58.0	100.0
	No	16.2	83.8	100.0

Using the test and holdout samples in cross validation

SPSS was used to select 50% of the cases as the test sample and a new variable with codes 1 or zero was created. Table 22 shows the test-retest results with ‘leave-one-out’ classification option. The results indicate that 62.6% of selected original grouped cases were correctly classified ((538+964)/2401*100 = 62.6%), 65.2% of unselected original grouped cases were also correctly classified ((210+456)/1021*100=65.2%) and 62.1% of selected cross-validated grouped cases also correctly classified ((532+960)/2401*100=62.1%). The three results show consistency with when the whole sample was used. Thus our discrimination equation obtained from the whole sample could be used to 'discriminate' new cases.

Table 22: Test – Retest classification results

Has child's birth been registered?			Predicted Group Membership		
			Yes	No	Total
Cases Selected	Original Count	Yes	538	713	1251
		No	186	964	1150
		Ungrouped cases	3	18	21
	%	Yes	43.0	57.0	100.0
		No	16.2	83.8	100.0
		Ungrouped cases	14.3	85.7	100.0
Cross-validated	Count	Yes	532	719	1251
		No	190	960	1150
	%	Yes	42.5	57.5	100.0
		No	16.5	83.5	100.0
Cases Not Selected	Original Count	Yes	210	275	485
		No	80	456	536
		Ungrouped cases	1	12	13
	%	Yes	43.3	56.7	100.0
		No	14.9	85.1	100.0
		Ungrouped cases	7.7	92.3	100.0

Table 23 shows Fisher's discriminating functions (classification function coefficients) which gives the weights of each independent variable for the individual group. Classification of new cases is based on Fisher's score for each group. A score for each case on each group's classification function is calculated and the case is assigned to the group by using the highest score.

Table 23: Fisher's discriminating functions (Classification Function Coefficients)

Independent Variable	Has child's birth been registered?	
	Yes	No
Vaccination card for child	3.982	4.270
Sex of head	6.435	6.480
Highest level of School by head	-0.829	-0.788
Area	15.632	15.857
Region	0.091	0.064
Religion of head	0.195	0.193
Mother tongue of head	-0.164	-0.159
Major ethnic group	1.988	1.917
Access to Radio	9.908	9.960
Access to Television	13.358	13.438
Mother's education	6.389	6.091
Wealth index quintiles	9.976	9.560
Participation in national immunization program	0.584	0.665
(Constant)	-77.067	-75.055

Summary

The F-ratios for the highest level of school attended by head of household, mothers education, location of household, access to radio and TV and wealth index quintile were significant meaning when considered individually they have a high potential of contributing to the model in differentiating between the registration behaviour of the households. On the other hand, F ratios of the variables sex, religion and ethnicity of household heads are not significant meaning when considered individually they do not contribute much in differentiating between the two categories.

Wilk’s lambda, another measure of a variable’s potential, indicated wealth index quintile of a household as the best in discriminating between the two groups followed by area of location , access to TV and mother’s education in that order.

The inter-correlation between the variables was found to be generally low except for education of mother and education of head of household and mother tongue and ethnicity. Quite a strong negative relationship between wealth index quintile of household and area of location of household was also observed. The test of equal population covariance matrices was found to be significant. This however, was not of great concern as a re-run of the analysis selecting ‘within groups’ and ‘separate groups’ options showed no significant change in classification results.

The results further show that the association between the discriminant score and the groups was not strong. However, the chi-square test indicated a high significant difference between the group centroids. The independent variable, wealth index quintile of household head, showed the greatest impact on the discriminant function followed by area of location of household. Wealth index quintile again, had the strongest correlation with the discriminant function.

The model showed a discriminating power of 63% of original group cases correctly classified. The cross-validation of the classification results supported the 63% of original group cases correctly classified.

CHAPTER 5

SUMMARY, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter gives a summary of the various methods employed in arriving at the factors that determine the chances of a child's birth being registered, discusses the findings and concludes with some recommendations.

Summary

This study by applying discriminant analysis method has tried to establish the most powerful factors that bring out the differences between households who have the tendency to register the birth of their children and those who do not. Again through this methodology the study managed to identify those variables which have a strong relationship with the registration behaviour of the households in the study.

In identifying the factors that determine whether a household will register the birth of its children or not, univariate and multivariate analyses were employed to differentiate between the two groups.

The distribution of the data showed that over half of the households surveyed had registered their children. In terms of education, approximately half of the household heads had middle school or JSS as the highest level of school attended. Nearly three quarters of the households participated in national immunization day programmes with 7 out of 10 located in rural areas. About three quarters of the households had access to Radio with only one quarter having access to a TV set. A little over half of the mothers in the households had no education with just over six percent going beyond the secondary level. Pentecostal Charismatic household heads were in the majority.

The preliminary analysis of the data revealed the relative contribution of each of the 13 independent variables to group differences. Household heads with higher educational background showed a greater propensity to register the birth of their children. A child living in an urban area has a greater chance of being registered than his or her counterpart in the rural area. Children in households with access to Radio and TV have a higher chance of being registered.

The discriminant analysis of the data showed that the F – ratios of nine of the independent variables indicated that they were significant. This means that when considered individually, before the creation of the over all model, these variables have significant impact in discriminating between the household's decision to register or not to register the birth of its children. The nine variables are: child in the household has a vaccination card; level of school attended by household head; region of the household; whether the household is located in the rural or urban community; level of education of mother in household; household's access to radio and TV; wealth index quintile of household and participation of national immunization day programmes. The wealth index quintile had the smallest Wilk's lambda value of 0.894 meaning taken alone, the wealth index quintile of a household is the best single independent variable to discriminant between the groups.

Generally, there were low inter-correlations between the variables except for the correlation between education of mother in household and education of household head which was quite high. Again the correlation between ethnicity of the household head and mother tongue of household head was also quite high. The values obtained for the centroids of the two groups showed a clear difference indicating that the two groups were different in terms of the independent variables.

In terms of classification, the analysis showed an overall, 63% of original group cases correctly classified from the 'leave-one out' method. This means that the model's discriminatory power is statistically different from a 50-50% chance.

Discussion

The study results collaborate with findings of previous work in this field. Prior study by the UN (July, 2007) came out with a finding that in Tanzania in 2003, children born into families in the richest 20% of the population are over 10 times more likely to be registered than those living in the poorest 20% of the households. In this study the wealth index quintile of a household was found to be a very important indicator in determining the chances of a child to be registered. Households in the upper quintile registered their children whilst those in the lower quintile failed to register their children. This suggests that families with scarce resources may be deterred by any form of fees or penalties for birth registration due to its direct costs or opportunity costs like; time, absence from work and household responsibilities.

The results further indicate that a significant positive correlation exists between a mother's educational level and her child's likelihood to be registered. As mentioned in the literature review, highly educated mothers or caretakers are usually exposed to information on legislation, importance of birth registration and how to obtain birth registration documents as they seek for health-care and education services for their children.

Another important finding is that children in households in rural communities have a lesser chance of being registered compared to their urban counterparts. This is consistent with the assertion that people living in urban areas are better informed on birth registration issues than rural dwellers. Again, accessibility difficulties to most rural communities may prevent awareness campaigns from reaching such areas and are therefore left out in such exercises.

It was observed from the study that households who had access to the media (radio and TV) where information and advice about registering births could be obtained, tendered to register their children. This observation agrees with the finding of Chalapati, Debbie & Colin, 2005 who also observed that mass media campaigns through newspapers, radio and TV create public awareness towards births and deaths registration.

The analysis further showed that children who participated in national immunization day programmes tendered to be registered, demonstrating the potential for integration between birth registration and programming for maternal and child health and early childhood development programmes. It is important to devise programmes in such a way that children who missed out in the registration of their birth on regular days, could be captured during such campaigns.

Conclusion

The study has shown that selected variables which significantly contribute to the differentiation of the groups are; child in household has a vaccination card, level of school attended by household head, location of household, whether household is located in rural or urban community, level of education of mother in household, household's access to radio and TV, and wealth index quintile of household. One of the most significant findings to emerge from this study is that the wealth index quintile of the household in which the child lives is the single most powerful factor to determine whether that child would be registered or not.

In all, these results suggest that children who have been denied the right to identity as a result of their birth not being registered tend to be in households who are poor and live in rural areas. Also, such children are likely to have been born by mothers who have low levels of formal education and are less likely to have adequate access to the media.

Recommendations

These findings suggest several courses of action for consideration. Interventions should target rural children living in poverty and their families. Where location of registration centers is a problem, it is necessary to conduct effective information campaigns that will reach all sectors of society.

Public awareness campaigns through the media and innovative programmes such as mobile or house-to-house registration campaigns at the national level should be conducted to reach rural populations and all sectors of society to boost coverage.

There should be interventions targeted at policy and legal reform to remove fees for late birth registration for all children to increase registration rates.

The finding that children who participated in national immunization day programmes tendered to be registered demonstrates the potential for integration between birth registration and programming for maternal and child health and early childhood development programmes. It is important to devise programmes in such a way that children and caregivers who seek health-care and education services are given information on how to obtain birth registration documents.

Finally, the strong correlation between the mother's educational level and her child's likelihood to be registered should inform planners to programme around the education of girls and interventions to provide information to and increase the knowledge of women and families.

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APPENDICES

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[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	

Table 25: Highest level of education of household head

	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
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Table 28: Region of household

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⦸🙞⑩⓿🙞⑨ ⑤	🗑🗍🖶	🖭🗐🗍	🖭🗐🗍
☞🙞⑤⓿⑨🙘 ③	🗋🖶🗋	🕿🗐🖶	🗍🖶🗐🕿
☝⑨🙞🙘⓿🙞⑨ ☛🙵🙵⑨🙘	🗑🗋🖶	🖭🗐🗔	🗋🖶🗐🗍
⊗⑥③⓿🙘	🗋🗑🖶	🖶🗐⊙	🗑🗋🗐🖭
☛🙘⑩⓿🙞⑨ ⑤	🗑🗑🕿	🖭🗐🕿	🗔🗋🗐🖶
☛⑩🙜🙘⑤⓿ ⓪	🗔🗍🗑	🗍🗍🗐🖭	▢🗔🗐▢
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✋⑥⑨⓿🙜🙞 ⑨⑤	▢🕿⊙	🗍🖶🗐🕿	🕿⊙🗐🗋
⊗⑦⑦🙞⑨ ☛🙘⑩⓿	🗑⊙⊙	🗍🗍🗐🗋	⊙🖭🗐🗔
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Table 29: Religion of household head

	☝⑨🙦⑧❶🙦 ⑤🙞❺	⊗🙜③⓪🙝 ✓🙦⑨🙞🙦⑤ ⓿	☞❶④❶③🙜⓿⓪ ❷🙦 ✓🙦⑨🙞🙦 ⑤⓿
☞🙜⓿🙤⑥③⓪🙞	🗔🖷🖶	🗍🗑🗐🖷	🗍🗑🗐🖷
✓⑨⑥⓿🙦⑩⓿🙜⑤⓿	🗔▯🗍	🗍🗍🗐🖶	📋▢🗐🗑
✓🙦⑤⓿🙦🙞⑥⑩⓿🙜③🗋	⊙▯🗑	📋🗑🗐📋	🗔⊙🗐▢
☞🙤🙜⑨⓪⑩④🙜⓿⓪🙞			
☚🙦🙦⑦🙦⑨ ☝⓪🙧🙦	🗍📋	▯🗐🗑	🗔⊙🗐⊙
☝🙦🙤⑥❷🙜🙤 ⃠⓪⓿⑤	📋⊙	▯🗐⊙	🗔🖭🗐🖶
🙦⑩⑩			
☒☚☛	⊙🖶	📋🗐▢	▢📋🗐🗍
☝⑥⑩③🙦④	🖷🖭🗍	📋📋🗐⊙	🖷🗔🗐🖭
☒⑨🙜🙝⓪⓿⓪⑥⑤🙜③	🗔🗔🖭	🗍🗑🗐▯	⊙🖷🗐🖭
☒⑦⓪⑨⓪⓿❶🙜③⓪⑩⓿	🗍🗑🖭	🗔🗐▯	🖭🗍🗐🖭
✋⑥ ☑🙦③⓪🙥⓪⑥⑤	📋🖷▯	🖷🗐⊙	🖭🖭🗐🖷
✗⓿🙤🙦⑨ ⑨🙦③⓪🙥⓪ ⑥⑤	🗍▯	▯🗐🗑	🗍▯▯🗐▯
	🗑🗔🖶▢	🗍▯▯🗐▯	

Table 31: Access to Radio by household

	✌⑨☙⑧❶☙⑤ ☙❺	⊗☙③⓪☙ ✓☙ ⑨☙☙⑤⓿ ☙	☞❶④❶③☙⓿⓪❷ ✓☙⑨☙☙⑤⓿
☙☙⑩	📋▭⊙⊙	🖶▭🗐🖶	🖶▭🗐🖶
✋⑥	⊙🖶🖶	📋▭🗐🗑	🗍▯▯🗐▯
☒⑥⓿☙③	🗑▭🖶▭	🗍▯▯🗐▯	

Table 32: Education of mother in household

	✌⑨☙⑧❶☙⑤ ☙❺	⊗☙③⓪☙ ✓☙ ⑨☙☙⑤⓿ ☙	☞❶④❶③☙⓿⓪❷ ✓☙⑨☙☙⑤⓿
✋⑥⑤☙	🗍🖶🖶🖶	▭⊙🗐▭	▭⊙🗐▭
✓⑨⓪④☙⑨ ❺	🖶🖶📋	🗍📼🗐▭	🖶🖶🗐⊙
❦⓪☙☙③☙ 🗋☝☒☒	📼▯▯	📋🖶🗐▯	📼🗑🗐🖶
☒☙☙⑥⑤ ☙☙⑨❺🗍	📋🗍🖶	🖶🗐🗑	🗍▯▯🗐▯
☒⑥⓿☙③	🗑▭🖶▭	🗍▯▯🗐▯	

Table 33: Wealth index quintile of household

	☝⑨৵⑧❶৵⑤ ঌ❺	⊗ଓ③⓪ꝏ ⑨ঌ৵⑤⓿	✓৵ ❷৵ ☞❶④❶③ଓ⓿⓪ ✓৵⑨ঌ৵ ⑤⓿
✓⑥⑥⑨৵ ⑩⓿	🗍☐🗑🗑	📋🖭🗐⊙	📋🖭🗐⊙
☒৵ঌ⑥⑤ ꝏ	🖭📋🗍	📋🖶🗐🖶	▭🖶🗐🗔
❡⓪ꝏꝏ③ ৵	▭🕿▭	🗍🖶🗐🖶	🕿🗑🗐☐
☝⑥❶⑨⓿ ৮	▭☐🗑	🗍🗔🗐▭	⊙🕿🗐▭
☑⓪ঌ৮ ৵⑩⓿	🗔🗑🗑	🗍📋🗐▭	🗍☐☐🗐☐
☒⑥⓿ଓ③	🗑🗔🖶▭	🗍☐☐🗐☐	

Table 34: Access to Television by household

	☝⑨৵⑧❶৵⑤ ঌ❺	⊗ଓ③⓪ꝏ ⑨ঌ৵⑤⓿	✓৵ ❷৵ ☞❶④❶③ଓ⓿⓪ ✓৵⑨ঌ৵ ⑤⓿
ɇ৵⑩	⊙🖶⊙	📋▭🗐🗍	📋▭🗐🗍
✋⑥	📋▭🖭🕿	🕿🗔🗐🖶	🗍☐☐🗐☐
☒⑥⓿ଓ③	🗑🗔🖶▭	🗍☐☐🗐☐	

Table 35: Major ethnic group of household head

	☝⑨♒⑧❶ ♒⑤❧❺	⊗❀③⓪❁ ✓♒⑨❧♒⑤ ⓿	☞❶④❶③❀⓿⓪ ❷♒ ✓♒⑨❧♒ ⑤⓿
☚②❀⑤	🗐🗐🖶🖭	🗑🗔🗐🗐	🗑🗔🗐🗐
✎❀🗋☚❀⑤☙④♒	🗐🖭▢	▢🗐🖶	🗑🖭🗐⊙
☚❸♒	🗑⊙🗔	🗐🗐🗐🗐	▢▯🗐🖭
✎❶❀⑤	🗐🖶🗑	▢🗐▯	▢▢🗐🖭
✎⑨❶④❀	⊙🖭	📋🗐🖶	▢⊙🗐🗔
❦⑥③♒ ☚❀☙❧ ❀⑤⓪	🖭▢▢	📋🖶🗐🖶	⊙🖶🗐🗐
✎⑨❶⑩⓪	🖶🗔	📋🗐🗐	⊙⊙🗐📋
×⓿♓♒⑨ ☚⓿♓ ⑤⓪❧ ☙⑨⑥❶⑦ ⑩	🗔▯🖶	🗐🗐🗐⊙	🗐▯▯🗐▯
☒⑥⓿❀③	🗑🗔🖶▢	🗐▯▯🗐▯	

Table 36: Gender of Household head

	☝⑨♒⑧❶♒⑤ ❧❺	⊗❀③⓪❁ ✓♒ ⑨❧♒⑤⓿ ❷♒	☞❶④❶③❀⓿⓪ ✓♒⑨❧♒ ⑤⓿
❦❀③♒	🗐🖶⊙🗐	▢🗐🗐🗔	▢🗐🗐🗔
✎♒④❀③ ♒	🗐🖶⊙🗔	🗔⊙🗐🖶	🗐▯▯🗐▯
☒⑥⓿❀③	🗑🗔🖶▢	🗐▯▯🗐▯	

Table 37: Vaccination card for child in households

	☝⑨⁓⑧❶⁓⑤ ℘❺	⊗ᴄᴣ③⓪ᴙ ✓⁓ ⑨℘⁓⑤⓿	☞❶④❶③ᴄᴣ⓿⓪❷ ⁓ ✓⁓⑨℘⁓⑤⓿
ℯ𝓇⁓⑩🗎 ⑩ ⁓⁓⑤	📋▭▭🖶	🖶🗑🗐☉	🖶🗑🗐☉
ℯ𝓇⁓⑩🗎 ⑤ ⑥⓿ ⑩⁓⁓ ⑤	🖶🖶▯	🗍📼🗐▯	📼📋🗐☉
✋⑥	📋🗔☉	🖶🗐📋	🗍▯▯🗐▯
☒⑥⓿ᴄᴣ③	🗑🗔🖶▭	🗍▯▯🗐▯	

[illegible]	[illegible]	✋	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	✋⑥	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	✋⑥	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	✋⑥	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	✋⑥	[illegible]	[illegible]	[illegible]	
☑[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	✋⑥	[illegible]	[illegible]	[illegible]	
☑[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	✋⑥	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	✋⑥	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	🖐⑥	🗍🖶⊙🖶	🗍🖶🗐🗑 🗑	▭🗐▯▯⊙	

Table 38: Group Statistics – Mean differences between groups

Table 38 *continued*: Group Statistics – Mean differences between groups

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 39: Religion of head of household and Child registration

✌♋⑩ ♐♏ ⓪③♌⑩ ♐⓪⑨⓿♏ ♐♒♒⑤ ⑨♒♓⓪⑩⓿ ♒⑨♒♌☞	☑♒③⓪♓⓪⑥⑤ ⑥♑ ♏♒♋♌ ✂🗋										
	👆♋⓿♏⑥③⓪♐	✓⑨⑥⓿♒⑩⓿♋⑤⓿	🗅 👆♏♋⑨⓪⑩④♋ ⓿⓪♐♒	✌♒♒⑦♒⑨ ✌⓪♑♏ ♓♒♏⑥♏♋❷ ✍⓪⓿	⑤♒⑩⑩	☒✌✌	☛⑥⑩③♒④	☒⑨♌♋⓿⓪⑤⓪⑥⑤♋③	☒⑦⓪⓪⑨⓪⓿❶♋③⓪⑩⓿	✍⑥ ☑♒③⓪♓⓪⑥⑤	⓪⑥⑤
♏♑♒⑩	🗔⊙🗐 🗍	▢🖶🗐 🖶	▢🗑🗐⊙	▢⊙ 🗐🗑	🕿🗍🗐 🗔	▢⊙🗐 🗍	▢🖭🗐☐	🗑🗑🗐🗔	🗔🖶🗐 ⊙	🗑🗑🗐🗑	🕿☐🗐 ☐
✋⑥	▢☐🗐 ⊙	🗔🗏🗐 🗔	🗔▢🗐☐	🗔🗍 🗐🕿	🗏⊙🗐🖶	🗔🗍🗐 🖭	🗔☐🗐🗍	🖶▢🗐▢	▢🗏🗐 ▢	🖶▢🗐 🖭	🗑☐🗐 ☐
☛👎	☐🗐⊙	🗍🗐☐	🗍🗐🗏	☐🗐☐	☐🗐☐	☐🗐☐	☐🗐🖭	🗍🗐🗍	☐🗐🕿	☐🗐🕿	☐🗐☐
☒⑥⓿♋③	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐	🗍☐☐

☒⑥⓿ᴄᴣ③	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□	🗍□□
	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□	🗐□

Table 40: Mother tongue of household head and child registration

Table 41: Covariance Matrices: Yes: child's birth has been registered

	Vaccination card for child	Sex of head	Highest level of school by household head	Location (urban or rural)	Region	Religion of head	Mother tongue of head	Major ethnic group	Access to Radio	Access to TV	Mother's education	Wealth index quintiles	Child participated in national immunization day
Vaccination card for child	0.243	-0.010	-0.071	0.005	-0.086	0.051	-0.428	-0.073	0.009	0.002	-0.015	-0.001	0.025
Sex of head	-0.010	0.249	-0.069	0.000	-0.055	0.037	0.460	-0.015	-0.001	0.005	0.000	-0.007	0.006
Highest level of school by household head	-0.071	-0.069	101.865	-1.007	-0.352	-13.640	-10.217	-1.968	-0.455	-1.588	6.091	4.938	-0.536
Location (urban or rural)	-0.005	0.000	-1.007	0.250	0.108	0.329	0.390	0.086	0.013	0.121	-0.066	-0.412	0.049
Region	-0.086	-0.055	-0.352	0.108	6.275	1.214	20.318	4.688	0.023	0.075	-0.058	-0.518	-0.140
Religion of head	0.051	0.037	-13.640	0.329	1.214	102.610	9.059	1.998	0.066	0.652	-0.925	-1.844	0.288
Mother tongue of head	-0.428	0.460	-10.217	0.390	20.318	9.059	627.174	83.672	0.339	0.480	-1.323	-3.999	-0.491
Major ethnic group	-0.073	-0.015	-1.968	0.086	4.688	1.998	83.672	16.421	0.018	0.005	-0.195	-0.591	-0.101
Access to Radio	0.009	-0.001	-0.455	0.013	0.023	0.066	0.339	0.018	0.135	0.052	-0.031	-0.121	-0.015
Access to TV	0.002	0.005	-1.588	0.121	0.075	0.652	0.480	0.005	0.052	0.306	-0.106	-0.474	0.016
Mother's education	-0.015	0.000	6.091	-0.066	-0.058	-0.925	-1.323	-0.195	-0.031	-0.106	0.468	0.326	-0.022
Wealth index quintiles	-0.001	-0.007	4.938	-0.412	-0.518	-1.844	-3.999	-0.591	-0.121	-0.474	0.326	1.691	-0.086
Child participated in national immunization day	0.025	0.006	-0.536	0.049	-0.140	0.288	-0.491	-0.101	-0.015	0.016	-0.022	-0.086	1.288
Access to TV	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mother's education	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Wealth index quintiles	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Child participated in national immunization day	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 42: Covariance Matrices: No: child's birth has been registered

Table 43: Functions at Group Centroids

✌❶⑤ഩ ⓿⓪⑥⑤	☛⓪⁓~⑤ ❷ଓ③❶~	✂ ⑥൞ ଓ⑨⓪ଓ⑤ഩ ~	⊗ ☞❶④❶③ଓ⓿⓪ ❷~ ✂	☞ଓ⑤⑥⑤⓪ഩଓ③ ☞⑥⑨⑨~③ଓ⓿ ⓪⑥⑤
🗍	▯🗐▢▢	🗍▯▯🗐▯	🗍▯▯🗐▯	🗐🗑🖶🖶

☒ଓ൶③~ 🗔▢✍🖰 ⦸⓪③②⑩ ✋ଓ④൶൞ଓ

☒~⑩⓿ ⑥൞ ✌❶⑤ഩ⓿⓪⑥⑤✆ ⑩🗋	⦸⓪③②⑩☎ ✋ ଓ④൶൞ଓ	☞~⓪▤⑩⑧ ❶ଓ⑨~	൞൞	☒⓪⁓🗐
🗍	▯🗐⊙🖶🖶	📋▢🗑🗐🖷▯ ▯	🗍🗔	🗐▯▯▯