

UNIVERSITY OF NAIROBI

**COLLEGE OF BIOLOGICAL AND PHYSICAL
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SCHOOL OF MATHEMATICS

**MODELING DETERMINANTS OF ADULT LITERACY AND
NUMERACY SKILLS IN KENYA**

By

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A PROJECT SUBMITTED TO THE SCHOOL OF MATHEMATICS IN PARTIAL FULFILLMENT

FOR THE DEGREE OF MASTER OF SCIENCE IN SOCIAL STATISTICS

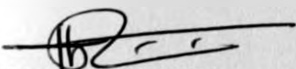
July 2011

Declaration

I the undersigned, declare that this project is my original work and to the best of my knowledge has not been presented for the award of a degree in any other University.

Jonathan N. Mbithi

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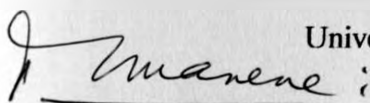
Date.....30th JULY 2011

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Signature.....

Date.....1/8/2011

Acknowledgement

I am grateful to GOD for seeing me through the completion of the course and research work.

I wish to greatly acknowledge and appreciate my supervisor, Prof. Manene for his scholarly guidance and comments in writing this project. Thanks to all my lecturers;

Dr. Achia, the late Dr. Nguti, Prof. JAM, the late Prof. Owino, Mr. Obudho , Dr. Odwesso, Mr. Nderitu, Mr.Mathenge and course mates for their continued support and encouragement.

Dedication

Dedicated to;

- My wife Caroline, my son Benson and my daughter Joy.
- My parents Jane & Daniel Mbithi, my brothers, the late Cyrrus, Barthez & Kennedy, and my sisters Caroline & Megan.

Abstract

This study describes the determinants of adult literacy and numeracy skills (ALNS) in Kenya with the aid of a logistic model analysis using the 2007 Kenya National adult literacy survey data.

The objectives were:- To investigate the distribution of adult literacy and numeracy skills by age-groups, to establish proportions of adult literacy and numeracy skills by province, regions (rural/urban), marital status, sex, disability and to establish the key determinants of adult literacy and numeracy skills in Kenya.

Various logistic regressions of determinants of ALNS were estimated and this took the following dimensions: age-group, gender, region (rural/urban), disability, marital status, awareness of literacy programmes and reading materials.

The results showed that 69.2% of the adult population had attained ALNS thus leaving 30.8% adults illiterate. The results also showed that 17% of the youth aged 15-19 years and 79.7% of adults aged 70+ years were illiterate.

The results further indicated high regional disparity in ALNS achievements with urban having 86.6% and rural 69.7%. Nairobi province had 95.1% and North-Eastern province 16.7%. There also exists gender disparity in ALNS levels with men rated at 76.6% and women at 64.1%.

Logistic analysis results showed that disability and programme awareness were insignificant while age-group, reading materials, marital status, gender and region were significant.

List of Abbreviations and Acronyms

| | |
|---------------|---|
| ALNS | Adult literacy and Numeracy Skills |
| ALE | Adult Literacy Education |
| DAE | Department of Adult Education |
| EFA | Education for All |
| KALA | Kenya Adult Literacy Association |
| KNALS | Kenya National Adult Literacy Survey |
| KNBS | Kenya National Bureau of Statistics |
| MDGs | Millennium Development Goals |
| UNESCO | United Nations Education, scientific and cultural Organization |
| ASAL | Arid and semi arid lands |

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CHAPTER 1

INTRODUCTION

1.1 Background to the study

Literacy is the ability to identify, understand, interpret, create, communicate and compute using printed and written materials. It is a powerful tool for promoting social, economic and political development of any country. The role of a literate adult population in propelling development cannot be overstated. Since independence the Government of Kenya has committed itself to the provision of Adult Education (Kibera, 1997).

Currently, this is very crucial for Kenya to attain the projections of the millennium development goals (MDGs) and vision 2030.

In 2002, the United Nations declared 2003-2012 the United Nations Literacy Decade. Karani (1996), observes; there is a decline in Adult literacy enrolment in Kenya which she attributes to: Inability to recruit adequate and qualified teachers, social factors which discourage some adults from attending classes, lack of adequate classes to attract adults and non availability of appropriate reading materials in some ethnic languages. The Kenya Government since independence has put emphasis on adult literacy in order to achieve faster and sustainable socio-economic development (UNESCO, 2007). The objectives of the Adult Education programmes include but not limited to; eradicating illiteracy, providing knowledge, skills and attitude for work, creating self confidence and fostering a positive behaviour towards life and society. To achieve this, learner(s) has/have to be exposed to specific content(s). The content(s) in adult education curriculum include; literacy, family life, health and nutrition, civics, environmental studies and agriculture (Kibera, 1997). It is hoped that if the content(s) is/are covered well, Kenya stands achieving the objectives of adult education and subsequently national

development. The majority of adults with low literacy and numeracy skills are substantially less likely than those with higher levels of the skills to carry out tasks requiring reading, writing and manipulation of numbers in their day to day activities.

There is henceforth a critical need to address the problem of illiteracy in Kenya. The illiteracy rate stands at 38.5% (KNALS Report, 2007). This is despite campaigns and programmes by the government to alleviate the problem. The National Adult Literacy Survey in 2007 revealed that 61.5% of the adult population had attained the minimum literacy level thus leaving 38.5% (around 7.8 million) adults illiterate. The survey also showed that only 29.6% out of the 61.5% of the adult population with minimum literacy level had acquired the desired mastery of literacy and numeracy competence. Spurred on by this high illiteracy rates and the importance of education in alleviating poverty, this study centrally focuses on the determinants of adult literacy using the Kenya National Adult literacy Survey data.

1.2. Statement to the problem

Adults are the prime movers of society. Achievement of Kenya's development goals would remain a pipe dream owing to the soaring adult illiteracy and the abysmally low mastery of basic skills as presently witnessed. It is for this reason that eradication of illiteracy, promotion of quality ALE programmes to be accessed by all, and the general encouragement of learning as a lifelong process must be uppermost in the national agenda.

The understanding of adult literacy and numeracy skills in Kenya has been reduced to the mere basic computation of literacy rates. Most of the findings point to distribution of illiteracy rates in different regions, but fail to pay attention to the causes. Further analysis is thus necessary to address the causes of illiteracy rates empirically.

This study therefore, is designed to investigate the categories of variables in the survey data that are key to determining adult literacy and numeracy skills in Kenya through application of logistic regression analysis.

1.3. Objectives

1.3.1. General objective to the study

The purpose of this study is to investigate the determinants of Adult literacy and numeracy skills in Kenya, through analysis of data collected by the Kenya National Bureau of Statistics (KNBS) through application of logistic regression analysis.

1.3.2. Specific objectives of the study

In this study, we will address the following specific objectives;

1. To investigate the level of Adult literacy and numeracy skills by gender and age-groups.
2. To establish proportion(s) of Adult literacy and numeracy skills by province, regions (rural/urban) and marital status.
3. To investigate whether acquisition of Adult literacy and numeracy skills is affected by awareness and availability of reading materials.
4. To establish key determinants of Adult literacy and numeracy skills in Kenya.

1.4. Statement of Hypothesis

$$H_0: \beta_{xi} = 0$$

$$H_a: \beta_{xi} \neq 0$$

where

X_1 = gender

X_2 = Age-group

X_3 = Region (rural/urban)

X_4 = province

X_5 = Programme awareness

X_6 = Disability

X_7 = Marital status

X_8 =Reading materials

and β is the change of the dependent variable due to a unit change of the independent variable. In this study, we shall run logistic regression for the dependent variables to find out how change of an independent variable by a unit affects ALNS, holding constant all other variables.

1.5. Research questions

1. Does Adult literacy and numeracy skills vary by age-group, gender and marital status?
2. Is there a relationship between Adult literacy and numeracy skills vis-a-vis regions (rural/urban) and provinces?
3. Is there a relationship between Adult literacy and numeracy skills vis-a-vis reading materials?
4. Is there a relationship between Adult literacy and numeracy skills vis-a-vis the programme awareness?

1.6. Significance of the study

This study uses KNALS data to describe the determinants of ALNS. The goal is to supply policy makers, researchers, practitioners and scholars with new invaluable information useful for making decisions about how to plan and deliver appropriate and efficient reading instructions for varied adult learner(s).

The Government of Kenya places Adult Learning and Education (ALE) on its prime development agenda as part of the country's general policy of bringing about accelerated and sustainable socio-economic development. This study will zero in unto offsetting aspects of government policy as here-below stated:-

1. The Kenya vision 2030 under whose scope the government aims at providing globally competitive quality education, training and research for the country's economic take-off. The country is committed to achieving an 80% Adult literacy rate by the year 2030.
2. National Poverty Eradication –The single-most effective way of achieving this is through provision of quality education to all and particularly Adults and out of school youth who are the mainstream working and producing lot.
3. The results of this study, will among other benefits, give a special focus to the marginalized and disadvantaged groups left in the periphery.
4. The Kenya Adults' Literacy Association (KALA) may use the results to address issues limiting acquisition of ALNS in the country. This is useful in meeting KALA's objectives among them to encourage more people to join literacy classes

and to lobby and advocate for Adult literacy and participation of adult learner(s) in decisions that affect them and their education.

1.7. Limitations of the study

The Kenya National Adult Literacy Survey (KNALS) measured Adult Literacy and Numeracy Skills through self-reports. Measuring ALNS using self-reports is usually suspect with reference to accuracy because self-reporting may be under influence from stigma associated with illiteracy. When adult learner(s) are asked to self-report, then response bias becomes a concern.

1.7 Organization of the study

This study will be organised into five chapters:

1. The first chapter will deal with the introduction to the study which has the background to the study, statement of the problem, purpose of the study, research objectives and research questions, limitations of the study and lastly organization of the study.
2. Chapter two will present the review of related literature.
3. In chapter three, methodology of the study will be presented.
4. Chapter four will consist of data analysis, research findings, presentation and discussion of the findings.
5. Chapter five, the summary of the findings, conclusions and recommendations for further research will be presented.

CHAPTER 2

LITERATURE REVIEW

The increasing need for literacy and numeracy skills in many aspects of adult life, for example, family, employment and community has made literacy and numeracy a requisite skill for life in today's society. In the context of Adult Basic Education (ABE), more emphasis is needed on providing essential literacy and numeracy instruction to adults to help them acquire knowledge and skills that is critical to adjusting to this ever-growing societal demand (Tout,et.al,2002).

The concern about literacy and numeracy skills' deficiencies in today's adult learner(s) is exacerbated by the fact that adult literacy programmes are not adequately prepared to provide literacy and numeracy skills to a diverse student population that bring different needs, interests, skills and attitudes.

Kenya has experienced limited attention to literacy and numeracy instruction and lesser research on how local Adult education programmes impart literacy and numeracy. There are many reasons for this lack of focus: little agreement on what constitutes literacy and numeracy; poor professional development in literacy and numeracy; limited understanding of how adults with diverse characteristics, needs, and backgrounds obtain literacy skills; and the lack of alignment among content standards, curricula and instruction, without forgetting assessments (KNALS Report,2007).

Analytical work on determinants of Adult literacy and numeracy skills in Kenya is at best, scanty. Most of the available studies are descriptive and focus barely on measurement of literacy.

Literacy surveys and national censa are the two literacy measuring strategies that have so far been in use in Kenya. Literacy surveys have been utilised to measure literacy through self-reports and literacy tests. Within the Adult literacy programmes in Kenya, there are no standardized literacy proficiency tests. Literacy tests are based on guidelines provided by the Department of Adult Education (DAE) and marked at the district level. The tests focus on reading, comprehension, writing and arithmetic.

Very few of those who enrol in Adult literacy pass the proficiency tests. From 1979 to 1990, for example, out of the 2.5 million learners enrolled, only 1/10 had passed the proficiency tests. The statistics for the first half of the 1990s were no better as only 6.6% of those enrolled passed the proficiency tests.

In Kenya, Adult literacy provision experienced considerable growth in the 1960s and the 1970s. By 1980, there were 11,766 Adult literacy centres and 13,204 registered teachers. However, ten years later in 1990, enrolment was less than half what it was in 1980. The decline is attributable to inadequate resources coupled with insufficient and worse still de-motivated teachers employing inappropriate teaching approaches. The National Adult Literacy Survey 2007 is the best attempt at measuring literacy levels in Kenya, to date. The survey revealed that 38.5% of the Kenyan population was illiterate. It further showed that the age cohort 15 to 19 recorded a literacy rate of 69.1%. North Eastern Province had the lowest literacy rate of 8.0% while Nairobi Province had 87.1%.

In Kenya, Adult literacy programmes have a long history in providing basic literacy and numeracy skills to people who have never or only briefly attended the more formal education system (Blunch, 2005). Ogechi (2001), in his study found that, teacher education, availability of blackboards and libraries, the number of books per classroom and private versus public schools have proved to be important determinants of Adult literacy and numeracy skills in Kenya.

According to Bunyi (2006), illiteracy is more widespread among the poor than the non-poor. In 1999, while the poor had 73.1% literacy rates, the non-poor had 82.7%, almost 10% points better-off.

In another study, Owino (1999), notes that there is a general lack of trained personnel to spearhead the struggle against illiteracy and manage lifelong education. Full-time, part-time or volunteer teachers, teach adult literacy classes. Unfortunately, most of the few trained teachers vacate on finding better paying jobs.

A majority of the target population of the Adult and post literacy education are either living in the rural areas or worse still, are the lowest salaried in urban areas (Mulusa, 1978). Most illiterate people cannot afford buying books and do not go on reading after completing their formal education. Literacy goes hand in glove with the availability of libraries (Ogechi, 2001). Therefore, simple reading rooms scattered in rural areas would be more effective than the public libraries presently being built per district basis (Chavaka, 1995). Ogechi (2001), further argues a case for enhanced publishing of reading materials for Adult education in Kiswahili and other indigenous languages. This supports the practice of starting basic literacy in the languages of the catchments in linguistically homogenous communities. Kiswahili can consequently play a major role in achieving high Adult literacy rates.

The learning conditions, especially in remote Eastern and North Eastern provinces, are not at all conducive as there are no enough classrooms and lessons are conducted in the dusty, windy and open grounds vulnerable to scorching sun (Karani, 2000). In another study, it was established that lack of conducive learning environment, unavailability of instructional materials, negative attitude towards learning and shortage of professionally trained trainers for Adult learners were some of the factors hindering many illiterate adults from attending the Adult education programmes (Ndiku et al, 2009). According to Ndiku, 91.45% of the learners interviewed noted that physical facilities in their centres were inadequate. This was confirmed by 83.33% of the teachers. Decline in enrolment was due to inadequate instructional resources as revealed by 61.11% of the teachers. Further, 77.77% of teachers indicated that the decline of enrolment in their centres was due to the fact that learners felt that they were too old to learn. Aggarwal(2001), observes; those adults who were uneducated think that it was too late to join literacy classes.

Prosser and Clarke (1972), argued that Adult literacy teachers needed to undergo training to prepare them to effectively serve adult learners. According to Ndiku, 33% of teachers had not attended any in-service or induction course.

From the above findings, it is evident that factors hindering adult learners from attending classes are numerous. This is a worrying state of affairs in Kenya's endeavour to attain Vision 2030, MDGs and EFA goals. Such goals cannot be gained if the literacy rates among the adult population are still appalling. Whereas, there is need to creatively look for ways of increasing recruitment of adult learners into Adult literacy programmes, there is need and reason to motivate them and drum up the importance of lifelong learning which is hinged on the pillars of learning to know, learning to do, learning to live together and learning to be, into these adult learners (Nafkho et al, 2005). Such learning is crucial owing to the reality of technology, economic, political and social aspects of modern world. This will not only enable the citizens to survive, but as well to exploit the environment for improved life.

Undoubtedly, thus; there is need to integrate formal and informal types of learning among the Adult learners to maximize acquisition of knowledge, skills and attitude for improved welfare of the people in the respective communities.

Literacy scholars henceforth conclude that literacy is a multidimensional construct, which manifests overlappingly within various social contexts, (Akinnaso. et al,1991). We conjecture that more focus should be directed towards the quality of Adult education, as measured by literacy and numeracy. Particularly in a development context, such increased attention is more than warranted. One of the key parts of this information-processing involves reading, writing and arithmetic. We suggest that sound education policy design and implementation should be grounded on considerations of the skills, which is the primary objective and target of education and which ultimately pours back into the economy as an important input of production. Analysis of the determinants of Adult literacy and numeracy skills may enable us to identify the causes of ALNS, as well as the most vulnerable groups. Such identification is necessary to purposely, direct a concerted target to these groups, thereby serving as an important mechanism for policy design and implementation.

CHAPTER 3

METHODOLOGY

3.1 SURVEY METHODOLOGY.

3.1.1. Sample Design

The sample for the KNALS covered all eight Kenyan provinces; Central, Coast, Eastern, Nairobi, North Eastern, Nyanza, Rift Valley and Western. A probability sample of about 18,000 households was selected to allow for separate estimates for key indicators for each of the provinces and districts in the country and for urban and rural areas. The survey used a two-stage sample design. The first stage involved selecting clusters from the national master sample maintained by the KNBS. A total of 1,200 clusters comprising 377 urban and 823 rural were selected from this master frame. The second stage involved the systematic sampling of households from a list of all households. Eighteen households were sampled from each of the clusters.

3.1.2. Survey Instruments

Four literacy assessment instruments were developed in consultation with a broad spectrum of stakeholders. Since the government's language of instruction policy is to use indigenous languages at the basic literacy level and introduce Kiswahili and English at the post-literacy level, the survey was conducted in the main language groups with English and Kiswahili to accommodate the prevailing cultural and linguistic diversity.

A household questionnaire was used during the survey to list all members in the selected households. This collected information relating to gender, age, marital status, religion, tribe, educational attainment, disability and employment for all household members aged fifteen years and above. Based on this basic information, all eligible members of the household were identified and one selected randomly to complete the individual questionnaire and assessment.

The individual questionnaire collected the following information: Awareness, participation and attendance in adult education programs, self-assessment of literacy and numeracy skills, purposes for reading, writing and computational skills, sustainability of literacy skills, reading attitudes, and work requirements, employment and occupation and language.

An institutional questionnaire, administered to sampled adult education centres, collected information on issues relating to the provision of adult education. The questions covered the following aspects: enrolment by gender for the past five years, number of instructors by gender for the past five years, institution's background information policies and programmes, assessment of learners, views of teachers, teaching staff remuneration and welfare, institutional infrastructure, special learning needs, language of instruction, monitoring and evaluation systems.

The KNALS also included a literacy assessment test for all selected respondents. This provided information such as whether the respondents could read and understand instructions or read and make use of the information provided. Unlike past literacy surveys where respondents who had attended school up to a particular level were assumed to be literate, all respondents were subjected to the same test.

The KNALS thus, measured literacy through direct assessment of men and women aged 15 years and above which focused on three skills: reading, writing and numeracy.

3.2. THE LOGISTIC REGRESSION MODEL

The binomial (binary) logistic regression is a form of regression that is used when the dependent variable is dichotomous and the independent variables are continuous, categorical or both. In the logistic regression model, the log odd of the outcome variable is modelled as a linear combination of the predictor variables. In this study, the outcome (response) variable is binary; literate or illiterate. The predictor variables of interest are; age-group, gender, province, region (rural/urban), programme awareness, disability, marital status and reading materials. Logistic regression was used to test the determinants of ALNS using the KNALS data. The dependent variable was the binary variable of whether an individual is literate (1) or illiterate (0).

To compute the response variable (literacy), we considered an individual's ability to read, write and do simple arithmetic. Each of the variables was coded as 1 for yes (ability to read, write or do simple arithmetic) and 2 for no (inability to read, write or do simple arithmetic). If an individual's score = 3, we recoded it as 1 for literate and if the Score ≥ 4 , we recoded zero (0) for illiterate.

We consider the first case where the response y_i is binary, assuming only two values that for convenience we coded as one(literate) and zero(illiterate) such that,

$$y_i = \begin{cases} 1 & \text{if the individual is literate} \\ 0 & \text{if the individual is illiterate} \end{cases}$$

The central mathematical concept that underlies logistic regression is the logit-the natural logarithm of an odds ratio. Logistic regression describes the relationship between a dichotomous response variable and a set of explanatory variables. The explanatory variables may be continuous or discrete (with dummy variables). We take y_i as a random variable that can take the values one and zero with probabilities π and $1 - \pi$ respectively such that,

$$\Pr[y_i=1|x_1,x_2,\dots,x_k]=\pi \quad (3.1)$$

and
$$\Pr[y_i=0|x_1,x_2,\dots,x_k]=1-\pi \quad (3.2)$$

Where x's are the predictor variables in our model.

The logistic model has the form,

$$\text{logit}(\pi)=\text{natural log(odds)}=\ln\left(\frac{\pi}{1-\pi}\right)=\beta_0+\beta_1x_1 \quad (3.3)$$

Where π is the probability of the outcome of interest (literacy), β_0 is the Y intercept and β_1 is the regression coefficient.

Therefore, our link function is $\ln\left(\frac{\pi}{1-\pi}\right)$ such that,

$$\ln\frac{\pi}{1-\pi}=\beta_0+\beta_1x_1+\beta_2x_2+\dots+\beta_kx_k \quad (3.4)$$

Whereby β denotes a vector of parameters, X is the design matrix and $X\beta$ is the linear component of the model such that,

$$\beta X=\beta_0+\beta_1x_1+\beta_2x_2+\dots+\beta_kx_k \quad (3.5)$$

and

$$\pi=(y=1|X=x)=\frac{e^{\beta_0+\beta x}}{1+e^{\beta_0+\beta x}} \quad (3.6)$$

where y is the outcome of interest(literacy).

The odds vary on a scale of $[0, \infty]$, so that the log odds can vary on the scale of

$[-\infty \infty]$. A solution to this problem is to transform the probability to remove the range restrictions. The π is restricted to the interval $[0, 1]$ by modelling it using a cumulative probability distribution such that,

$$\pi = \int_{-\infty}^t f(s)ds$$

where $f(s) \geq 0$ and $\int_{-\infty}^{\infty} f(s)ds = 1$

This probability density function $f(s)$ is known as the tolerance distribution.

When we exponentiate equation (3.4) we get,

$$\exp(\text{logit}(\pi)) = \exp(\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k) \quad (3.7)$$

$$\frac{\pi}{1-\pi} = \exp(\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k) \quad (3.8)$$

$$\pi = \frac{e^{(\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k)}}{1 + e^{(\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_kx_k)}} \quad (3.9)$$

Therefore our logistic or logit model is

$$\pi = \ln\left(\frac{\pi}{1-\pi}\right) = \frac{e^{\beta_0 + \beta x}}{1 + e^{\beta_0 + \beta x}} \quad (3.10)$$

$$\text{logit } \pi_i = \ln\left(\frac{\pi_i}{1-\pi_i}\right) = x_i'\beta \quad (3.11)$$

Hence our link or transformation function is $\ln\left(\frac{\pi}{1-\pi}\right)$ whereby

$\text{logit}(\pi) = \ln\left(\frac{\pi}{1-\pi}\right)$ is the logistic transformation of the probability of being literate.

By letting

$$\sum_{j=0}^k \beta_j x_j = \beta_0 + \beta_1 x_1 + \dots + \beta_k x_k = z \quad (3.12)$$

We can have the logistic function which is the inverse of the logit function obtained

as

$$\frac{\pi}{1-\pi} = e^z \Rightarrow \pi = (1-\pi)e^z \Rightarrow \pi = \frac{e^z}{1+e^z} \quad (3.13)$$

Note that our model has unknown parameters $\beta_0, \beta_1, \beta_2, \dots, \beta_k$ which must be estimated in order to fit the logistic model to our data. Logistic regression normally uses maximum likelihood to estimate these parameters.

3.2.1 The Likelihood Function

The likelihood function is given by

$$L = \prod_{i=1}^n \binom{n_i}{y_i} \pi_i^{y_i} (1-\pi_i)^{n_i-y_i} \quad (3.14)$$

The log-likelihood function is given by,

$$\ln L = \sum_{i=1}^n \left[\ln \binom{n_i}{y_i} + y_i \ln \pi_i + (n_i - y_i) \ln(1 - \pi_i) \right] \quad (3.15)$$

$$= \sum_{i=1}^n \left[\ln \binom{n_i}{y_i} + y_i z - n_i \ln(1 + e^z) \right] \quad (3.16)$$

Where $Z_i = \sum_j^k \beta_j x_{ji}$. The derivative of the log-likelihood function with respect to the unknown β parameters is,

$$\frac{\partial \ln L}{\partial \beta_j} = \sum_{i=1}^n y_i x_{ji} - \sum_{i=1}^n n_i x_{ji} \frac{e^z}{1 + e^z}, j = 0, 1, 2 \dots k. \quad (3.17)$$

Therefore our betas will be estimated as, $\hat{\beta} = (X'X)^{-1}(X'y)$ where X is the matrix of our predictors.

3.2.2 The Goodness of fit

We can use the likelihood ratio test whereby the ratio of the maximized value of the likelihood function for full model \hat{L}_f over the maximized value of the likelihood function for the simpler model \hat{L}_c . The likelihood-ratio test statistic is given by,

$$-2 \log \left(\frac{L_0}{L_1} \right) = -2 [\log(L_0) - \log(L_1)] = -2[L_0 - L_1] \quad (3.18)$$

A comparison between \hat{l}_c and \hat{l}_f can be made on the basis of the deviance statistic which is given by

$$D = -2 \ln \frac{\hat{l}_c}{\hat{l}_f} = -2 [\ln \hat{l}_c - \ln \hat{l}_f] \quad (3.19)$$

Deviance statistic involves a comparison of the log of the maximum of the full model (saturated model) and the model without any of the predictor variables (null model).

When \hat{l}_c is small relative to \hat{l}_f , then the value of D is large, indicating that the current model is not good. Small value of D are encountered when \hat{l}_c is similar to \hat{l}_f indicating that the current model is good.

In modelling n binomial observations, the likelihood function is given by

$$L = \prod_{i=1}^n \binom{n_i}{y_i} \pi_i^{y_i} (1 - \pi_i)^{n_i - y_i} \quad (3.20)$$

On fitting a logistic model with k+1 unknown parameters $\beta_0, \beta_1, \beta_2, \dots, \beta_k$ and fitted values π_i are obtained where,

$$\text{logit}(\pi) = \hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + \dots + \hat{\beta}_k x_{ki} \quad (3.21)$$

The maximum log-likelihood under this model is given by

$$\ln \hat{L}_c = \sum_{i=1}^n \left[\ln \binom{n_i}{y_i} + y_i \ln \hat{\pi}_i + (n_i - y_i) \ln (1 - \hat{\pi}_i) \right] \quad (3.22)$$

and the maximum log-likelihood function for the full model is given by,

$$\ln \hat{L}_f = \sum_{i=1}^n \left[\ln \binom{n_i}{y_i} + y_i \ln \pi_i^* + (n_i - y_i) \ln (1 - \pi_i^*) \right] \quad (3.23)$$

The deviance is given by

$$D = -2 [\ln \hat{L}_c - \ln \hat{L}_f] \quad (3.24)$$

$$= 2 \sum_{i=1}^n \left[y_i \ln \frac{\pi_i^*}{\hat{\pi}_i} + (n_i - y_i) \ln \left(\frac{1 - \pi_i^*}{1 - \hat{\pi}_i} \right) \right] \quad (3.25)$$

3.2.3. THE ODDS-RATIO

The odds-ratio is calculated using the logistic function:

$$\Pr(Y = 1) = \frac{\exp(X\beta)}{(1 + \exp(X\beta))} \quad (3.26)$$

and

$$\Pr(Y = 0) = \frac{1}{(1 + \exp(X\beta))} \quad (3.27)$$

To simplify the notation, let $\Pr(Y=1) = \pi$ and $\Pr(Y=0) = 1 - \pi$ for $\pi \in (0,1)$, and odds ratio will be given by:

$$\text{Odds-Ratio} = \frac{\pi}{1-\pi} = \frac{\exp(X\beta)/(1+\exp(X\beta))}{1/(\exp(X\beta))} = \exp(X\beta); \quad \frac{\pi}{1-\pi} \in (0, \infty). \quad (3.28)$$

Taking the natural logarithm of equation (3.28) we get,

$$\ln\left(\frac{\pi}{1-\pi}\right) = X\beta; \text{ where } X\beta = \beta_0 + X_1\beta_1 + X_2\beta_2 + \dots + X_k\beta_k; \quad (3.29)$$

The derivative to get the relationship between the estimated parameters and the odds-ratio is,

$$\frac{\partial \ln\left(\frac{\pi}{1-\pi}\right)}{\partial x_i} = \beta_i \quad (3.30)$$

The parameter β_i , represents the percentage change in the log-odds ratios from a unit change in one of the independent variables, x_i .

To establish the relationship between the odds-ratio and the probability of π , we proceed as follows,

$$\text{Log-Odds} = \ln\left(\frac{\pi}{1-\pi}\right) = \ln(\pi) - \ln\left(\frac{1}{1-\pi}\right) \quad (3.31)$$

$$\frac{\partial(\log - odds)}{\partial \pi} = \frac{1}{\pi} - \frac{1}{(1-\pi)^2} \quad (3.32)$$

Expanding the term representing the percentage in the log odds-ratio we get;

$$\Delta \ln \left(\frac{\pi}{1 - \pi} \right) = \ln \left(\frac{\pi_2}{1 - \pi_2} \right) - \ln \left(\frac{\pi_1}{1 - \pi_1} \right) = \beta_i, \quad (3.33)$$

Where π_1 and π_2 are the two probabilities defining the change in the log odds-ratio.

Furthermore,

$$\ln \left(\frac{\pi_2}{1 - \pi_2} \right) - \ln \left(\frac{\pi_1}{1 - \pi_1} \right) = \ln \left(\frac{\pi_2 / (1 - \pi_2)}{\pi_1 / (1 - \pi_1)} \right) \quad (3.34)$$

and $\exp(\ln x) = x$.

This shows that $\frac{\pi_2 / (1 - \pi_2)}{\pi_1 / (1 - \pi_1)} = \exp(\beta_i)$. It is usually the reported odds-ratio and is

actually a ratio of two odds-ratios.

3.3 Assumptions of the logistic regression model.

1. Logistic regression does not assume a linear relationship between the dependent and independent variable.
2. The dependent variable need not to be normally distributed, but does assume its distribution is within the range of the exponential family of distribution.
3. The dependent variable need not to be homoscedastic for each level of the independent variable-no homogeneity of variance assumption.
4. Logistic regression does not require that the independent variables be interval or unbounded.
5. Logistic regression assumes that error terms are independent and all relevant variables are included in the regression model.
6. The logistic regression assumes a linear relationship between the logit of the independents and the dependent.
7. No assumption of normally distributed error terms.

CHAPTER 4

DATA ANALYSIS

4.1. The Data.

This study uses data collected by the Kenya National Bureau of Statistics on a survey for Adult literacy and numeracy skills in Kenya, 2007.

Sampling was done using the National Sample Survey and Evaluation Programme(NASSEP-) sampling frame which is composed of 1800 clusters selected with probability proportional to size (PPS) from a set of all Enumeration Areas.

4.2. Data Management

Data used in this study was collected, edited and captured by KNBS experts in the field. Data verification was done in the KNBS office using Fox-Pro Program. The data was then transferred to SPSS for further management.

For our analysis all variables apart from the variables of interest were dropped. Some cases were deleted since they had missing information. The analysis was done in SPSS and R.

4.3 Descriptive Data Analysis.

Table 4.1 Summary findings on literacy.

| Literacy | | | | |
|------------|-----------|---------|---------------|--------------------|
| | Frequency | Percent | Valid Percent | Cumulative Percent |
| Illiterate | 4683 | 30.8 | 30.8 | 30.8 |
| Literate | 10528 | 69.2 | 69.2 | 100.0 |
| Total | 15211 | 100.0 | 100.0 | |

Table 4.1 shows that out of the 15211 individuals interviewed 4683(30.8%) were illiterate and 10528(69.2%) were literate.

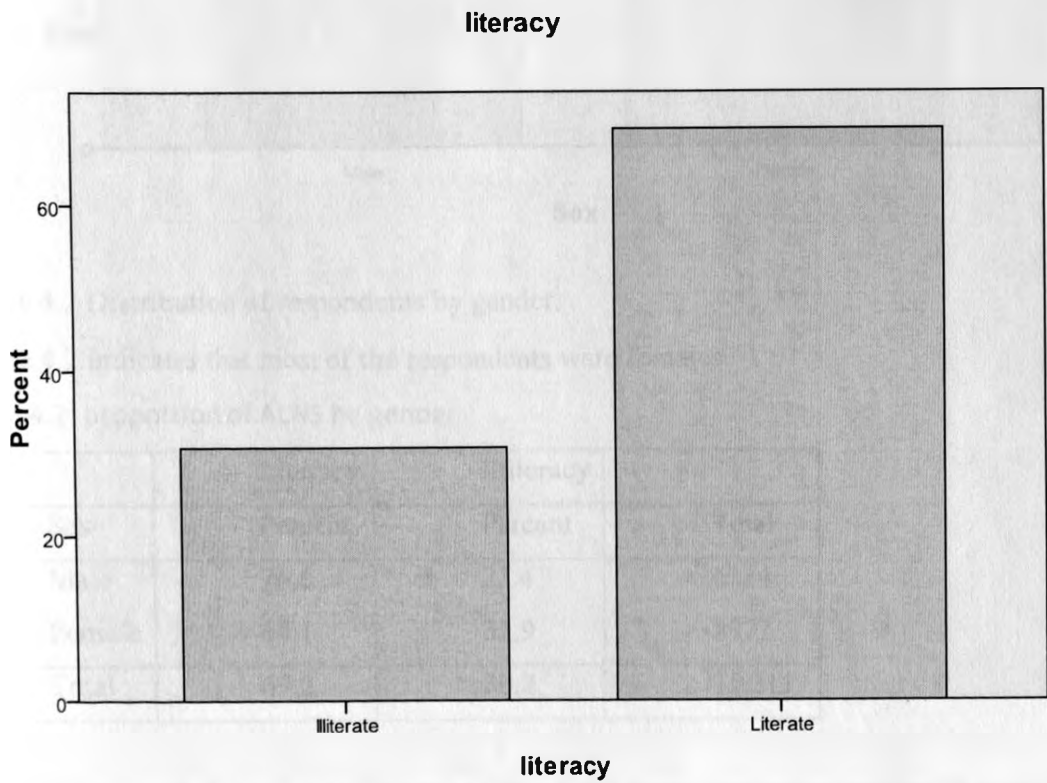


Figure 4.1. Literate verses illiterate

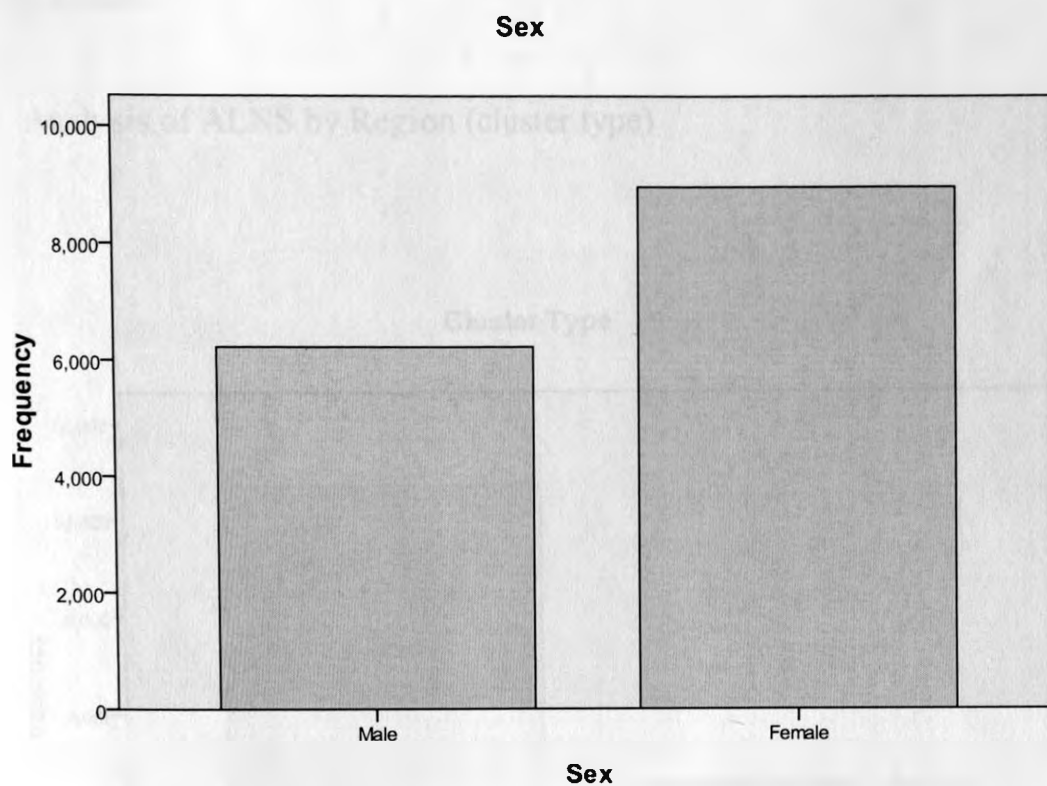


Figure 4.2 Distribution of respondents by gender.

Figure 4.2 indicates that most of the respondents were females.

Table 4.2: proportion of ALNS by gender

| | Literacy | Illiteracy | |
|--------|----------|------------|--------|
| Sex | Percent | Percent | Total |
| Male | 76.6 | 23.4 | 6234 |
| Female | 64.1 | 35.9 | 8977 |
| Total | 69.2 | 30.8 | 15,211 |

Table 4.2 shows that there is a disparity of about 10% between the proportion of males' to females' literacy and numeracy skills. This can be attributed to stereotypes and cultural beliefs where some communities prefer education for a particular gender. This is an important finding and adult literacy policy and practice needs to be designed to

favor women. Adult literacy programmes should concentrate on issues that would attract women.

4.3. Analysis of ALNS by Region (cluster type)

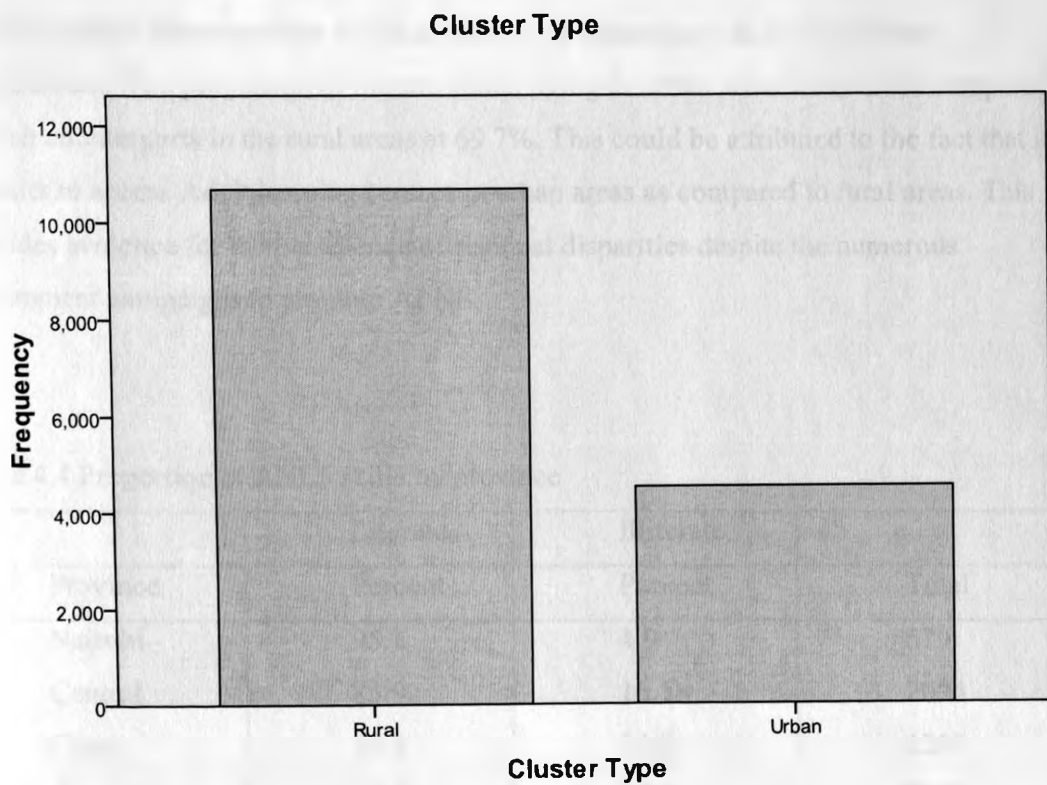


Figure 4.3 Distribution of respondents by region (rural/urban)

Figure 4.3 shows that most of the respondents were from the rural areas.

Table 4.3 Proportion of ALNS by region

| | Literacy | Illiteracy | |
|--------|----------|------------|-------|
| Region | Percent | Percent | Total |
| Rural | 69.7 | 30.3 | 10687 |
| Urban | 86.6 | 13.4 | 4526 |
| Total | 69.2 | 30.8 | 15213 |

Table 4.3 gives the proportion of Adult literacy and numeracy skills by regions (rural/urban). The proportion of literate adults living in urban areas was 86.6% compared to their counterparts in the rural areas at 69.7%. This could be attributed to the fact that it is easier to access Adult learning centres in urban areas as compared to rural areas. This provides evidence for the persistence of regional disparities despite the numerous government campaigns to promote ALNS.

Table 4.4 Proportion of ANLS skills by province

| | Literate | Illiterate | |
|---------------|----------|------------|--------|
| Province | Percent | Percent | Total |
| Nairobi | 95.1 | 4.9 | 679 |
| Central | 83.9 | 16.1 | 2094 |
| Coast | 66.4 | 33.6 | 1299 |
| Eastern | 62.5 | 37.5 | 2562 |
| North-Eastern | 16.7 | 83.3 | 574 |
| Nyanza | 76.6 | 23.4 | 2462 |
| Rift valley | 66.8 | 33.2 | 3839 |
| Western | 65.5 | 34.5 | 1702 |
| Total | 69.2 | 30.8 | 15,211 |

Table 4.4 gives the proportion of Adult literacy and numeracy skills by provinces. Nairobi province had the highest proportion of adult literacy (95.1%), followed by Central province (83.9%) and Nyanza province with a proportion of 76.6%.

North Eastern province had the lowest proportion of adult literacy (16.7%) followed by Eastern province at 62.5%. Such low levels of ALNS reflected in North-Eastern may be associated to ASAL conditions where the communities practice pastoral activities.

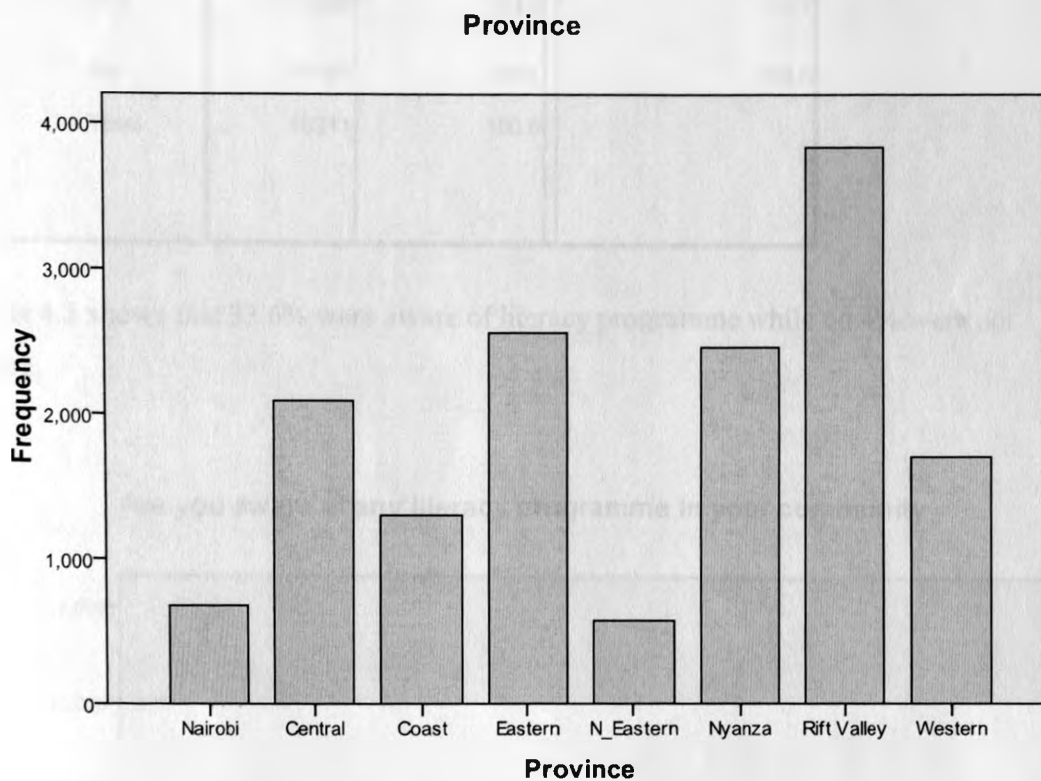


Figure 4.4 Distribution of respondents by province

From figure 4.4 Rift valley province had the highest number of respondents while North Eastern had the lowest.

Table 4.5 Proportion of ANLS by programme awareness

Are you aware of any literacy programme in your community

| | Frequency | Percent | Cumulative Percent |
|-------|-----------|---------|--------------------|
| Yes | 5046 | 33.6 | 33.7 |
| No | 10065 | 66.4 | 100.0 |
| Total | 15211 | 100.0 | |

Table 4.5 shows that 33.6% were aware of literacy programme while 66.4% were not aware.

Are you aware of any literacy programme in your community

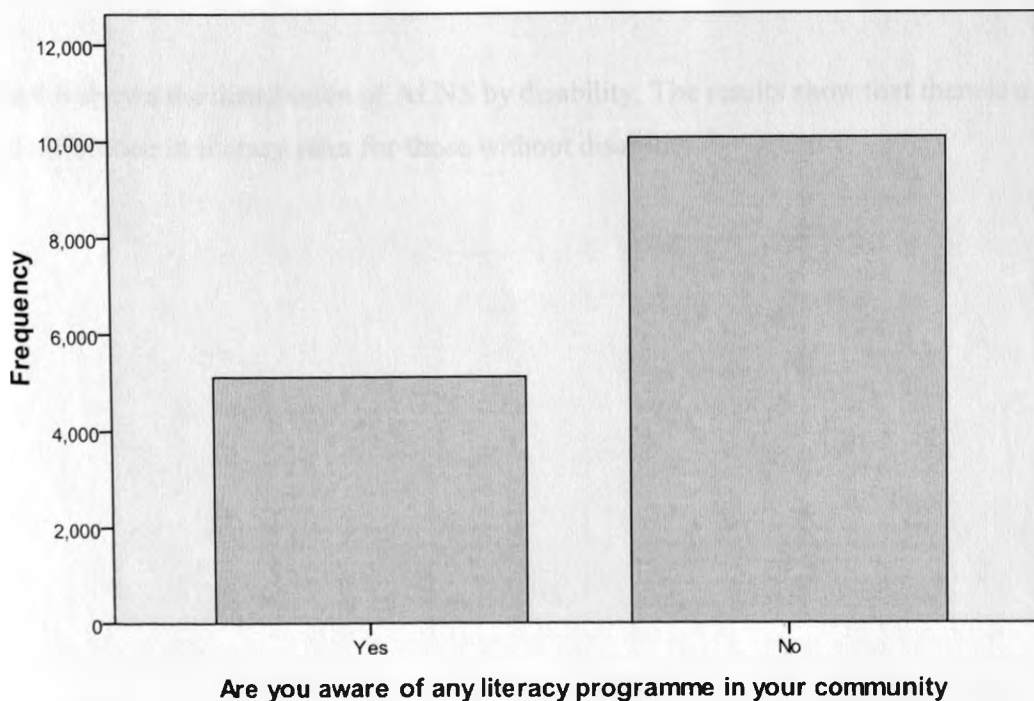


Figure 4.5 shows that most of the respondents were not aware of literacy programmes in their communities.

Table 4.6. Proportion of ALNS by disability.

| | Literacy | Illiteracy | |
|---------------|----------|------------|-------|
| Disability | Percent | Percent | Total |
| disability | 52.3 | 47.7 | 2887 |
| No disability | 73.2 | 26.8 | 12324 |
| Total | 69.2 | 30.8 | 15211 |

Table 4.6 shows the distribution of ALNS by disability. The results show that there is a small difference in literacy rates for those without disability.

Table 4.7: proportion of ALNS by age-group

| | Literate | Illiterate | |
|--------------|-------------|-------------|--------------|
| Age-group | Percent | Percent | Total |
| 15-19 | 83.0 | 17.0 | 1642 |
| 20-24 | 81.0 | 19.0 | 2321 |
| 25-29 | 81.9 | 18.1 | 2286 |
| 30-34 | 78.9 | 21.1 | 2027 |
| 35-39 | 78.5 | 21.5 | 1606 |
| 40-44 | 70.2 | 29.8 | 1198 |
| 45-49 | 62.1 | 37.9 | 925 |
| 50-54 | 51.5 | 48.5 | 816 |
| 55-59 | 50.3 | 49.7 | 491 |
| 60-64 | 32.8 | 67.2 | 518 |
| 65-69 | 25.4 | 74.6 | 417 |
| 70+ | 20.3 | 79.7 | 964 |
| Total | 69.2 | 30.8 | 15211 |

Table 4.7 shows the distribution of adult literacy and numeracy skills by age-groups. The results indicate that ALNS acquisition decreases with age-groups. Age-group 15-19 had the highest proportion of ALNS (83.0%) with the rates decreasing with age. Age-group 25-29(81.9%) while age-group 70+ had the lowest literacy proportion of 20.3%. This provides evidence that literacy and numeracy skills tend to deteriorate with age.

Table 4.8: Proportion of ALNS by marital status

| | Literate | Illiterate | |
|----------------|----------|------------|-------|
| Marital status | Percent | Percent | Total |
| Single | 84.2 | 15.8 | 3699 |
| Married | 69.9 | 30.1 | 9447 |
| Divorced | 60.2 | 39.8 | 161 |
| Separated | 64.6 | 35.4 | 356 |
| Widowed | 30.9 | 69.1 | 1544 |
| Total | 69.2 | 30.8 | 15211 |

Table 4.8 shows the distribution of ALNS by marital status. The results show that single adults had the highest proportion of ALNS (84.2%) followed by the married at 69.9%. The widowed had the lowest proportion of ALNS at 30.9%.

Table 4.9: Proportion of ALNS by reading materials.

| Are you able to find materials for reading | | | |
|--|-----------|---------|--------------------|
| | Frequency | Percent | Cumulative Percent |
| Yes | 11358 | 56.8 | 56.8 |
| No | 3853 | 43.2 | 43.2 |
| | | | 100.0 |
| Total | 15211 | 100.0 | |

Table 4.9 shows that 56.8% were able to access reading materials while 43.2 were unable.

4.4 Simple Logistic Regression

Table 4.10 Logistic analysis by province

| Province | Odds Ratio | Std Error | LCI | UCI | P-value |
|---------------|------------|-----------|-------|-------|---------|
| Intercept | Reference | - | - | - | - |
| Central | 0.979 | 0.219 | 0.631 | 1.52 | 0.924 |
| Coast | 0.944 | 0.218 | 0.600 | 1.48 | 0.802 |
| Eastern | 0.217 | 0.047 | 0.142 | 0.332 | 0.000 |
| North-Eastern | 0.045 | 0.011 | 0.028 | 0.073 | 0.000 |
| Nyanza | 0.679 | 0.150 | 0.441 | 1.05 | 0.079 |
| Rift-valley | 0.172 | 0.037 | 0.113 | 0.262 | 0.000 |
| Western | 0.266 | 0.058 | 0.173 | 0.409 | 0.000 |

The results in Table 4.10 were obtained by running a logistic model.

The results indicate that the odds of ALNS in Central province is 0.979 times the odds of ALNS in Nairobi province. Similarly the odds of ALNS in Coast province is 0.944 times the odds of ALNS in Nairobi province. Nairobi, Central and Coast province have more or less similar ALNS rates.

The odds of ALNS in Eastern is 0.217 times the ALNS of Nairobi province. The lowest ALNS was recorded in North-Eastern with odds of 0.045 times the odds of Nairobi province. This matches the results of the descriptive analysis in table 3.1.

Central, Coast and Nyanza provinces were not significantly different Nairobi province at 95% confidence interval since the interval in the provinces is inclusive of 1. The test statistic is statistically significant for Eastern, North-Eastern, Rift-valley and Western since the interval does not include 1 and p-values are less than 0.05.

Table 4.11: Logistic analysis by age-group

| Age-group | Odds Ratio | Std Error | LCI | UCI | P > z |
|-----------|------------|-----------|-------|-------|--------|
| Intercept | Reference | - | - | - | - |
| 20-24 | 0.824 | 0.087 | 0.670 | 1.01 | 0.068 |
| 25-29 | 0.903 | 0.102 | 0.724 | 1.13 | 0.367 |
| 30-34 | 0.818 | 0.096 | 0.650 | 1.03 | 0.087 |
| 35-39 | 0.785 | 0.096 | 0.617 | 1.00 | 0.048 |
| 40-44 | 0.534 | 0.067 | 0.418 | 0.683 | 0.000 |
| 45-49 | 0.419 | 0.054 | 0.324 | 0.540 | 0.000 |
| 50-54 | 0.238 | 0.031 | 0.184 | 0.307 | 0.000 |
| 55-59 | 0.211 | 0.031 | 0.159 | 0.280 | 0.000 |
| 60-64 | 0.138 | 0.020 | 0.104 | 0.182 | 0.000 |
| 65-69 | 0.094 | 0.014 | 0.069 | 0.127 | 0.000 |
| 70+ | 0.073 | 0.010 | 0.056 | 0.096 | 0.000 |

The results in Table 4.11 were obtained by running a logistic regression model in STATA. The results show that the odd of an age-group 20-24 having acquired ALNS is 0.824 times the odds of an age-group 15-19 adult. This means that the odds of acquiring ALNS decrease by about 18% for age-group 20-24, compared to age-group 15 – 19. We conclude with 95% confidence that the odds of age-group 20-24 acquiring ALNS is between 0.67 and 1.01 times the corresponding odds for age-group 15-19. Similarly, the odds of age-group 25-29 gaining ALNS is 0.903 times the odds of age-group 15-19 which is about 10% decrease compared to age-group 15-19. We can conclude with 95% confidence that the odds of gaining ALNS for age-group 25-29 is between 0.724 and 1.13 times the corresponding odds for age-group 15-19.

adults being literate. The confidence interval of the odds is (2.01, 2.54) which means we conclude with 95% confidence that the odds of acquisition of ALNS for adults in urban areas is between 2.01 and 2.54 times the corresponding odds of adults in rural areas.

The confidence interval does not include one; therefore, the test statistic is significant at 95%. Furthermore, $0.000 \leq 0.05$ which confirms the significance of the test.

Table 4.14: Logistic analysis by marital status

| Marital status | Odds Ratio | Std error | LCI | UCI | P > z |
|----------------|------------|-----------|-------|-------|--------|
| Intercept | Reference | - | - | - | - |
| Married | 0.866 | 0.066 | 0.746 | 1.00 | 0.058 |
| Divorced | 0.744 | 0.165 | 0.482 | 1.15 | 0.181 |
| Separated | 0.791 | 0.124 | 0.583 | 1.07 | 0.134 |
| Widowed | 0.573 | 0.060 | 0.466 | 0.704 | 0.000 |

Table 4.13 shows logistic analysis results for marital status. The results show that the odds of ALNS for the married is 0.866 times the odds of ALNS for single individuals. The odds of ALNS for the divorced is 0.744 times the odds of the single.

Similarly, the odds of ALNS for the separated individuals is 0.791 times the odds of the single individuals. The lowest ALNS for the widowed is 0.573 times the odds for the single.

The widowed is statistically significant at 95% confidence interval. The married, divorced and separated are not significantly different from the reference (single).

Table 4.15: Logistic analysis by Disability

| Disability | Odds Ratio | Std error | LCI | UCI | P > z |
|------------|------------|-----------|-------|-------|--------|
| Intercept | Reference | - | - | - | - |
| Disability | 0.942 | 0.061 | 0.837 | 1.060 | 0.322 |

Table 4.15 show the results of logistic analysis by disability. The results show that the odds of ALNS for the disabled is 0.942 times the odds of lack of disability. This means that ALNS decreases by about 6% for the disabled compared to those without disability. This difference is negligible and as indicated in the confidence interval (0.837, 1.060) the results are not significant at 95% confidence interval. Also $0.322 > 0.05$ and therefore, disability is not a factor that significantly explains ALNS in Kenya.

4.5. Multiple Logistic Regression

Block 0: Beginning Block

Table 4.16 Classification Table^{a,b}

| Observed | | | Predicted | | |
|----------|--------------------|------------|------------|----------|--------------------|
| | | | literacy | | Percentage Correct |
| | | | Illiterate | Literate | |
| Step 0 | Literacy | Illiterate | 0 | 4661 | .0 |
| | | Literate | 0 | 10485 | 100.0 |
| | Overall Percentage | | | | 49.2 |

a. Constant is included in the model.

b. The cut value is .500

Table 4.16 Variables in the Equation

| | | B | S.E. | Wald | Df | Sig. | Exp(B) |
|--------|----------|------|------|----------|----|------|--------|
| Step 0 | Constant | .811 | .018 | 2120.736 | 1 | .000 | 2.250 |

Table 4.16 represents the results with only the constant. Logistic regression compares this model with a model including all the predictors to determine whether the latter model is more appropriate.

Table 4.15 suggests that the null model would predict 49.2% of the variation correctly.

Table 4.17 Variables not in the Equation

| | | | Score | df | Sig. |
|--------------------|-----------|------------|----------|------|------|
| Step 0 | Variables | Disability | 476.221 | 1 | .000 |
| | | PROV1 | 164.417 | 1 | .000 |
| | | c_type | 623.962 | 1 | .000 |
| | | Sex | 271.991 | 1 | .000 |
| | | agegroup | 2335.693 | 1 | .000 |
| | | marital | 1401.588 | 1 | .000 |
| | | C01 | 6.459 | 1 | .011 |
| Overall Statistics | | 3024.241 | 7 | .000 | |

Table 4.17 tells us whether each independent variable improves the model. All the predictors are highly significant although (COI) for programme awareness is slightly lower than the others. This means that, if the predictors are added, they would improve the predictive power of the model.

Note that if the predictors are not significant, then termination of analysis would occur at this point.

Block 1: Method = Enter

Table 4.18 Omnibus Tests of Model Coefficients

| | | Chi-square | df | Sig. |
|--------|-------|------------|----|------|
| Step 1 | Step | 3151.143 | 7 | .000 |
| | Block | 3151.143 | 7 | .000 |
| | Model | 3151.143 | 7 | .000 |

Table 4.18 presents the results when the predictors are included. The classification in table 4.19 shows that, by adding the predictor variables, we can now predict with 76.6% accuracy.

To evaluate the model fit and whether each of the independent variables included make a significant contribution to the model, we shall use the model chi-square.

Model chi-square tests the overall significance of the model.

In our case, model chi-square has 7 degrees of freedom, a value of 3151.14 and a probability of $p < 0.000$ (table 4.18). This is an indication that the null model has a poor fit. This means that the predictors have a significant effect and create essentially a different model.

Table 4.19 Classification Table^a

| Observed | | | Predicted | | |
|----------|----------|--------------------|------------|----------|--------------------|
| | | | Literacy | | Percentage Correct |
| | | | Illiterate | Literate | |
| Step 1 | Literacy | Illiterate | 1964 | 2697 | 42.1 |
| | | Literate | 850 | 9635 | 91.9 |
| | | Overall Percentage | | | 76.6 |

a. The cut value is .500

Table 4.20 Variables in the Equation

| | B | S.E. | Wald | Df | Sig. | Exp(B) | 95% C.I. for EXP(B) | |
|---------------------|-------|------|---------|----|------|--------|---------------------|-------|
| | | | | | | | Lower | Upper |
| Step 1 ^a | | | | | | | | |
| Disability | -.044 | .053 | .687 | 1 | .407 | .957 | .861 | 1.0 |
| PROV1 | -.114 | .010 | 138.763 | 1 | .000 | .892 | .875 | .9 |
| c_type | .741 | .049 | 231.754 | 1 | .000 | 2.097 | 1.907 | 2.3 |
| Sex | -.563 | .042 | 176.758 | 1 | .000 | .569 | .524 | .6 |
| Agegroup | -.241 | .008 | 979.224 | 1 | .000 | .786 | .774 | .7 |
| Marital | -.178 | .020 | 78.271 | 1 | .000 | .837 | .804 | .8 |
| C01 | .013 | .042 | .105 | 1 | .746 | 1.014 | .934 | 1.1 |
| Constant | 3.082 | .152 | 410.261 | 1 | .000 | 21.799 | | |

a. Variable(s) entered on step 1: disability, PROV1, c_type, sex, agegroup, marital, C01.

Table 4.20 has several important elements. The Wald statistic and the associated probabilities provide an index of the significance of each predictor in the equation. The Wald statistic has a chi-square distribution.

The $\text{logit}(\beta)$ for disability is -0.044 with an odds ratio, $\text{Exp}(\beta)$ of 0.957 . This means that individuals with disability are 0.957 times compared to those without disability to be literate. Disability is not significant in explaining literacy. Similarly, the $\text{logit}(\beta)$ for region is 0.741 with an odds ratio, $\text{Exp}(\beta)$ of 2.097 . This means that individuals in urban areas are about 2 times compared to those in rural areas to be literate.

Region is highly significant in explaining literacy.

In the same way, the $\text{logit}(\beta)$ for sex is -0.563 with an odds ratio, $\text{Exp}(\beta)$ of 0.569 . This means that the probability of a female being literate decreases by about 44% compared to males.

The β values are the logistic coefficients that are used to create a predictive model.

Region has the highest contribution in literacy prediction.

CHAPTER 5

5.0 Conclusion and Recommendations

5.1 Summary of the findings

A key finding was that on average, 30.8% of the Kenyan adult population could not read, write and do simple calculations. This is a major challenge, given the central role literacy plays in national development and the empowerment of individuals to lead a fulfilling life.

Another key finding was that the age cohort 15 to 19 years recorded a literacy rate of 83.0%. This implies that the youth is fairly literate. The findings also indicated that ALNS decreased with increase in age.

There were also variations in literacy levels by regions. Urban areas recorded higher rates of 86.6% compared to rural areas of 69.7%.

In the provinces' category, Nairobi had an ALNS rate of 95.1% which was the highest while North-Eastern had ALNS of 16.7% the lowest among all other provinces.

Such regional disparities confirm the trend where areas that are economically well-off have an advantage in terms of academic enlightenment compared to poor areas.

Disability is not inability. The findings exposed that disability and programme awareness are not key factors in determining ALNS.

5.2 Conclusion

This study identified six determinants of ALNS which were province, reading materials, gender, marital status, region and age-group. Disability and programme awareness were not significant determinants of ALNS. The results expressed that 69.2% of the adult population had attained ALNS thus leaving 30.8% adults illiterate. The results also showed that 17% of the youth aged 15-19 years and 79.7% of adults aged 70+ years were illiterate.

The results further indicated high regional disparity in ALNS achievements with urban areas having 86.6% and rural 69.7%. Nairobi province had 95.1% and North-Eastern province 16.7%. There also exists gender disparity in ALNS levels with men rated at 76.6% and women at 64.1%.

5.3 Recommendations

In this study, we suggest the following recommendations;

- More centres of adult learning should be especially in rural areas to be accessed by the poor and marginalized rural populace.
- There should be more allocation of funds to the Adult Education Department for the provision of enough reading materials. This would encourage more adult learners to enrol especially those who cannot afford to buy reading materials.
- The public should be informed on Adult learning programmes and the value of education through the mass media and public *barazas*. This would encourage more adults to enrol at the learning centres.
- Further research may include Adult teacher training curricula, the impact of medium of instruction on learning and the relevance of the skills taught to adult learners on day to day experiences.

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