The Odds of Progressing from First to Second Birth in the Context of HIV/AIDS and Fertility Decline in Agincourt Rural Area of South Africa

A RESEARCH REPORT SUBMITTED TO THE FACULTY OF HUMANITIES AND SCHOOL OF SOCIAL SCIENCES, UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG, SOUTH AFRICA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN THE FIELD OF DEMOGRAPHY AND POPULATION STUDIES FOR THE YEAR 2010

Goodness Mildred Shabangu

9304855E

15 December 2010

Supervisor:
Dr. Jill Williams
Associate lecturer:

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
FACULTY OF HUMANITIES
SCHOOL OF SOCIAL SCIENCES
FIELD OF DEMOGRAPHY AND POPULATION STUDIES

DECLARATION:

I Goodness Mildred Shabangu hereby declare that this research report is my own original work. It is being submitted to the Faculty of Humanities and School of Social Sciences, University of the Witwatersrand, Johannesburg, South Africa, in partial fulfillment of the requirements for the degree of Master of Arts in Demography and Population Studies. I declare that this research report has not been submitted before in part or in full for any other degree or examination at this university or any other institution.

_____

15 December 2010

ACKNOWLEDGEMENTS:

I would like to acknowledge my indebtedness to all the people who helped me through my entire studies towards this degree: Special thanks to my supervisor Dr Jill Williams for her constant support, positive feedback, encouragement and guidance throughout all stages of this report regardless of distance. My sincere thanks to my girls Lolo, Lulu, and Lele for their patience and selflessly sharing their time with my studies and work. My sincere thanks to Montze for moral support. I am grateful to the Wellcome Trust Fellowship Foundation for financially assisting my studies, Mama Jane Menken and to the MRC/Wits Rural Health Transitions and Research Unit – Agincourt for the opportunity, especially to Professor Kathy Kahn, Professor Stephen Tollman, Dr Mark Collinson and to Casey Blalock, Chodziwadziwa Kabudula and Professor Tom Moultrie for their statistical support. Last but not least, I thank the Almighty God for this achievement.

DEDICATION:

To my late mother Virginia and my late brother Otha for handing over such a responsibility to me.

TABLE OF CONTENTS

Page No.

DECLARATION: ..... **I**

ACKNOWLEDGEMENTS: ..... **II**

DEDICATION: ..... **III**

TABLE OF CONTENTS ..... **IV**

LIST OF FIGURES ..... **VII**

LIST OF TABLES ..... **VII**

CHAPTER 1 ..... **1**

1.0 INTRODUCTION **1**

1.1 GENERAL INTRODUCTION **1**

1.2 PROBLEM STATEMENT **7**

1.3 AIMS AND OBJECTIVES **8**

1.3.1 General Objective 8

1.3.2 Specific Objectives 9

1.4 RESEARCH QUESTIONS **9**

1.5 HYPOTHESES **10**

1.6 JUSTIFICATION OF STUDY **11**

1.7 OPERATIONAL DEFINITIONS AND ABBREVIATIONS **14**

CHAPTER 2 ..... **16**

2.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK **16**

2.1 LITERATURE REVIEW 16
2.1.1 Introduction 16

2.2 FACTORS CORRELATED TO PARITY PROGRESSION 17
2.2.1 Parity progression as a measure of fertility 17
2.2.2 Timing of first births and birth intervals 19
2.2.3 Maternal age and marriage 20
2.2.4 Education and progression 22
2.2.5 Sex of the first child 23
2.2.6 Social policies and their effects on fertility 24
2.2.7 HIV/AIDS effects on fertility 24

2.3 THEORETICAL AND CONCEPTUAL FRAMEWORK 26

CHAPTER 3 30

3.0 DATA AND METHODS 30

3.1 INTRODUCTION 30

3.2 SOURCE OF DATA AND STUDY DESIGN 31
3.2.1 Background of the Agincourt Health and Demographic Surveillance System (AHDSS) 31
3.2.2 Instrumentation and data processing 32
3.2.3 Sample Population 33

3.3 DATA ANALYSIS 34

3.4 DATA LIMITATIONS 36
3.4.1 Education 37
3.4.2 Contraceptive use 37
3.4.3 Multiple births 38
3.4.4 Marriage 38
3.4.5 Conclusion 39

CHAPTER 4 40

4.0 DATA ANALYSIS 40

4.1 DESCRIPTIVE ANALYSIS 40
4.1.1 Characteristics of Agincourt women with first live births (1993- 2002) 40

4.2 BIVARIATE ANALYSIS 41
4.2.1 Proportion of mothers who had a second birth within a 5-year period 42
4.2.2 Factors affecting progression to second birth 45
4.2.3 Distribution of second births by period and age 45

Statistical Distribution 47

4.3 BIVARIATE ODDS OF PROGRESSING TO A SECOND BIRTH **48**

4.4 BRIEF SUMMARY OF DESCRIPTIVE RESULTS **52**

CHAPTER 5 ..... **54**

5.0 LOGISTICS REGRESSION **54**

5.1 MULTIVARIATE ODDS OF PROGRESSING TO A SECOND BIRTH **54**

5.2 AGE AND PERIOD DIFFERENTIALS ON PROGRESSING TO A SECOND BIRTH WITHIN FIVE YEARS **56**

5.2.1 Changes in relative odds of progression to a second birth over time 56

CHAPTER 6 ..... **62**

6.0 DISCUSSION OF FINDINGS AND CONCLUSSION **62**

6.1 INTRODUCTION **62**

6.1.1 Review of Findings to research questions 63

6.2 SIGNIFICANCE OF FINDINGS **72**

CHAPTER 7 ..... **74**

7.0 LIMITATIONS OF STUDY AND RECOMMENDATIONS **74**

7.1 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FUTURE DATA COLLECTION **74**

7.1.1 Education 74

7.1.2 Marriage 75

7.1.3 Contraceptive use 76

7.2 RECOMMENDATIONS **77**

7.2.1 Future research 77

7.2.2 Policy implications 79

REFERENCES **82**

APPENDIX 1: FERTILITY LEVELS AND TRENDS AND HIV PREVALENCE IN RURAL SOUTH AFRICA **89**

APPENDIX 2: LOCATION OF AGINCOURT DSS **90**

LIST OF FIGURES

Figure 1 - Conceptual framework 28

Appendix 1, Figure 1 - Total Fertility Rates in Agincourt HDSS, 1993-2007 89

Appendix 1, Figure 2 - Age Specific Fertility Rates in Agincourt HDSS, 1993-2007 89

Appendix 1, Figure 3 - Mean Age at Birth in Agincourt HDSS, 1993-2007 89

Appendix 1, Figure 4 - HIV Positive Pregnant Women in South Africa, 1993-2007 89

LIST OF TABLES

Table 1: Characteristics of first time mothers in Agincourt between 1993-2007 43

Table 2: Proportion of mothers who had a second birth in 5 years 44

Table 3: Measuring progression to second births within 5 years by socio-demographic characteristics of mother 47

Table 4: Distribution of mothers' outcome of progressing to second birth within 5 years by age and period 48

Table 5: Period difference on the Odds of progressing to a second birth within 5 years by age 49

Table 6: Bivariate analysis of progressing to second birth within 5 years between 1993 and 2002 51

Table 7: Modeling odds of progressing to a second birth within 5 years by period of first birth and socio-demographic characteristics of older moms with reference to teen moms 55

Table 8: Changes in relative odds of progression to second birth over time (1993-1997 and 1998-2002) 59

CHAPTER 1

1.0 INTRODUCTION

1.1 GENERAL INTRODUCTION

Following the history of the African continent of high fertility among black Africans, many countries in the continent have made successful attempts to bring fertility down. Fertility decline has stalled at above replacement levels in many places and in others, closer to replacement fertility (Garenne, et al 2007). For example, Southern Africa has lowest fertility in the region, estimated at 2.8 children per woman. Such achievements are attributed to earlier family planning programmes which in other countries like South Africa were aimed at reducing the population of the black South Africans. However, recent studies show that contraceptive use has steadily decreased in many parts of the Sub-Saharan Africa, posing a challenge to maternal and child health (Gribble and Haffey, 2008).

One of the demographic findings is that delayed births with longer birth intervals is emerging as the major driver of fertility decline in numerous Sub-Saharan African countries including South Africa, leading to an evolution of fertility determinants other than proximate determinants outlined in Bongaarts literature (Timaeus and Moultrie 2008). However, such trajectory may be shaped by socio-historical, economic and institutional changes over time. In the African continent, South Africa has lower fertility rates, especially among African women due to long birth intervals that can be explained by a desired spacing (Timaeus and Moultrie 2008). Even for Africans, fertility in South Africa is near replacement level, a situation which is likely to have

many demographic, economic and social implications among which HIV/AIDS and its relation to fertility behaviour is one (Garenne et al. (20007).

Culture in Africa has also been characterized by non-marital and teenage fertility, preference for large families, particularly in rural areas. This resulted in early first births particularly among teenagers in the continent among which South Africa ranks the highest (Preston-Whyte and Zondi, 1992). Although fertility has fundamentally dropped in the region, teenage motherhood still remains high in South Africa. Findings from DHS surveys indicate that about 35% of 19 year old girls in South Africa have given births at least once (Caldwell, 1992), 80% have had sex and all these often happen outside marriage (Makiwane, 2010). Early first births are consequences of inaccessible contraceptives for teenagers in traditional societies controlled by health services staff. However, teenagers in South Africa have unique pattern in that the first births are followed by a relatively long period before progressing to the second birth. In fact, contraceptives are accessible for teen moms after their first births to allow them to return to school (Tollman, 2008).

Changes over time also play a role in parity progression. South Africa has achieved fertility reduction much earlier and higher than other countries in Sub-Saharan Africa (Caldwell and Caldwell, 1987), dropping by more than 70% between the 1960s and the 1990s (Moultrie and Timaeus, 2003) and (Swartz, 2002). Fertility levels among South African women decreasing from 6 children in 1970 to 3.2 in 1996 with mean birth spacing intervals doubling from 2.5 years to 4.2 years (Theunissen, 2002). Of interest to this study, Agincourt follows a similar pattern with a decline of about 4.0 to 2.3 children per woman between 1992 and 2004 (Garenne et al,

2007), see appendix 1. While this early decline in the African continent was attributed to response to economic effects, in South Africa it is linked to apartheid policies, the availability and quality of family planning services (Burgard, 2004) and the significant levels of spousal and partner separation which strongly encouraged African male labour migration to urban areas and restricted their women and families (Kaufman 1998).

Much of the African continent is now also hard hit by the HIV/AIDS epidemic. High fertility is inextricably tied to the epidemic because unprotected sex can result in both pregnancy and transmission of HIV/AIDS. However, HIV/AIDS is of great concern even for countries with relatively lower fertility such as South Africa where the HIV/AIDS epidemic is advanced (Gribble and Haffey, 2008). South Africa faces challenges in fighting HIV/AIDS transmission in part because of the age structure of childbearing and particularly historically high rates of adolescent childbearing (Varga, 2003). High teenage fertility indicates that girls are at early risk of transmission and may have a lengthy reproductive span during which avoiding HIV/AIDS may be difficult.

While studies attribute accelerated fertility decline as the end result of the policies, especially for the non-whites (Swartz 2002), it is not uncovered in-depth how the decline has affected birth intervals for adolescents, particularly those in high HIV/AIDS prevalence areas. High HIV/AIDS prevalence may encourage early childbearing since women or couples may be afraid of impeded fertility in their lives, or, it may be that HIV/AIDS prevention efforts are reducing teenage childbearing. Since it remains to be proven what the impact of HIV/AIDS is on the childbearing intentions of adolescents in South Africa. It therefore remains a research area to explore higher

teenage first births and to measure their progression to second births over time.This study seeks to find out if and how adolescent childbearing has changed in both prevalence and pace during the fertility decline and increasing HIV prevalence. This study seeks to address these questions by looking at the age structure of first births and the determinants of having a second birth in rural South Africa during a period of decreasing fertility and increasing HIV prevalence.

The evolution of HIV dates back to the 1970s in central Africa and having being a major burden of disease (BOD) in the 1980s (Garenne and Zwang, 2008). This is a period in line with the beginning of fertility transition in the continent, yet studies did not assume any association between HIV/AIDS and fertility. Recently 22 million people are said to be living with HIV/AIDS in Sub-Saharan Africa, among which 5.5 million are in South Africa (Gribble and Haffey, 2008).

HIV/AIDS prevalence is said to be higher among females under the age of 40 years whereby 80% of the prevalence is among women aged 20-24, with only a third of men of the same age group infected. This indicates the high risk of exposure among young women, including teenagers. The apartheid governance institutionally located the Agincourt area in Limpopo before 2006 and in Mpumalanga thereafter. HSRC research 2000-2007 records show that HIV/AIDS prevalence among pregnant women in the two provinces were said to be 18% and 28% respectively in 2006, (http://www.hsrc.ac.za/research/outputDocuments/5890), a period embracing the study sample period (1993-2007). The records also show a reduction of fertility through life expectancy of 46.5 years for females and 41 years for males. These figures indicate that women are at higher risk of mortality due to HIV/AIDS, 3-4 years prior to fertility exit age.

Although there is still dearth of literature directly associating HIV/AIDS with fertility decline, the high HIV/AIDS prevalence in the country will soon account for fertility trends more than other determinants. In the Agincourt DSS area HIV/AIDS began to be prevalent as early as 1990 (Garenne et al. 2007) and had become the leading cause of death among children and young adults by 2000 (Zwang et al 2007). HIV/AIDS can theoretically result in lower or higher fertility such as reducing the fecundity and conception chances and increasing the chance of fetal loss. Consequently, other than to prove womanhood women may choose to have early births, before they are infected, prolong births until they are married, limit or stop births for fear of getting infected or because they are infected (Gregson 1994, Kirshenbaum et al. 2004, and Yeatman 2008). Eventually, this behavior contributes to timing of births and pattern of parity progression which remain unexplored (Bongaarts 2006).

Although there is vast literature on reproductive health and fertility trends, the focus has largely been on proximate determinants of fertility such as age of marriage, age at first birth and contraceptive use. South Africa is a country that has been characterised with a high level of non-marital births which usually occur during the teenage years where a young woman is more likely to give birth to her first child when she is below 20 years of age, in the secondary school and she is very unlikely to settle down for marriage (Garenne and Joseph, 2002).

There is high existence of early first births among unmarried women and teenagers and higher births rates among older women, however, progressing to second births take longer than expected due to level of exposure in childbearing. Thus, teenage motherhood appears to be much more pronounced on first births than second births which can be attributed to timing of births and

related consequences. Older women have delayed first births and shortened reproductive exposure due to delayed age at marriage, a major proximate determinant. These transitions are largely contributing to the reduction in fertility, yet barely explored.

The Agincourt Health and Demograhic Surveillance System (described further in Chapter 3) has appropriate data to help understand the socio-historical, economic and institutional changes underlying the progression thereby affecting fertility transition. For instance, the period which marks the earlier years of the DSS, 1992 is the last 2 years prior to end of apartheid governance with its policies repealed 2 years after, changing of women's socio-economic status in the society and the beginning of HIV epidemic with its political controversy regarding interventions. Parity progression, mainly birth spacing and intervals are central in understanding fertility trends and transitions and can well offer comprehensive understanding of declining fertility in rural areas facing diseases of life style and new sexual and reproductive health policies (Timaeus and Moultrie 2008). It is in the light of the above arguments with fertility data from the Agincourt HDSS, a rural area of South Africa that this study seeks to fill this vacuum by exploring factors affecting parity progression to see whether age and socio-demographic changes over time are of any significant effect to progression to second births from first live births given between 1993 and 2002.

1.2 PROBLEM STATEMENT

Fertility levels among South African women decreased continuously from the 1970s to date and average birth intervals have doubled from 2.5 to 4.2 years. Agincourt follows a similar pattern with a decline of about 4.0 to 2.3 children per woman between 1992 and 2004 (Garenne et al, 2007). There is high premarital and early first births at ages below 20 years in South Africa where more than 30% of 19-year-old girls is said to have given birth at least once (Garenne and Joseph, 2002; Kaufman et al 2001). In addition to that mother age at birth and birth intervals have association with survival of the child, early births (<18 years), late births (35+ years) and short intervals (<2 years) are associated with high infant and child mortality risks (Davanzo, et al., 2004), Having high levels of non-marital (21%) and teenage births in South Africa (Garenne et al., 2007) where marriage in not guaranteed is an indication of unprotected sexual intercourse which increase risk of infections.

HIV/AIDS infections lowers fertility by up to 40% and HIV/AIDS sero-prevalence in South Africa was estimated at 35% among pregnant women in 2004 (Garenne Zwang 2008). With life expectancy having dropped from 54–37 years for females and 50-38 years for males in 1999 and 2010 respectively, it is projected that HIV/AIDS related child mortality would be 100/100 000 births in South Africa in 2010. One of the hospitals in Kwazulu-Natal had already reached 81% of AIDS related child deaths in paediatric ward by 1999 (Coombe, 2000). According to (Zwang et al 2007), since 2000 HIV/AIDS has accounted for majority of the deaths in the Agincourt area. Under 5 mortality in Agincourt has increased with life expectancy dropping from 72 to 60 years for females and from 66 to 52 years for males. Child mortality increased from 39/1000 to 77/1000 between 1992 and 2003 (Kahn et al, 2007). High mortality and low fertility can

eventually have a major effect on population growth (Garenne et al, 2007). For instance, there was a positive population growth of 30.9 per 1000 birth rates and 5.0 per 1000 death rates in 1992. Between 2000 and 2004 the area achieved a negative growth of 21.0 per 1000 CBR and 10.9 per 1000 CDR. HIV/AIDS is responsible for about 35% deaths among 15-49 year age groups in the Agincourt area. All the issues indicated above, can well affect teenage childbearing and parity progression in a number of ways. Therefore it is worth looking at the rudiments behind the decline, viz, why so high a decline even with early first births and non-marital births and what are the factors associated with progressing to a second birth.

1.3 AIMS AND OBJECTIVES

With the continuing decline to lower fertility in rural South Africa, it is imperative to explore the effects of socio-demographic factors on the proximate determinants of fertility paying more attention to factors such as characteristics of first time mothers and the period within which they had their first births. It is therefore the ultimate aim of this study to explore parity progression by modeling birth intervals from first live birth to second birth in the Agincourt rural area of South Africa.

1.3.1 General Objective

The main objective of this study is to assess whether age and period of first birth have effects on parity progression in order to explore how parity progression and associated background effects such HIV/AIDS contribute to fertility decline in rural South Africa over time.

1.3.2 Specific Objectives

Specifically, this study aims:

i) To explore factors associated with progressing from first to second birth and how that changes with age over time.

ii) To determine the age of women at first birth and the likelihood of progressing to a second birth within a period of five years following the first live birth.

iii) To examine the characteristics of mothers with first and second births in a rural setting with declining fertility.

iv) To investigate how changes in society, particularly the HIV epidemic, is likely to significantly influence the pace of transitioning from first to second birth among women of different age groups in rural South Africa.

v) To compare the time differential of the birth transition among teenage mothers and older mothers in rural South Africa.

1.4 RESEARCH QUESTIONS

The study addresses the following research questions:

i) What percentage of woman who have had a first live birth progress to a second birth within five years following the first birth?

ii) Do adolescents have different odds of progressing to a second birth than older moms?

iii) Are there differential odds of progressing to a second birth within 5 years between first live births which occurred between period 1993-1997 and period 1998 -2002?

iv) Is there an effect of age and period on the odds of progressing from first birth to second birth?

v) Is there any variation in the odds of progressing to a second birth by age at first birth, education, refugee status, marriage, and sex of first child, birth parity and period at first birth on the odds to transitioning to second birth?

1.5 HYPOTHESES

Based on the above background I would like to test the following hypothesis

Hypothesis:

i) Almost half of all the women who have had a first live birth are most likely to progress to second birth within 5 years of the first birth.

ii) The odds of progressing from first to second birth within five years are lower for teenage mothers than they are for older mothers.

iii) There is no difference in time period for both teenage mothers and older mothers to the odds of progressing from first to second birth within five years after the first birth.

iv) Teenage mothers will have lower education at first birth and be more likely to be former Mozambican refugee than older first time mothers that are South Africans. These differences will be the same in the second period.

v) The odds of progressing from first to second birth within five years vary with age of mother, education status, refugee status, marriage, first birth parity type/number, sex and death of first child. These differences will be the same in both periods.

1.6 JUSTIFICATION OF STUDY

There is lack of literature that brings understanding of the likelihood of progressing from first to second birth for adolescent mothers and differences between odds of progressing between them and older mothers. It is essential, and therefore the motivation of this study to understand how early first and late first births and non-marital births can delay or stagnant the subsequent births in an area that has undergone socio-historical trajectories and high rates of HIV/AIDS, and how the progression pattern may ultimately influence fertility future fertility.

There exists relatively unexplored longitudinal data in Agincourt which can be used to achieve the research objectives. It is worth noting that the analysis will produce best quality results because longitudinal data surveillance systems are characterised with most reliable data. In this light, this study is being considered for the following three reasons:

First, South Africa experiences the highest proportionion of teenage childbearing in sub-Saharan Africa and the demographic transition is still ongoing even in rural areas. There are also high rates of maternal health risks and mortality in the country than other parts of the world. Moreover, the high rates of teenage pregnancies in South Africa expose young mothers below the age of 18 and those who space their births earlier at maternal health risks that can sometimes be life threatening. Also, childbearing at an older age and long period spacing of beyond 5 years intervals increase maternal and child health risks (USAID, 2006). Therefore, timing and spacing of pregnancies play a substantial role in maternal and the survival and health of the birth outcomes.

Second, availability of modern contraceptives in the 1970s was rather aimed at limiting black population than to reduce fertility of the country at large irrespective of race to match the demand and supply for better economic development. The post apartheid policies have liberated the society which may have contributed to acceleration in the pace of the fertility decline in South Africa (Moultrie and Timaeus, 2002). The fertility decline of South Africa has been associated with a wide margin between first and second birth.

Third, there also exist social policies that cannot be separated from changing lifestyle and behaviour in rural societies particularly that of the youth. Although such policies are intended to improve living conditions, they are also likely to contribute to deviation from cultural norms. For example, early sexual indulgence regardless of any recognised union or any intention towards union formation (Makiwane, 2010; Monde, 2010) can be manipulative of the social policies aimed at improving the lives of the youth by keeping them at school.

Moreover, since teen mothers are less likely to be married or maintain the union with the fathers of their first child, there are risks of exposure to infectious diseases such as HIV/AIDS which might result to shocks and stresses on affected households. The burden is usually carried by the economically perverse elderly and the state. There exists relatively unexplored longitudinal data source in Agincourt rural area of South Africa, which can be used to achieve the research objectives.

Conducting a study on birth spacing and intervals will contribute to the understanding of the health risks associated with child spacing and birth intervals and other maternal demographic factors associated with child and maternal health among specific ages of women of child bearing age. Analysis of the study will contribute to a deeper understanding of fertility determinants and effects, particularly the decline in fertility as well as understanding of continuous demographic transition in rural South Africa.

Although the report is not intended on evaluating the social policies, in addition to contribution to knowledge, analysis will help in revising and strengthening of reproductive health, socio-economic and education policies that are most likely to affect fertility for improved policies and intervention towards discouraging teenage motherhood, and unprotected sex and more education around sexual and reproductive health. The analysis will also contribute to evaluation of immerging fertility determinants, interventions and in improving access to health services, awareness and treatment.

1.7 OPERATIONAL DEFINITIONS AND ABBREVIATIONS

- **AHDSS:** Agincourt Health and Demographic Surveillance System. Agincourt is the main village in the DSS, used to identify the entire DSA. The village where the surveillance office activities are taking place. An area where better health services were located during the apartheid governance (a referral health centre by the DSA clinics and a laboratory and central location between the Gazankulu and Lebowa homelands, currently dividing quasi urban and rural villages)
- **ASFR:** Age Specific Fertility Rate
- **Birth** refers to a live pregnancy outcome in this report limited to 1^{st} (P_1) births occurring within the specified 2 time periods (1. 1993–1997 2. 1998-2002) and 2^{nd} births (P_2) occurring within 5 years after the P_1 (up to 2007) and will be used as birth and parity interchangeably.
- **BOD:** Burden of Disease
- **CBR:** Crude Birth Rate
- **CDR:** Crude Death Rate
- **CEB:** Children Ever Born
- **DHS:** Demographic Health Survey
- **DSA:** Demographic Surveillance Area
- **DSS:** Demographic Surveillance Site
- **HIV/AIDS:** Human Immuno-Virus/Acquired Immuno-Deficiency Syndrome
- **HSRC:** Human Sciences Research Council
- **MRC:** Medical Research Council

- **Odds** - in this report odds refers to the likelihood that a women will have a second birth within five years following the first live birth
- **Parity Progression**: "denotes the probability that a woman after delivering her i-th birth will ever proceed to the next birth" (Mazharul Islam and Yadava, 1997, 201). The concept of parity progression ratio (PPR) first put forward in 1953 by French demographer L. Henry refers to the proportion of those who have borne more than (i + 1) children among a group of women having borne i children, i being any integer, including 0 (Mazharul and Yadava, 1997). PPR has been used to measure the extent to which women of 45-49 age groups have given their first and subsequent order births regardless of the intervals between the birth orders (Newell, 1988). Hence, in this report, progression in parity will be limited to transitioning from first to second live births over a defined period of time to understand how birth spacing and time affect fertility trends, particularly in rural areas that have undergone tremendous historical, economic and social transitions.
- **Refugee Status:** DSS term used to refer to citizenship distinguishing non-South Africans, legally residing in the DSA, mostly from Mozambique
- **RENAMO:** Resistência Nacional Moçambicana
- **Teenager/Teenage mother/teen mom:** A woman who gave birth between age 12 and 18 years.
- **TFR:** Total Fertility Rate. Average number of children a woman would bear, if she survived through the end of the reproductive age span and experienced at each age a particular set of age-specific fertility rates (Newell, 1988).

CHAPTER 2

2.0 LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 LITERATURE REVIEW

2.1.1 Introduction

Very little focus has been put to associating fertility decline with parity progression, especially birth spacing and intervals. Even attempts made by scientist such as Lesthaeghe and Calwell in the late 80s and early 90's respectively, studies on fertility mainly focus on describing the decline rather than paying attention to the factors influencing the decline (Timaeus and Moultrie, 2008).

Numerous studies in Sub-Saharan Africa reveal that shorter birth intervals put the child at risk of infectious diseases during childhood or infant mortality (RamaraRao et al, 2006). Yet, majority of women in most poor and less educated societies are not following any birth planning programs regardless of their willingness to do so due to changing circumstances in their societies over time. Parity progression can be understood by examining the relationship between age at first birth and the rate of progression to subsequent births among maternal age groups coupled with other socio-demographic issues.

In the United States, studies have attributed transition to second birth to age at first birth (Rasekh and Momtaz, 2007). In contrary to findings by Pebley (1981) that women, who have an early birth in South Africa, tend to have subsequent births more rapidly, early first births is South Africa are usually followed by prolonged second births due to high rates of contraceptive use after the first birth (Timaeus and Moultrie, 2008 and Garenne et al, 2007). Social policies cannot

be separated from having effect on the timing of birth (Ekert-Jafte et al, 2002). In South Africa, apartheid policies played a role in influencing timing of first birth through unequal distribution of resources and forbidding interaction of blacks with wider South African community (Sibanda and Zuberi, 2005). For example, older women could utilize available contraceptives while teenagers could not copy lifestyles such as sexual and reproductive health practices from the other advantaged races due to limitations on social networks. There were health services barriers to contraceptive use or termination of pregnancy (Makiwane and Udjo, 2006). Teenagers could not access contraceptives without parental consent. Hence, the high number of teenage pregnancies among the black population particularly in rural areas, with Venda ethnic groups being the highest (Sibanda and Zuberi, 2005).

In the post-apartheid era, government introduced policies that addressed the past segregation yet controlling fertility. In the light of this background, this chapter offers a review of literature on factors that are associated with progression from first births. Since there is scanty of literature specifically on progression from first to second birth, this chapter will allude on progression generally, yet highlighting on how the first to second births are major drivers to subsequent births.

2.2 FACTORS CORRELATED TO PARITY PROGRESSION

2.2.1 Parity progression as a measure of fertility

Fertility is affected by other factors that are influenced by demographic, health and reproductive histories of women and cultural background of societies in which women of various characteristics within the fertility age group find themselves (RamaraRao et al, 2006; Bongaarts

2006). Using Bongaarts 1976 conceptual framework of proximate determinants, a study conducted by RamaraRao et al (2006) in Mozambique using data from 1997 and 2003 DHSs found that background factors affecting birth spacing are associated with social and cultural norms, reproduction behaviours and use of family planning measures. Major factors include timing of first birth, age at first birth, nuptiality and woman's education. These factors have varying effects on progression of births by revealing women's reproductive patterns through birth intervals (Rasekh and Momtaz, 2007).

A study using survey fertility data from the United States and Costa Rica, modeling parity progression has demonstrated the extent to which birth spacing and intervals are fundamental measures of fertility, allowing integration of macro and micro level analysis of fertility trends and population growth. The study further indicates that birth spacing and intervals can further translate into fertility rates and can allow population projections, thereby guide on population and reproductive health programmes. Also explored in this study, Feeney (1983) states that spacing and intervals allow for analysis of fertility determinants that may intervene during the progression process such as education, citizenship marriage etc, as well as differentials in the likelihoods of progressing from the first to subsequent births

Of similar findings in South Africa, a study conducted at the Africa Centre DSS in Kwazulu-Natal, using longitudinal surveillance data to explore the role of birth spacing and intervals on fertility decline reports that birth intervals in South Africa are long, thereby contributing to decline in fertility. Findings from 2008 South African DHS indicate that teenage pregnancy remain an area of concern since it remained high even with declining fertility among other age groups. Higher rates of teenage fertility are found to be among Coloured and African girls with low education status. The results further assert that with each additional year proportion of

pregnant teenager grew from 2.4% to 35% in 1998 (Swartz (2002). This shows relation of fertility with timing of first birth.

2.2.2 Timing of first births and birth intervals

Analysis of the South African 1996 census and 1998 DHS performed by the MRC BOD research unit associate the decline in fertility levels among South African women from about 6 children in 1970 to 3.2 in 1996 nationally with the doubling of mean birth intervals of 2.5 years to 4.2 years (Theunissen, 2002). Similarly, in their study on postponement and birth intervals, (Timaeus and Moultrie, 2008) report that the mean birth intervals among African South Africans have increased from 2.5 years by 1960 and 70s, the beginning of fertility decline in the continent to about 6 years long by the mid-1990s. The interval is much higher when compared to other countries in Sub-Saharan Africa. The mean birth intervals for Lesotho, Zimbabwe and Namibia were 4-5 years and 3 years for Kenya, Malawi, Mozambique, Tanzania and Zambia. A study on advanced maternal age in the European countries has also related delayed first births and progression rate from first to subsequent births to low fertility whereby findings revealed a mean of 26 years (Davanzo et al, 2004).

As Lappegård (2000) indicates, timing of birth and birth spacing are of crucial significance in fertility studies and analysis. In other societies customs play a pivotal role in determining timing of the first birth among couples. Rasekh and Momtaz (2007) state that a study conducted in 2001 in Nepal found that first births are much valued which suggest prolonged subsequent births However, in some societies such as the high teenage births among Vendas in South Africa (Sibanda and Zuberi, 2005), as well as non-marital births, delayed second births are due to

experiences related to first birth and socio-economic position forcing unmarried women and teenagers to delay their second births (Ekert-Jafte et al (2002). Moreover, coupled with contraceptive use, women who are single when they have their first births are less exposed to intercourse than married women. Therefore, birth numbers become depressed during years in which women delay child bearing (Udjo, 2005).

In the past Africans were viewed as pronatalist characterized with large families (Sibanda and Zuberi, 2005). However, recent literature reveals that there is a transition in African and traditional society from the "wealth-flows theory" which believes that large families constitute family assets, to practices that are influencing reduced desired fertility (Mankiwa-Adebusoye, 2001). In the face of new and social economic imperatives, emphasizing women empowerment, these practices are witnessed in most societies in the Sub-Saharan Africa where women are making fundamental decisions with regard to how and when they transition from one birth to the other as well as when to cease childbearing.

2.2.3 Maternal age and marriage

Age at marriage is considered as the major determinant of birth intervals as it explains age at first birth whereby many births usually happen in unions. Studies reveal that age at marriage and therefore age at first birth has biological and maturational factors which affect birth intervals. It is found that the first birth determines the transition from parity one to parity two among young women while in older women the effect is transitioning from parity two to higher order parity. Late marriage is also associated with swifter birth intervals (Rasekh and Momtaz, 2007). A study by Chakraborty and colleagues reveals that out of 55 DHS surveys 51 found young moms to be

progressing much earlier to the next births than older mothers due to reproductive age and having achieved desired family sizes respectively. In Mozambique, teen moms and young moms were found to have the most likelihood of progressing to the next birth much earlier than mid aged and older moms. Women in unions were found to be more likely to progress much earlier due to greater exposure to intercourse and pregnancy (RamaraRao et al 2006).

However, compared to other Sub-Saharan countries, marriage in South Africa is not universal with characteristics of non-marital unions. Similar to fertility, marriage in South Africa is influenced by the apartheid policies; in particular the labour migration laws separating women form their spouses leading to delayed marriages, cohabitation and multiple partnerships. Literature indicates that even with an attempt by the post apartheid government to introduce new marriage act, marriage decreased. Furthermore, the political transformation coincide with the rise of HIV/AIDS which further created uncertainties with regard to family formation decision-making thereby increasing informal unions (Hosegood et al., 2009). With lower rates of marriage, exposure to childbearing remains very low and impact on declining fertility characterizing the country currently. A study on marriage trends using data from the Africa Center DSS in rural KwaZulu-Natal reveal that non-marital and cohabitation for men and women aged 50 years increased from 14% and 5% respectively in the 1970s to 27% and 18% respectively in early 2000. Moreover, mean age at marriage was found to be 31 years for men and 25 years for women (Hosegood, et al, 2009). This is an indication of delayed exposure to first births among married couples.

2.2.4 Education and progression

Although a study in India, did not find any significant association between women's education and parity progression (child spacing and birth intervals), education has a fundamental impact on birth preferences in many societies (Rasekh and Momtaz, 2007). According to Sibanda and Zuberi, (2005), woman of low socioeconomic status within which education is an indicator, are expected to have first birth at a younger age, yet, timing of subsequent births increase with increasing education. Education is a key determinant of fertility preferences in that it determines decision-making with regard to child bearing and spacing since women of child bearing age have to think of their own education and their children's.

Although children's education has been proven to be an important determinant of parent's decision to limit fertility, education or schooling experiences of the mother influence the subsequent fertility behaviour. Fertility has been seen as a limitation on schooling particularly of women. Thus, education forms the foundation of knowledge about fertility behaviour by increasing the cost of childbearing thereby reducing the motivation to have children as well as access to income to cater for the welfare of the children (Axinn, 1993).

Numerous studies report a correlation between education of the mother and the likelihood of progressing to second birth. A study focusing on marital fertility in China found that educated and economically advanced mothers could access advanced technology to determine the sex of the child on conception, could easily pay the penalty of bridging the one child policy, or decide on how many children they want to have as compared to uneducated first time mothers (Zhenechao 1997). Although a study in Korea found that better educated mothers space earlier

than less educated, out of 51 DHS surveys, 38 found less educated women to be more likely to progress to the next birth earlier than the educated women. RamaraRao and colleagues indicate that since Mozambicans have lower literacy levels especially among the teenagers (15-19) the likelihood of progression is higher on mothers with low education status.

2.2.5 Sex of the first child

A survey was conducted in China between 1992 and 1993 on women on their first marriage with first births occurring before their 35th birthday, looking at period and socio-demographic effects on the likelihoods of having a second birth in areas where the 'one child' policy restricted women to 2 children in four years interval following the first birth. Using proportional hazard models, sex of the first child was found to be a predictor for transitioning to a second birth, with mothers of first born girls having higher progression likelihoods (Zhenechao, 1997). In Mozambique, women who gave birth to girls were more likely to progress to the next birth much earlier than those with boys.

Other effects on progression include survival of the first child, parity type (single or multiple births) and time period. Often death of the first child have more likelihood of earlier progression to the second birth in that at times parents plan a new pregnancy to replace a lost child, while multiple first births delays the second birth. Period did not have a significant difference on progression in the analysis of the 2 periods of the Mozambique DHSs (1997 and 2003) yet intervals were generally shorter in Mozambique (RamaraRao et al 2006).

2.2.6 Social policies and their effects on fertility

Current reproductive health policies seek to introduce corrective measures to the previous apartheid governance, but interventions and services still give birth to secondary problems affecting fertility. For example, legalising abortion to deal with unwanted pregnancies is vital. However, strengthening of contraceptive usage that are preventive for married women and those that are protective for unmarried women in the context of escalating HIV/AIDS can address the emerging effects on fertility. Education policies also allow pregnant girls to continue with schooling which was prohibited by the apartheid government (Kaufman, et al, 2001). While consequences related to teenage motherhood such as taking care of the child would discourage teenage pregnancies, schooling while pregnant and economic support can reverse attempts to combat teenage motherhood which is shown by the increase from 34% to 40% of teenage fertility in the later period of this study.

Because teenage mothers are less likely to get married to the fathers of their first child, changing partners tends to prevail after the first birth which introduces the HIV/AIDS effects on fertility. Women's fertility behaviour is changing because they either respond to the HIV/AIDS effects behaviorally or biologically. The former by making conscious decisions to stop having children and the latter by sterility due to the presence of the disease in their systems and mostly they are HIV positive by the time they have their first child (Makiwane and Udjo, 2006).

2.2.7 HIV/AIDS effects on fertility

As long as there is no absolute cure for HIV/AIDS women of childbearing age are more likely to die earlier before reaching menopause due to life expectancy reduced by HIV/AIDS mortality.

Children born with HIV have a limited life span lower than maternal age even if they can be on ARVs. The epidemic also causes changes in reproductive behaviours as people tends to practice protective intercourse reducing exposure to pregnancy. HIV/AIDS related behaviour consequentially hinders progression to second births since first births are hardly achieved (Marks and Potts, 2001). However, current literature on HIV/AIDS and fertility correlation is based on assumptions due to less scientific focus on the subject.

Findings reveal that fertility in Sub-Saharan Africa is lower at 2.8 children per woman attributed to high contraceptive use. Among other countries in the region, South Africa accounts for 12.7% of HIV/AIDS prevalence among female ages 15-24 (Gribble and Haffey, 2008). A study conducted in rural Kwazulu-Natal on 21,847 women did not find a strong association between HIV/AIDS and fertility decline as HIV/AIDS was only responsible for 12% of fertility reduction. However, the rate is expected to rise in the near future (Camlin, et al, 2004). Similarly, HIV/AIDS effect on Agincourt fertility has been found to be relatively small according to Garenne et al, (2007) in their study on Fertility trends in Agincourt. However, the study highlights that the effect is in a rise as seen by the 25% HIV- positive pregnant women which is responsible for 35% negative effect on TFR that can account for a 9% fertility decline. In a different study, HIV/AIDS was found to have a strong correlation with fertility through non-marital reproductive behaviours. Nonetheless, the relationship between fertility decline and HIV/AIDS remains complex until widely explored (Garenne and Zwang, 2008).

2.3 THEORETICAL AND CONCEPTUAL FRAMEWORK

With background from earlier research and findings, the framework assumes that parity progression from first to second birth in South Africa in rural Agincourt is formulated as follows: The ***period of first birth*** is shaped by institutional and social practices. Births that were given in the earlier period have their pattern shaped by the apartheid governance, family planning and social policies, norms and values. This period women would marry late, or indulge in non-marital relationship due to male labour migration to urban areas with curfew controls against spouses and families where male partners would form interim sexual relationships at places of work. While both female partners would remain infecund, the one back home would abstain because husband is away and the one at place of work due to induced contraceptive use (Hosegood et al., 2009). At the same time, culture would not allow young girls to practice contraceptive use while consequences of unprotected intercourse were not communicated to them either institutionally or at home. Hence, rise in teenage and non-marital fertility and late first births among wives of migrants and older women (Marks and Potts, 2001). Since any form of spousal arrangement was not stable to reproductive intercourse, second births were most likely to be delayed, paused or prevented, hence, declining TFRs.

The practices of the first period with low TFRs perpetuated to the second period already showing biological and health implications on progression and fertility in general. One of the health and biological effects is the spread of HIV/AIDS and its effect on maternal health which exacerbated the effects on progression and eventually the decline in fertility. However, we see institutional changes taking effect on the second period through social, education, health and reproductive,

policies. Analysis of age and period effects on parity progression and underlying factors leading to fertility decline is summarised in the framework in Figure 1 below.

Adapted from the analytic framework in Bongaarts (2006), this framework summarises how the variables of interest to this study coupled with social, demographic and biological variables affect progression from first to second birth, which determine progression to subsequent births and ultimately impact on fertility transition. Some of the variables outlined on the framework do not have a direct measure due to nature of available data and insufficient documentation around the subject of analysis. These are variables used to describe social changes over time such as health and social policies, behavioural and biological variables. However, these variables are included as covariates to help analysis of period effect on progression since they evolve with social changes over time.

The main variables (highlighted) with statistical measures are also outlined in the model as exposure variables referred to by Bongaarts and Coale as proximate determinants. The index of marriage which determines the age and period to first birth as well as period of exposure to reproductive life (Bongaarts, 2006), will be measured by the proportion of women and their ***marital status*** at ***period of first birth.*** Due to data limitations, marital status of women with second birth is not explored; the mean age at first birth which will be measured by proportion of first and second births by ***age category of mother.***

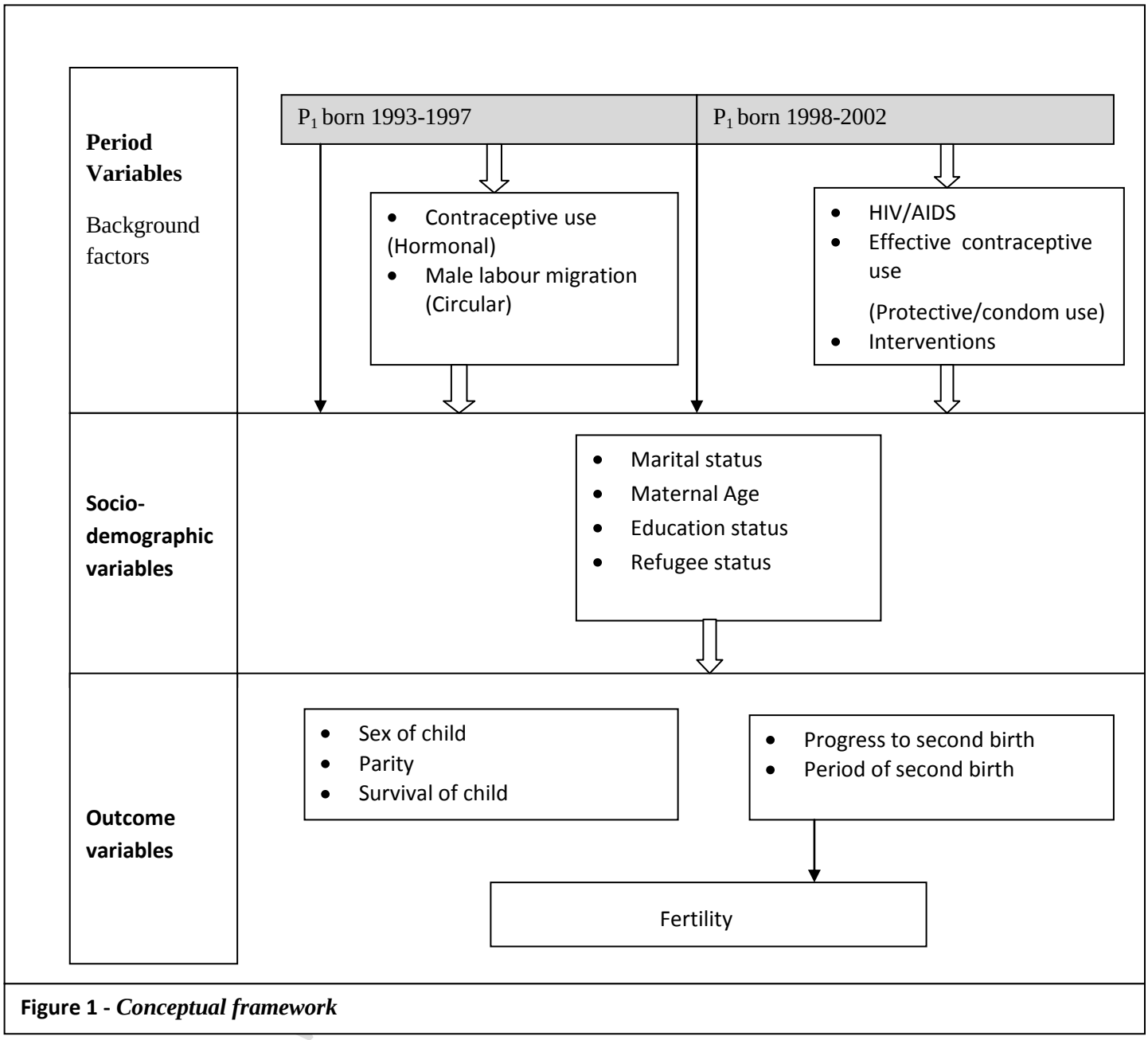


Figure 1 - ***Conceptual framework***

Another set of variables outlines in the framework is the socio-demographic indicators that are backing the proximate determinants such as ***education status***, ***refugee status*** regarded as

background variables in the framework as they influence fertility behaviour leading to the outcome. Finally, the framework also summarises the outcome variables which will be measured by the outcome of the first birth (***multiple/single birth***s, ***sex of first child*** and ***survival/death of first child***). These variables will be further explored in the literature review section to validate this conceptual framework with findings from past research.

Intermediate factors can also affect fertility behaviour of individual women such as progression of births. Age of mother at first birth, education of mother, income status and household living conditions as well as gender of the child can determine how soon/long a woman gives the second birth. For example, if a woman gives birth at her early adolescent age, she may postpone the second birth due to experiences with the first birth or due to schooling; education of mother may substitute time to raise children; income status may determine how many children a woman can have and how often depending on economic support (Caldwell and Caldwell, 1987). If women marry at a later age, they may choose to have children in short intervals to finish early or before they exit the fertility age group while women marrying early may decide to space longer even though they can choose to have their first birth early. Also, outcome of the first birth such as single or multiple births, sex preference and survival of the first birth may determine how soon a woman progress to a second birth.

CHAPTER 3

3.0 DATA AND METHODS

3.1 INTRODUCTION

There are scarcely data sources that can be exploited to associate parity progression and social factors that affect fertility transitions (Timaeus and Moultrie, 2008). There is valuable data that remain under-utilised but are useful for examining trends and transitions in fertility in the former homelands of South Africa. In Mpumalanga province, within the sub-district of Bushbuckridge valuable demographic information is collected from a geographically defined population. This section gives a full description of this research area and defines the uniqueness of the data that can help with understanding of major demographic indicators such as fertility of rural South Africa.

With the use of data collected from the Agincourt Health and Demographic Surveillance System (AHDSS) between 1992 and 2007 the study models the association between socio- demographic factors, time period and fertility behaviour using simple logistic regression. This chapter presents the design and data collection method, setting and sample as well as statistical analysis used in this study. I also report in this chapter the limitations encountered from the data and those of the study.

3.2 SOURCE OF DATA AND STUDY DESIGN

The Agincourt Health and Demographic Surveillance Site (AHDSS) conduct household surveys that can fairly describe population dynamics of rural South Africa within which this study derives its data. An HDSS refers to a small scale system using unique methods for collecting ongoing exhaustive surveys on health and demographic issues to monitor trends of a population defined by a geographical boundary, which lends itself into specific analysis (Delaunay, et al, 2007).

3.2.1 Background of the Agincourt Health and Demographic Surveillance System (AHDSS)

The AHDSS is situated in the remote rural east of South Africa, 500 km north-east of Johannesburg and next to the Mozambique border (Appendix 2, Figure 1) and has been a host for former Mozambican refugees who were displaced by RENAMO [1] in the early 80's (Marks and Potts, 2001). The AHDSS was established mainly to monitor the impact of primary health services decentralisation in marginalised homeland areas (Tollman et al 1995).

The AHDSS has been conducting census data annually to record and update all vital events in 21 villages making up a total population of approximately 70,000 people at a density of 174 persons per km^2. The study population is comprised of 2 nationalities, Mozambicans (31% of the total population) and South Africans sharing the same language (Shangaan) but varying cultural norms and beliefs especially during the early periods of displacement. Of vital contribution to

[1] **RENAMO** *A Portuguese acronym for "**Re**sistência **Na**cional **Mo**çambicana," a Mozambican National Resistance political party led by Afonso Dhlakama which was formed in 1976 by white Rhodesian officers against militants seeking to overthrow the Rhodesian government. Sponsored by among others, the South African armed forces. A resultant of the civil war that caused about hundred thousand deaths and more than a million refugees by the late 1980s, who ironically found refuge in South Africa.*

understanding effects on fertility behaviour is the main demographic, health and socio-economic variables measured routinely by the DSS such as births, deaths, marriage, migrations, household relationships and socio-economic status, residence status, refugee status, education, and health seeking behaviour, which the variables of interest for this study are formulated. It is therefore in the interest of the study to explore the variations through bivariate and multivariate analysis to model the association and interaction between the above indicators and the periods of interest.

3.2.2 Instrumentation and data processing

In order to understand time and age effect on parity progression among women in rural South Africa, I use panel data derived from the AHDSS (n=12,942) of women aged 12-50 that ever had

a first birth. Fertility data in Agincourt DSS is collected from all women of childbearing age using three questionnaires during census updates. First, the populated census questionnaire is used to capture basic demographic information of all the people within the DSS at household level. Second, the pregnancy outcome questionnaire is used to record the outcome of the pregnancy in case there was a pregnancy between the census periods. Third, the maternity history questionnaire is administered to capture retrospective maternity information of all women who were present in the DSS during the baseline census (1992) and any woman who was missed or in-migrated to the DSS between the preceding and subsequent census updates to ensure a record of their fertility history. Different to other household interviews where the most knowledgeable person in the household is regarded as the best respondent, all maternal related information is asked directly from the respective woman with a limit of two revisits in the evenings and weekends in case the respondent is not at home at the time of interviews. In

addition, other important variables linked to fertility such as union status and education are collected. Education and marriage are special modules that are administered on intervals with the latter done in every five-year period with effect of the baseline in 1992**.** The study draws data on education status from the 1992, 1997, 2002 and 2005 modules, coded as education status within 2 years of first birth (Garenne, et al, 2007).

3.2.3 Sample Population

The original sample consists of 12,942 women with live births in the time period 1993-2007. For the purpose of this study, the sample was restricted to women who had a first live birth between 1993 and 2002. The original dataset (n= 12,942) is narrowed by eliminating births that fall out of the recreated parity measure based on live births. It was further narrowed down by linking the mothers who had a first child to the residence status. I dealt with right censoring by eliminating mothers that did not have a second birth within 5 years of the first live birth and were not present in the DSS (no residence status) 5 years following the first birth. I kept mothers that had a second birth even if they were later not present in the DSS after having progressed to the second child. The indicator for second births was generated by creating a time variable that indicates interval between 1st and 2nd birth. Women with a second birth within five years are given a 'Yes', while women without a second birth in five years are assigned a 'No'. Therefore, the data for first births span 1993-2002 and for the second birth through 2007. The final sample includes women with first births (n= 8,943) and women who had a second birth within 5 years (n= 3,584). The attrition above has impacts on the desired analysis. Thus, dropping mothers that leave the site has an unknown effect on the results as it could either underestimate the second births (if those

leaving were more likely to have a second birth) or overestimate the number of second births (if those leaving were less likely to have a second birth).

3.3 DATA ANALYSIS

The study uses simple logistic regression to assess the association between the variables and the outcome (had second birth within 5 years). Logistic regression analysis is based on a situation whereby there is 1 or more independent variables leading to the outcome and there are only 2 possible outcomes (0-1). Since some of the independent variables are categorical, dummy variables will be created to enable dichotomous variables (0-1) and a Y=1 and N=0 in this study. For example, marital status limited to single/married and all informal unions classified as Y with missing status as = N. Age of mother at first live birth continuous variables were recorded and dummy variables created for each category (teenmom (12-19), youngmom (20-29), midagemom (30-39), oldmom (40+). Education is also continuous and was grouped into three categories, low/no education, high education and missing education. All other variables not elaborated here are dichotomous.

Using STATA 10 and MS excel, full descriptive analysis was performed to obtain frequencies of the main variables of interest which characterize the first time mothers (Age at first birth, education, marriage, refugee statuses, parity type, sex and survival of the first birth (Table 1). The outcome (progression to second birth), predicted by the above characteristics were be summarized in proportions. Chi squared tests were used to test for independence of the independent variables and the outcome variable. Bivariate logistic were also used to compare the

frequency distribution in association with the 2 time periods of analysis (1993-1997 and 1998-2002) and age (teenage moms 12-19 and older first time moms (20-50). Multivariate analysis were performed by running logistic regression models to test the odds of the outcome and according to associated factors. Controlling for significant effect, all socio-demographic characteristics outlined above were modeled and the best fit model was adopted for the analysis. With the obtained results, regression model was run separately by period to test for different determinants of the outcome across time period on the odds of progression to a second birth in 5 years. The statistically validate the analytic model, results are interpreted at 95% confidence interval (CI) and p-values >.05 is considered as statistically significant and the logit is defined by Pampel (2000) as:

$$L_i=\ln[P_i/(1-P_i)]$$

and can be transformed into the odds by:

$$\ln(P/1-P)=b_0+b_1X_1+b_2X_2,$$

$$e^{\ln(p/1-p)}=e^{b}_{0}+b_1{}^{X}{}_{1}b_2{}^{X}{}_{2},$$

$$P/1-P=e^{b}_{0}*e^{b}{}_{1}{}^{X}{}_{1}*e^{b}{}_{2}{}^{X}{}_{2}$$

The Odds Ratio given in Logistic Regression can be interpreted as an increase or decrease in the odds for a birth by the different independent variables time period. Such that % change

$$=(e^{b}-1)*100$$

3.4 DATA LIMITATIONS

Observation at a DSS is conducted at a given area over a period of time. Although this system can monitor trends, some of the baseline data is retrospective that may lead to recall bias. Updates include everyone who enters the DSS not observed from the beginning (Delaunay, 2007). While a lot of effort is invested to ensure that all retrospective and prospective births are recorded through a series of data quality checks from field, office and data capture level, some minor errors may occur when recording births. For instance, some women might not disclose their pregnancy status due to cultural beliefs and family matters. Births occurring outside the study site and not living with the mother might not be considered as legitimate for entry onto the maternity history form due to data collectors probing skills; abortions, still births and live births that died before the subsequent surveillance may also be omitted or miss recorded (Garenne et al 2007).

It is fundamental to have explorative data on all proximate determinants of fertility in order to broadly understand the underlying effects on the decline in a transitioning society such as the Agincourt area. Yet, the data available for this study limit the type of analysis that could be performed. The data has missing intermediate variables that might be related to the odds of having a second birth. For this study there were no data available on contraceptive use and refugee status is used as a proxy for socio-economic factors, assuming refugees are likely to have lower socio-economic status than South African citizens. The data on education is available for only part of the sample and the data on marriage has certain limitations described below.

3.4.1 Education

The AHDSS measures education status on a five year period. For this study women were assigned their education level if it was known within 2 years of the first birth. This is a fair proxy for education at the time of first birth. However, because of this definition, education status is missing for many of the births (n=2832). Education is a crucial factor on fertility even with other confounding factors are controlled in that it does not only improve women status in society, but empower them to make decisions on childbearing and fertility control. Moreover, reproductive health education is usually more accessible at schools than in any other public institutions. Hence, any education status matters in fertility analysis (Marks and Potts, 2001). This limitation was dealt with by testing for the effect of missing education data by including a dummy variable for missing education on analysis.

3.4.2 Contraceptive use

Using the Bongaarts 1978 model of proximate determinants of fertility, the index of contraceptive use was found to be the second major effect on fertility transition in rural South Africa, followed by postpartum infecundity (Phalkamuleni et al 2007). The 1974 national planning programmes also reached the AHDSS at the early years of its establishment and although imposed by the apartheid government, usage was high among black women (Garenne et al 2007). However, information on contraceptive use in the area is not as much documented due to lack of vital events registration prior to the start of the DSS. The available data on contraceptive use in the AHDSS is only collected for before and after pregnancy with a limitation to yes/no responses indicating whether or not the woman was on any form of contraceptive at time of conception. Therefore no contraceptive use data was only available for

those women that had a second birth and therefore could not be included in the logistic model. Contraceptive use prior to first birth could have been used as a proxy, but was not due to the low quality of the data.

3.4.3 Multiple births

According to Anderson and Bean (1985), controlling parity allows revealing differentials on spacing and ceasing childbearing. Conversely, the sampling frame limits analysis to first live births although data on all pregnancy outcomes multiple births (twins and triplets) exist on the dataset. To include all live births I controlled for multiple births by aggregating all first multiple births (twins and triplets to one category and coded them as parity 1(first births) and subsequent births as parity 2 (second births) without accounting how many they are or segregating them according to number, yet linked to the particular first time mother.

3.4.4 Marriage

In line with available literature, being single[1] in Agincourt and married refer to different statuses that a person can have by living or ceasing to live with another person, which includes 'consensual unions' (Bongaarts 1983). Marriage data in Agincourt has its first registry conducted from retrospective union information in 2005, three years after the sample first live births censoring period (1993-2002), and updated annually thereafter. This results in missing marital status information in the sample data set where all missing values are set to single if type of union was not specified. The missing data has major implications on analysis since old terminated unions are reported at baseline, where reference to partners might be difficult to retrieve or duplicated. Therefore the available data on marriage and the way it is coded in the

data set might underestimate the number of births within marriage and this effect is more pronounced for births in the earlier time period.

3.4.5 Conclusion

Even with the above data limitations, the AHDSS provides an important opportunity to explore the impact of the characteristics of mothers (particularly age) and the birth outcomes on the odds of progressing to a second birth and, importantly, on how the effects of these characteristics have changed over time. Even though the results will need to be interpreted with caution, it is a good starting point for an analysis if the determinants of progressing from first to second births for women in rural South Africa during a time of fertility decline and growing AIDS epidemic.

CHAPTER 4

4.0 DATA ANALYSIS

4.1 DESCRIPTIVE ANALYSIS

4.1.1 Characteristics of Agincourt women with first live births (1993-2002)

A total sample of 8,943 mothers who had a first live birth during time period 1993-1997 and time period 1998-2002 were analyzed. Descriptive results are summarized on Table 1 below. Results indicate that 69% of the first time mothers are South African while 31% are former Mozambican refugees and the mean age at first birth is 23.7 years. Of the total first live births, 56% were given during the first time period (1993-1997). Young mothers between the ages 20-29 account for 41.6% of the births and 36.3% births from teenage mothers between ages 12-19. First live births from mothers who are 40 years and above account for only 3.3% in total, both periods combined while 0.5% of the first births are from those with missing age records.

Among other socio-demographic characteristics forming part of the independent variables, it is worth noting that the marital and education status of women of childbearing age are factors that play a vital effect in determining their sexual and reproductive choices. It is noted on Table1 that majority of the births are non-marital accounting to 65% of the total observed births with only 35% that are marital, 27.5% and 8% coming from formal and informal unions respectively. Meanwhile a number of mothers (31.7%) do not have education status records, but the analysis suggests that first time mothers have low education. Thus, only 3.4% of the mothers had post

high school education, 32.5% had secondary education, 19.2% had primary while 11.5% had no formal or any form of education.

In addition to the above described independent variables, the outcome of the first birth was included for analysis as that may also determine the interval between the first and the second birth. Thus, sex of the first birth, parity type (whether the first birth was single or multiple) and its survival (whether the first child survived or died after birth/infancy) are also crucial in describing progression from first birth and spacing intervals to second birth.

It is noted on Table 1 that 50.4% of the first live births are female. Although all birth parities that are not single were aggregated and coded multiple births, there is only a few of those in both periods as data shows 98.9% are single births. Furthermore, only 4.1% of the first births died after having entered the sample.

4.2 BIVARIATE ANALYSIS

All first time mothers in Agincourt between 1993 and 2002 were examined to see whether or not they progressed to a second birth within 5 years. This section therefore discusses the proportion and characteristics of first time mothers who progressed to a second birth and factors associated with the progression. Pearson Chi2 tests were used to determine which factors are likely to have a significant effect on the odds that women have a second birth within 5 years.

4.2.1 Proportion of mothers who had a second birth within a 5-year period

As shown on Table 2 below, of all first time mothers (N= 8,943) with first live births occurring on both periods combined, 40% (N= 3, 584) progressed to second birth within 5 years following the first live birth. Of the total second time mothers, 44% had a second birth during the first period and 36 % during the second period. There were 2,751 refugees and 6,187 South African. The proportion of refugees who progressed to a second birth was 56.67%. With regard to proportion of women with second births by maternal age, 46% of young moms and 41% of mid aged moms had a second in 5 years. A small proportion of teen moms and older moms (35 year and older) progressed to second birth in 5 years, 38% and 27% respectively in both time periods. There is a small proportion of unmarried women (36.8%) who had a second birth while a bigger proportion (46.14%) of married women had a second birth in 5 years.

Outcome of the first child seems to be related to progressing to a second birth. For instance, 44% of women who lost their first child progressed to a second birth in 5 years. Also, as noted on Table 2, a lower proportion of mothers with multiple births progressed to a second birth within 5 years. Only 31% of women who had multiple births progressed to a second birth, 9% less than those who had single first births. Progression to second birth for mothers who had first births that were girls is 40.71% while those who gave first births to boys is 39.22%. The distributions of second births indicate which socio-demographic factors affect the odds of progressing to a second birth within 5 years, which will be discussed in the subsequent section.

Table 1: Characteristics of first time mothers in Agincourt between 1993-2007

Characteristics of mothers with first births	Frequency N=8 943	Percentage of mothers	Mean (SD)
Period of first live birth			0.441239 (**0.4965629**)
0. 1993-1997	4, 997	**55.9**	
1. 1998-2002	3, 946	**44.1**	
Age at first birth			23.74747 (**7.240522**)
12-19	3, 249	**36.3**	
20-29	3, 720	**41.6**	
30-39	1, 636	**18.3**	
40+	297	**3.3**	
Missing	41	**0.5**	
Citizenship			0.307787 (**0.4616037**)
0. South African	6, 187	**69.2**	
1. Former Mozambican	2, 751	**30.8**	
2. Missing	5	**0.1**	
Education status within 2 years of first birth			3.097059 (**1.607748**)
0. No Education	1, 027	**11.5**	
1. Basic/Some	151	**1.7**	
2. Primary	1, 718	**19.2**	
3. Secondary	2, 910	**32.5**	
4. Higher	305	**3.4**	
5. Missing	2, 832	**31.7**	
Marital status at first birth			0.6879123 (**1.388516**)
0. Single	5, 807	**64.9**	
1. Married	2, 394	**26.8**	
5. Informal Union	694	**7.8**	
6. Remarried	48	**0.5**	
Sex of first child			0.509784 (**0.4999325**)
0. Male	4, 334	**48.5**	
1. Female	4, 507	**50.4**	
2. Missing	102	**1.1**	
First birth parity/type			0.0111819 (**0.1051576**)
0. Single	8, 843	**98.9**	
1. Multiple	100	**1.1**	
Survival of First child			0.0411495 (**0.198647**)
Alive	8,575	**95.9**	
Died	368	**4.1**	

Table 2: Proportion of mothers who had a second birth in 5 years

Women who had a second birth in 5 years	First Births	Second Births	Proportion of Second Births
Period of first birth			
0. 1993-1997	4,997	2,205	44.13
1. 1998-2002	3,946	1,379	34.95
Total	8,943	3,584	40.08
Age of mother at first birth			
1. Teen Mom (12 – 19)	3,249	1,226	37.73
2. Young Mom (20 – 29)	3,720	1,692	45.48
3. Mid-Age Mom (30 – 35)	1,039	427	41.10
4. Old Mom (35+)	894	237	26.51
Union status at first birth			
0. Single	5,807	2,137	36.80
1. married	3,136	1,447	46.14
Education status at first birth			
1. No, basic, some, education	2,896	1,404	48.48
2. Secondary or more	3,215	1,054	32.78
3. Missing education	2,832	1,126	39.76
Sex of first birth			
0. Male	4,334	1,700	39.22
1. Female	4,507	1,835	40.71
First birth parity type			
0. Single birth	8,843	3,553	40.18
1. Multiple births	100	31	31.00
Survival of first child			
0. Died	368	162	44.02
1. Alive	8,575	3,422	39.91
Refugee status			
0. Non refugee	6,187	2,022	32.68
1. Refugee	2,751	1,559	56.67

4.2.2 Factors affecting progression to second birth

There are socio-demographic factors associated with the odds of progression. Based on the assumption that the odds of progressing from first to second birth in five years, vary with age of mother, education status, refugee status, marriage, first birth parity type, sex and death of first child, Table 3 below summarizes results of the variations giving both the distribution and the results for the chi-squared test for each independent variable. To assess the level of significance on the effects, results are presented on p-values derived from Pearson chi2 test. P-values of =/< 0.05 represent a significance test of the distribution of second births by various characteristics (independent variables): education status of the mother; whether the mother is in or not in any form of nuptial union; refugee status of the mother since the sample includes former Mozambican refugees; sex of the first child (whether the first child was a boy or girl); whether the first birth was single or multiple parity as well as whether the first child survived or died. P-values below 0.05 indicate that there is a statistically significant difference in the distribution of second births by the characteristics tested.

Chi2 tests results show a statistically significance difference in distribution of second births by education, marriage and refugee status (P = 0.000), while the distribution of second births by parity, survival, and sex of first child is less likely to be different sex of the first child (P=0.153), parity type (P=0.063) and survival of the first child (P=0.115).

4.2.3 Distribution of second births by period and age

Since age and period are of special concern in this analysis, Table 4 shows the results for chi-squared tests of the distribution of second births by period, age and then by age and period.

Using Pearson chi2 to test the assumption that the odds of progressing from first to second birth within five years is different by age and period. Distribution of second births by age and by period, and then by age and period was measured. Table 4 indicates that the distribution of second births by age/period is statistically significant (p=0.000). The different distribution of second births by teens and all older moms is also statistically significant (p=0.00).

Finally, the P-value (0.000) proves that the distribution of second births by age of mothers is significantly different between the two periods. So the distribution of second births to teen moms is significantly different in the earlier period as compared to the later period. Similarly, the distribution of second births is significantly different for all older moms in the second period than in the first. This means that the age effects or the influence of age on progression to second births are changing over time. However, the progression of teen moms to a second birth remains different than older moms.

To explore what changes are happening over time, I calculated the odds of having a second birth by various characteristics separately for each characteristic. A better idea of how affects the odds of progressing to a second birth in 5 years is seen on Table 5. The odds are calculated by dividing the number that did have a second birth (Yes) by the number that did not (No). There is a decline in the odds of progression between the first and the second period for all age groups. The difference varies from 19% to 34% of likelihood to second birth in 5years. Changes in hierarchical order shows a decline in progression rate among young moms from 1.02 odds to 0.64, mid aged mom from 0.80 to 0.54 odds, teen moms from 0.71 odds to 0.51, and older moms from 0.44 chance to 0.24. There is also a decline on associated socio-demographic effects over

time. These changes will be discussed lengthily in the subsequent section (multivariate logistic analysis).

Table 3: Measuring progression to second births within 5 years by socio-demographic characteristics of mother

Socio-demographic characteristics of mothers	**Outcome of Progression to a second birth within five years**		**Statistical Distribution**	
	No	**Yes**	**Total**	Pearson chi2 **(p-Value)**
Education N=8943				156.4895 **(0.000)**
No- Basic education	1,492	1,404	2,896	
Secondary/higher education	2,161	1,054	3,215	
Missing education	1,706	1,126	2,832	
Citizenship N=8, 938				456.3571 **(0.000)**
Refugee	1,192	1,559	2,751	
South African	4,165	2,022	6,187	
Marital status (N=8, 943)				73.9881 **(0.000)**
Single	3,670	2,137	5,807	
Married	1,689	1,447	3,136	
(Sex of first child) Sex preference N= 8841				2.0433 **(0.153)**
Female	2,634	1,700	4,334	
Male	2,672	1,835	4,507	
First birth parity /type N=8943				3.4689 **(0.063)**
Single birth	5,290	3,553	8,843	
multiple birth	69	31	100	
First child survival N=8943				2.4881 **(0.115)**
Died	206	162	368	
Alive	5,153	3,422	8,575	

Table 4: Distribution of mothers' outcome of progressing to second birth within 5 years by age and period

Age and period distribution	Outcome of progressing to a second birth within five years		Statistical Distribution	
	No	**Yes**	**Total**	**Pearson chi2 (P-Value)**
Period difference N=8943				
1993-1997	2,792	2,205	4,997	77.3667 **(0.000)**
1998-2000	2,567	1,379	3,946	
Age Difference N=8, 902				13.3345 **(0.000)**
Teen moms	2,023	1,226	3,249	
Older moms	3,297	2,356	5,653	
Age/period difference N=8943				
Teen moms N= 3, 249				19.7163 **(0.000)**
1993 -1997	986	696	1,682	
1998 – 2002	1,037	530	1,567	
Older moms N=5653				
1993-1997	1,774	1,507	3,281	58.2179 **(0.000)**
1998-2002	1,523	849	2,372	
Missing age N=41				
1993-1997	32	2	32	0.4329 **(0.511)**
1998-2000	7	0	7	

4.3 BIVARIATE ODDS OF PROGRESSING TO A SECOND BIRTH

The results on Table 6 show the bivariate odds of progressing to a second birth within 5 years. Different from the odds presented in Table 5, each odds ratio gives the odds of the group in

comparison to the omitted category, whose odds are set at 1. If the odds are equals to 1, it indicates no difference between the omitted category and the compared group (Pagano and Gauvreu, 2000). These results suggest again that characteristics of the mother such as age, education, citizenship, and marital status are significantly related to whether or not a woman will have a second birth in five years.

Table 5: Period difference on the Odds of progressing to a second birth within 5 years by age

	1993-1997			1998-2002		
Determinants	**Yes**	**No**	**Odds**	**Y**	**N**	**Odds**
Teen moms (12-19)	696	986	0.71	530	1037	0.51
Young Moms (20-29)	1045	1020	1.02	647	1008	0.64
Mid age moms (30-34)	286	354	0.81	141	258	0.55
Old moms (35+)	176	400	0.44	61	257	0.24
Refugee	1,002	619	1.6	557	573	1.0
South African	1,200	2,172	0.6	822	1,993	0.4
Married	857	880	1.0	590	809	0.7
Single birth	1,348	1,912	0.7	789	1,758	0.4
Multiple births	18	43	0.4	13	26	0.5
No/ basic education	945	891	1.1	459	601	0.8
Secondary education	515	940	0.5	539	1,221	0.4
Male P_1	1,045	1,414	0.7	655	1,220	0.5
Female P_1	1,140	1,347	0.8	695	1,325	0.5
P_1 Alive	2,137	2,700	0.8	1,285	2,453	0.5
P_1 Died	68	92	0.7	94	114	0.8

Yes = Had P_2 in 5 years **No** = Had no P_2 in 5 years

When examining the likelihood of progressing to a second birth within 5 years by period, the earlier period indicates a higher probability than the later period. First time mothers in period

1998-2002 have 32% lower chance of progressing to second birth within 5 years as compared to the earlier period. Refugee mothers have more than twice the chance of progressing to the second birth within 5 years. Compared to teen moms, young moms (20-29) mid aged moms (30-34) have higher odds of progression compared to teen moms, 38% and 15% respectively. The probability that an older mom of 35-49 will progress to a second birth in 5 years is 40% lower than teen moms.

Socio-demographic status indicate that married first time mothers have a 47% chance of having a second birth in 5 years than unmarried first time mothers. Educated first time mothers have 48% lower chance of having a second compared to first time mothers with low education status. Outcome of the first births that are single also show a high probability of progression to a second birth in 5 years. It is noted on Table 6 that while mothers who had multiple first births, their probability of progressing to a second birth is 33% chance lower than those who had a single first birth. First time mother who had first born girls are 6% higher the chance of second birth and those who lost their first child have a probability of 18% chance of a second birth in 5 years.

Table 6: Bivariate analysis of progressing to second birth within 5 years between 1993 and 2002

Measures of odds of progressing to second birth in 5 years	Odds Ratio	S. E	P>Value	95% CI Min	95% CI Max	Odds % (Scale)
Period of first birth						
Born 1993-1997*	-	-	-	-	-	-
Born1998-2002	0.680	0.03	0.000	0.624	0.741	32 (<)
Citizenship						
Non Refugee*	-	-	-	-	-	-
Refugee	2.694	0.13	0.000	2.457	2.954	169 (>)
Mom Age (Age Category)						
Teen mom*	-		-	-	-	-
Young mom	1.377	0.07	0.000	1.251	1.515	38 (>)
Mid-age mom	1.151	0.08	0.053	0.998	1.328	15 (>)
Old mom	0.595	0.05	0.000	0.505	0.702	40 (<)
Marital Status						
Single*	-	-	-	-	-	-
Married	1.471	0.07	0.000	1.347	1.607	47 (>)
Education status of mother						
No/basic education*	-	-	-	-	-	-
Missing education	0.701	0.04	0.000	0.632	0.779	30 (<)
Secondary or higher education	0.518	0.03	0.000	0.467	0.575	48 (<)
Survival of first child						
First child alive*	-	-	-	-	-	-
First child died	1.184	0.13	0.115	0.960	1.461	18 (>)
Gender/ sex of first child						
Male*	-	-	-	-	-	-
Female	1.064	0.05	0.153	0.977	1.159	6 (>)
Parity type						
Single birth*	-	-	-	-	-	-
Multiple birth	0.669	0.15	0.064	0.437	1.024	33(<) `

* = Reference group, < = lower odds, > = higher odds, **CI** = Confidence Interval

Data shows that women's socio-demographic status has a profound effect on fertility. While there are women without a measure for education, they cannot be omitted from the analysis since they constitute 31% of the total sample. Mothers with missing education measure have significantly lower odds (-30%) of having a second birth in 5 years. They are different in relation to their fertility than women with basic, little or no education, with significant p-value =0.000. Mothers with secondary or higher education have 48% lower odds of having a second birth in 5 years than those with basic (no education or primary) education. Effect of socio-demographic status is also noted on the 47% higher odds for married mothers as compared to unmarried mothers. Mothers who had multiple first births have 33% lower odds of progressing to a second birth in 5 years compared to those who gave single first births. Death and sex of the first child put the mother on 18% and 6% odds of progressing to second birth respectively. However, in bivariate analysis these relationships are not significantly different. They will be included in the multivariate analysis below to control for characteristics of the birth and to see if the relationships become significant when controlling for other factors.

4.4 BRIEF SUMMARY OF DESCRIPTIVE RESULTS

In Summary, descriptive and bivariate analysis reveal that mothers who gave first births between 1993-1997 are more than mothers who gave first births in time period 1998-2002. Thus, more than half of first time mothers are in period 1. Most mothers who had first births in both periods were between ages 20-29, followed by 36% of teen moms ages 12-19. Majority of the births were single births and a very small number of multiple births in both periods. Less than half of

the mothers had a second birth in 5 years. The proportion of women who had a second birth is among young moms, married women and refugees. Educated women were less likely to have a second birth in 5 years. Those few who lost a first child or had a first born girl were also likely to have a second birth.

CHAPTER 5

5.0 LOGISTICS REGRESSION

5.1 MULTIVARIATE ODDS OF PROGRESSING TO A SECOND BIRTH

As indicated in bivariate analysis, there is a statistically significant association between having a second birth within five years following the first birth and socio-demographic factors (age, marriage, and education and refugee status). This section presents multivariate analysis showing odds ratios in 2 models. The multivariate models consider the influence of variables simultaneously, therefore controlling for the impact of other variables on the calculation of the odds. Variables that appeared not to be significant in the bivariate model are left in for the multivariate model to see if they are significant when controlling for other factors.

Odds ratios in Table 7 show that the period in which the first child was born is significant in influencing progression to second birth within 5 years at a 0.01 significant level. The odds ratio of progressing to a second birth for older moms in the later period were 0.66 in model1 and OR = 0.68 in model2. Maternal age was also a significant determinant of progression at 0.01 p-value level. There is a significant difference between older mothers and teen moms in progressing to second birth within 5 years in both models. It is worth noting that mid-age moms are just on the edge of being significantly different to teen moms at the 0.05 level with equal odds ratios in both models (OR= 0.857).

Marital, education and refugee status were also found to be significant in determining progression for all mothers other than teen moms. It also makes a significant difference at

p=0.023 to progress to second birth for moms who had multiple first births. However, it is worth noting that the results show that having a first born that is a girl does not change the odds of progressing to second birth within 5 years. Yet, when removing female from the model (see Model 2), all other determinants remain constant except for child survival indicator. Thus, effect of the (*var* First child died) disappears to non significance (*p=0.086)*. In future models both sex of the first child and death of the first child are included to see if there are differences over time in their significance.

Table 7: Modeling odds of progressing to a second birth within 5 years by period of first birth and socio-demographic characteristics of older moms with reference to teen moms

Measures of odds of progressing to second birth in 5 years	**Model 1**			**Model 2**		
	Odds Ratio (S.E)		**95% CI Min Max**	**Odds Ratio (S.E)**		**95% CI Min Max**
Born 1998 -2002	0.669**	(0.031)	0.611 0.734	0.681**	(0.032)	0.622 0.747
Teen mom	Ref		-	-		- -
Young mom	1.226**	(0.065)	1.105 1.361	1.222**	(0.064)	1.102 1.355
Mid-age mom	0.857*	(0.069)	0.732 1.003	0.857*	(0.068)	0.733 1.002
Old mom	0.384**	(0.036)	0.320 0.461	0.385**	(0.035)	0.321 0.461
Married	1.493**	(0.077)	1.350 1.652	1.493**	(0.076)	1.351 1.651
Basic/no education	Ref		-	-		- -
Secondary/Higher education	0.668**	(0.041)	0.592 0.753	0.663**	(0.040)	0.589 0.747
Missing education	0.783**	(0.046)	0.698 0.879	0.785**	(0.046)	0.700 0.880
Refugee	2.378**	(0.123)	2.149 2.632	2.362**	(0.121)	2.136 2.612
Female	1.065	(0.049)	0.974 1.165	-	-	- -
Multiple birth	0.596*	(0.136)	0.381 0.932	0.586**	(0.133)	0.375 0.914
First child died	1.255*	(0.142)	1.004 1.567	1.214	(0.137)	0.973 1.516
	Pseudo R2 0.066 Log likelihood = -5530.4623			**Pseudo R2 0.066 Log likelihood = -5530.4623**		

*Significant change: *= 0.05 level; ** 0.01 = level; **CI** = Confidence Interval*

5.2 AGE AND PERIOD DIFFERENTIALS ON PROGRESSING TO A SECOND BIRTH WITHIN FIVE YEARS

This section analyses the odds of progressing to a second birth within 5 years according to socio-demographic factors separately for the time periods. The socio-demographic differentials were tested by analyzing changes in odds of progression over time. Multivariate logistic regression showed that period has a statistically significant effect on the odds of progressing to a second birth in five years. Table 8 gives the odds ratios for each model by period (1993-1997 vs. 1998-2002). As discussed earlier these periods differ both by fertility level and socio-biological effects. So a comparison of periods and attention to changes in odds by age may give some indication as to associate changes in the social determinants of progressing to a second birth between the periods.

5.2.1 Changes in relative odds of progression to a second birth over time

This section seeks to test the assumption that the differences in odds of progression are comparable over time. Socio-demographic determinates show a similar pattern of progression odds over time except for a variation noted on age of mother, birth parity and sex preference are affected by period. The odds ratios are comparable for both time periods. However, some determinants are more significant in the second period and some are less significant than they were in the earlier period. These magnitudes are discussed first before discussing those factors that lost or gained significance across the periods. This is indicated by the level of decline or increase in the odds of progression in the later period as compared to the earlier period presented Table 8.

Notably, changes over time do not affect the direction of the differences by most factors, but have impact on the magnitude of the differences. Maternal age maintained the same magnitude of significance with reference to teen moms in both periods except for young moms. Mid age moms were not significant in both periods while old moms were significant in both periods. Maternal status also maintained the same magnitude of significance in both periods. i.e., marriage, education and refugee status were highly significant in both periods. Outcome of first birth changes in magnitude in all the periods. The level of significance for multiple births, first child died and female first child are affected by period on their influence on the odds of progressing to a second birth, hence their magnitude changes over time.

When we look at changes in age over time, the odds of progressing for mid age moms were a little higher in the earlier period and went slightly down in the later period. Yet, in both periods the difference to teen moms was not significant (OR=0.905 and 0.785 for time period 1 and time period 2 respectively). This age group is not affected by period. The odds of progressing for older moms (35 years and older), were significant at the same magnitude in both periods (0.01 level) although decreased in ratio (OR = 0.434 and 0.300 in period1 and period2 respectively), young moms were 1.245 odds of progressing to second birth in 5 years in the earlier period which went down to 1.177, changing the level of significance from 0.01 level to a 0.05 p-value level in time period 2. Therefore odds of progression over time are declining for all age groups. It is worth noting that maternal age shows a questionable period changes. Teen moms and young moms had significant different odds in the earlier period where young moms had higher odds when compared to teen moms. The later period shows change in age over time where the margin

becomes narrower and less statistically significant. Teen moms and young moms shift to have more or less equal odds.

The effect of refugee status shows a decrease in odds ratios over time. Refugees had more than twice the (263% higher) odds of progressing in the first period which went down to 200% higher odds of progressing in the second period. The magnitude does not change by period but the odds are changing downward. While the odds of progressing to a second birth for married women still remained higher on both time period, odds become even higher than non-married women and teen moms in the second period (from 37% to 69% higher. These effects are significant at a 0.01 level for both periods.

Table 8: Changes in relative odds of progression to second birth over time (1993-1997 and 1998-2002)

Characteristics of mothers for period difference in progressing to second birth in 5 years	**1993-1997 (N=4909)**				**1998-2002 (N=3887)**			
	Odds Ratio	**(S.E)**	**95% CI Min**	**Max**	**Odds Ratio**	**(S.E)**	**95% CI Min**	**Max**
Teen mom	Ref	-	-	-	-	-	-	-
Young mom	1.245**	(0.089)	1.082	1.433	1.177*	(0.094)	1.006	1.377
Mid- age mom	0.905	(0.094)	0.739	1.108	0.785	(0.101)	0.610	1.010
Old mom	0.434**	(0.050)	0.346	0.544	0.300**	(0.049)	0.217	0.414
Secondary/Higher education	0.676**	(0.056)	0.575	0.795	0.640**	(0.059)	0.533	0.768
Missing education	0.804**	(0.059)	0.695	0.929	0.741**	(0.073)	0.612	0.898
Married	1.372**	(0.094)	1.199	1.569	1.690**	(0.133)	1.448	1.971
Refugee	2.633**	(0.181)	2.302	3.012	2.037**	(0.163)	1.741	2.382
Multiple birth	0.484*	(0.143)	0.272	0.864	0.829	(0.299)	0.408	1.682
First child died	0.940	(0.163)	0.669	1.322	1.581**	(0.236)	1.180	2.119
Female	1.131*	(0.068)	1.005	1.273	0.977	(0.068)	0.852	1.121
	Pseudo R2 =0.0663				**Pseudo R2 =0.0551**			
	Log likelihood = -3148.1768				**Log likelihood = -2371.846**			

*Significant change: *= 0.05 level; ** 0.01 = level; **CI** = Confidence Interval*

Same applies to education status; the magnitude of significance does not change over time. The effect of education remain significantly lower in both periods, Thus, women with higher education and missing education have consistent lower odds of progression in both periods.

However, there is a decline in the second period from OR=0.676 to 0.640 for mothers with secondary and higher education and from OR= 0.804 to 0.741 for those with missing education status. The latter is pointed out for more elaboration in the later sections.

The outcome of the first child was important in determining the interval of progressing to a second birth in earlier period. Having multiple first births was significant in the first period but lost significance in the second period. In the second period, those with multiples first births did not have significantly different odds of progressing than moms with single births OR= 0.484 in the earlier period at a 0.05 significance level in the earlier period which declined to no significance (OR= 0.829) in the latter period. In the first period, having a first born girl increased the likelihood of a second birth in 5 years (OR = 1.131) while in the later period, female first births (OR =0.977) are no longer significantly determining progression to a second birth within 5 years.

Another change noted is with the survival of the first child. Results show a change over time in the effect of losing a first child. In earlier period, women whose first child died were not more likely to progress to a second birth within five years (OR = 1.01) and in the later period, losing the first child significantly increases the odds of progressing to a second birth within five years (OR =1.58).

In summary results obtained from multivariate analysis show comparable odds of progressing to a second birth on both time periods. Socio-demographic determinates show a similar pattern of progression odds over time except for a variation noted on age of mother, birth parity and sex preference which is affected by period. Mid age group is not affected by period. Teen moms and

young moms shift to have more or less equal odds. However, odds of progression are declining for all age groups over time. Maternal age maintained the same magnitude of significance with reference to teen moms in both periods except for young moms which shows a questionable period changes showing a change in age over time among teen moms and young moms where the margin becomes narrower and less statistically significant. Married women still remained higher on both time periods, and become even higher on the later period. Although refugees have 200% odds of progression, their odds are decreasing over time. Women with higher education and missing education have consistent lower odds of progression in both periods. The level of significance for multiple births, first child died and female first child are affected by period while multiple births and sex of first child are losing significance over time. Losing the first child significantly increases the odds of progressing to a second birth within five years. These findings will be discussed further in chapter 6.

CHAPTER 6

6.0 DISCUSSION OF FINDINGS AND CONCLUSSION

6.1 INTRODUCTION

This study sought to assess the determinants of the odds of progressing from first to second birth and the difference in odds by age of mother over time. The main interest was to find out whether maternal age and socio-demographic indicators such as education, citizenship, marital status and first child outcomes are associated with the likelihood of progressing to a second birth and how these indicators are affected by changes over time. There have been studies on fertility decline and parity progression but focus has been mainly on spacing and intervals. Studies which have related progression to fertility studies have concentrated on proximate determinants as factors influencing progression in a positive way. There is still a need for research to assess the underlying effects on parity progression that are eventually contributing to fertility decline. HIV/AIDS is one major factor that has attracted numerous researches, however studied separate from fertility regardless of its irreversible outcomes on fertility. It is in this light that the analysis was focused on seeking to answer several questions about the progression from first to second birth in Agincourt during a period of fertility decline and increased HIV prevalence. The study had limitations attributed to the time frame, sample and data which warrants further in-depth investigation and analysis in future research. This section provides a review of the questions, the answers found and a brief discussion of the findings, limitations and recommendations.

6.1.1 Review of Findings to research questions

i) What percent of women progress to second birth within five years following the first birth?

Descriptive results in Chapter 4 showed that 40.8% of women progressed to a second birth within five years. Table 2 breaks this progression down into period and shows that 44% of women progressed to a second birth within five years in the first period (1993-1997) and 36% progressed to a second birth within 5 years in the later period (1998-2002). The results suggest a change in the likelihood of progressing to a second birth within five years over time with the latter period indicating a low chance of second births within 5 years for all mothers. Since this change is a decline rather than an increase, it is along with earlier findings in Agincourt by (Garenne et al, 2000) of TFR decline from 3.7 in 1993 to 3.4 in 1997 and 3.0 1998 to 2.7 in 2002.

ii) Do adolescents have different odds of progressing to a second birth than older moms?

Descriptive analysis presented on Table 2 shows a lower proportion of teen moms of having a second birth in 5 years. Bivariate analysis presented on Table 6, indicates that the odds of progression for young moms (20-29) and mid age moms (30-34) are respectively 38% and 15% higher than teen moms. The odds of progressing for old moms are approximately 40% lower for old moms than teen moms.

Multivariate analysis which controls for other factors shows that only young moms have higher odds of progressing to the second birth than teen moms. Other ages (30-34, 35+) have statistically significant lower odds of progressing to a second birth. So, compared to moms that are closest in age to them, teen moms have a lower probability of progressing to a second birth in five years.

There are a few explanations related to the age difference in odds. Due to lack of knowledge on reproductive issues, permissiveness of the society regarding non marital fertility and improved education policies allowing pregnant girls to continue with schooling, teenagers are more likely not to be practicing protective intercourse. Hence they continue to be higher on first births but halt progression to second birth due to consequences of teenage motherhood and, continuing schooling. Findings by the UNAIDS/WHO global HIV/AIDS report indicates that South Africa accounts for 12% of HIV/AIDS positive among the 15-24 years age group. This could be another probable explanation of the low progression odds among teen moms. Thus, HIV/AIDS could be affecting their fertility by limiting their reproductive life span before they reach the next age group. Hence, progression to second birth remains low among teen moms in both periods as compared to moms 20-29.

iii) Are there differential odds of progressing to a second birth within 5 years between first live births which occurred between period 1993-1997 and period 1998 -2002?

Bivariate analysis in Table 6 showed that women with first births in the later period had 32% lower odds of progressing to a second birth. Multivariate analysis in Table 7 shows that this holds when controlling for other factors and women with first births in the later period have

about 32% -33% lower odds of having a second birth. The difference in odds of progressing by time period is expected due to the drop in fertility between the periods. This is the same period of the study, which shows a comparable pattern of progression to the decline in fertility. As indicated by descriptive analysis 56% of the first time mothers were from the first period (1993-1997) and 44% were in the second period (1998-2002), (Table 1) while 44% and 35% of the second time mothers (Table 2) in period 1 and were period 2 respectively. This indicates a decline in first births as well as decline in the likelihood of progression to second births in period 2. Garenne's work on fertility indicates that following the transition in Sub-Saharan Africa and South Africa, TFR in Agincourt declined from 3.7 in 1993 to 3.4 in 1997. By 1998 the TFR was 3.0 down to 2.7 in 2002.

This finding merely confirms earlier research that although there are still high rates of early fertility; either delays in second births or a decision not to have a second birth at all is contributing to fertility decline. Although data used in this report do not indicate which is the case, only that the odds of progressing to a second birth within five years decrease in the second period for all age groups as shown in Table 5, possible effects might be related to among other issues increase fertility due to high rates of maternal and child mortality.

There have been numerous social changes which affect fertility taking place during period 1 and revealing consequences in the later period. Of crucial effect, HIV/AIDS was already pronounced in South Africa and claimed a few deaths in the Agincourt area (Garenne and Zwang, 2008). Around 1993 HIV/AIDS mortality was starting to warrant a need for treatment but the beginning of the second time period for this study (1998), coincide with the time that the government

decided against ARVs. Although not included as a measure in this study, Agincourt mortality data demonstrates an increase in children (0-4) and young adults (20-49) mortality during the latter period which HIV/AIDS is responsible for. In the earlier period child mortality accounted for 39/1000 deaths and increase to 77/1000 deaths in the latter period with the rise of HIV/AIDS (Kahn et al., 2007). The consequences of this may have resulted to escalating mortality particularly among young women and children due to HIV/AIDS. The impact of HIV/AIDS on fertility in this regard could be that during the later period infected young mothers may die or infect their children who'll die at a later stage.

iv) Is there an effect of age and period on the odds of progressing from first birth to second birth?

Table 4 gives results for the chi squared tests comparing the distribution of second births between time periods for teen moms and all older moms. Table 5 also shows how the odds of having a second birth are lower for each age group in the second period. Following the same hierarchy as discussed earlier, the decline across age groups in the later period is between 10% to 38% low probability of having a second birth in 5 years.

These results suggest that the effect of distribution of second births for teens is different in the two periods and that there is an interactive effect between age and period on the odds of progressing to a second birth. For this reason I decided to run the models of the determinants of progressing separately for each period to see if the effects of the variables on the odds of progressing also changed over time.

Multivariate analysis in chapter 5 indicates that period has a significant effect on either teen moms or young moms. The relative odds presented in Table 8 show that young moms were having a 1.2 chance more of progressing to a second birth in 5 years than teen moms in the earlier period. When we look at the second period, we see the odds among teen moms (12-19) and young moms (20-29) changing over time. Their odds are almost intercepting in the later period, with young moms having 1.17 chance compared to teen moms which is not statistically significant. This raises a question because age does not reverse to allow teen moms to catch up with young moms.

Existing literature on teenage fertility indicated that it is higher at first births. This study also shows similar results since there are fewer teen moms progressing to second births. Hence, the low difference on progression between teen moms and young moms is likely to be caused by changes in reproductive behaviour among the young moms. Possible explanation of the leveling odds among teen and young moms can be attributed to delayed marriage, prolonging of second births due to increase use of hormonal contraceptives before marriage and preventive contraceptives such as condoms due to the rise of HIV/AIDS as well as HIV/AIDS mortality. The HSRC, DHS and national statistics as well as findings by (Garenne et al, 2007) from Agincourt verbal autopsy data includes that 80% of HIV/AIDS sero-prevalence is among the 20-24 age group. In line with findings by Garenne and Zwang (2008) that HIV/AIDS had a strong correlation with fertility through pre-marital reproductive behaviours, it can be assumed from these findings that the reversed likelihood of progressing among young moms may be because they are likely to be infected with HIV/AIDS or die before progressing to the second birth.

Further analysis on relative odds indicate that notwithstanding the difference in odds of progression over time, there is no variation on the determinants of the odds of progressing to a second birth by socio-demographic factors over time, except for sex and death of P_1 which change in the later period showing that they are affected by period. Thus, as presented in Table 8, it did not matter anymore what the sex of P_1 was in the later period as we see the odds becoming non significant in period 2. However, losing P_1 became very significant in the later period which was not in the earlier period.

Findings by Garenne et al, (2007) indicate that between 2000 and 2004 the Agincourt DSA achieved a negative growth of 21.0/1000 CBR and 10.9/1000 CDR and that HIV/AIDS is responsible for about 35% among 15-49 year age groups in the Agincourt area. In that light, findings from this study can draw conclusions that the increase in infant and child mortality due to HIV/AIDS might have increased the odds of having a second birth among mothers who lost their first child to have a replacement birth within 5 years. The odds of progressing to second birth in 5 years remain at a lower level in the second period than the first although HIV/AIDS may have put pressure on fertility through its impact on child mortality.

v) Is there any variation in the odds of progressing to a second birth by age at first birth, education, refugee status, marriage, and sex of first child, birth parity and period at first birth on the odds to transitioning to second birth?

Descriptive analysis in chapter 4 found that all socio-demographic determinants explored in this study were in one way or the other related to the odds of progressing to a second birth in five years. In line with numerous earlier studies on fertility this study found that, age of mother, her

education status, citizenship and marital status defines fertility behavior, with married and refugee mothers having the high probability of a second birth in both periods. Results on Table 6 show the level of significance of the socio-demographic determinants. However multivariate analysis presented in Table 7 in 2 models indicates that all socio-demographic determinants were significant except for sex of first child (in model 1) and survival of the child (in model 2).

But, Table 8 shows that running the models separately by period gives a clearer picture of the determinants of progressing to a second birth. Having a girl influences the odds in the first period but not in the second period and having a child die does influence the odds in the second period not the first. Mothers who lose their first child will want to replace the child which raises questions on the model. Survival of the child lost significance in the second model when the non significant sex of P_1 was removed in the second model which could suggest that most of the children were P_1 female.

Another crucial finding is that the odds of progressing to a second birth for married women were still higher on both time periods but become even higher in the second period (from 37% to 69% (Table 8). As modeled by Bongaarts and other fertility scientists, this result could be an indication of the effect of the index of marriage and contraceptive use. Thus, married first time mothers were more exposed to regular intercourse that increase their child bearing likelihood. Also, in the absence of data on contraceptive use, the results suggest that contraceptive use is low among married mothers. Another explanation could be that delayed marriage puts pressure on married mothers to have children much earlier so that they can achieve their desired family sizes before they exit fertility age. In the context of rising HIV/AIDS, married mothers may be

encouraged to have more children in advance of unforeseen HIV/AIDS effects on their fertility as well as that their reproductive life span is shorter.

Furthermore, the effect of refugee status shows that they have twice the chance of having a second birth in both periods. Descriptive analysis on Table 1 and 2 accords findings by Garenne's literature on Agincourt fertility that Mozambicans have higher fertility rates compared to South Africans. This is shown by the smaller population (N= 2,751) of Mozambicans/refugees and a bigger size (N= 6,187) SA; a proportion of 31.7% of Mozambican first time mothers and 56.67% of Mozambican second time mothers. However, their odds ratios also decrease in the latter period. In addition to factors explaining the decline in the odds of progression among South Africans, it may be associated with that the earlier period was when they entered the country and the latter period was when some were returning to Mozambique while some chose to remain during the migration integration period since 2002. Hence, the decrease in the later period may be caused by those that were censored from the sample because of out migration, which this data does not show.

The effect of education on the odds of progression remains significantly lower in both periods. Thus, women with higher education and missing education status have consistent lower odds of progression in both periods. As found in descriptive and bivariate analysis (Chapter 4) that women with higher education status are less likely to go onto second birth in 5 years, Table 8 also breaks down the results by period which show the same significance on both periods and even lower odds during period 2. Generally educated women can well make decisions with regard to their reproductive behaviour, proving high usage of contraceptives among educated

women due to socio-economic commitments such as further education and employment. This could also be that the first births were non marital reducing exposure to reproduction thereby encouraging delays to second births.

However, it is peculiar to see women with missing education status showing a statistically significant influence on the odds of progressing to a second birth. There is something of notice among this group of women but the data cannot show what it is since their education category is undetermined. They could be those with less education, higher or mixed. Nevertheless, the findings show in one way or another that education is a major factor in determining progression to second birth in 5 years. The data has also given enough distinction to confirm that lower education status is associated with higher odds of second births while better education decrease the likelihood. Educated women may be effectively practicing birth control measures voluntarily for longer spacing or they may be using more of protective contraceptives to prevent HIV/AIDS infections which depress their fertility.

Another interesting finding is the changes noted on the outcome of the first child in its influence to a second birth. Sex of the first child was significant in determining progression to second birth. In the later period it does not seem to matter whether the first child is a boy or a girl. The results for the earlier period suggest a preference for sons which might influence women to have more children much earlier. Son preference exists in some parts of the world. But the results for the second period suggest there is no son preference so either this was a weak influence or one that has changed over time. More research would be needed to clarify this result.

In addition to the fact that there are few mothers with multiple births in the later period, multiple births are more of a genetic factor which does not happen to every woman. The low incidence of multiple births in period 2 could be because among those who are still giving birth, there is very few if any giving birth to twins and more; some may do but lose the child to maternal mortality (abortion, still births, HIV/AIDS at birth, etc.) which this data is not able to show. One other reason could be a resultant of fears among a number of women to have more children due to HIV/AIDS and related effects.

Findings also show that losing a first child in the later period puts more pressure of having a second birth. The odds increase from 0.9 to 1.5 chance in period 2 (Table 8). This is significant at 0.01 level, raising questions around infant mortality. It suggests that the higher infant and child mortality brought about by HIV/AIDS might be encouraging women to try again for a child sooner than they would if their first child survived. More research needs to be done in this area to confirm the findings, especially in the relationship between HIV/AIDS and fertility.

6.2 SIGNIFICANCE OF FINDINGS

It is imperative that the study attempted to describe factors that affect progression to a second birth and shed a light on factors that are of high significance. Having shown that changes over time have effects on the odds of progression by affecting the socio-demographic determinants, it will help future studies and fertility analysis to take into consideration demographic transitions over time and how that impact on fertility. One other aspect of period effect on fertility is the issue of young adults and child mortality. The study findings reveal a decline in progression of

first births to second births among young women and that more recently the death of a child has become a significant factor in the odds of progressing to a second birth within 5 years. This is a significant finding that might be HIV/AIDS related mortality. In an attempt to find out what drives progression to second birth and what is contributing to the current fertility decline as we have more likelihood of second births due to P_1 dying. According to Kahn, et al., (2007) Agincourt child and young adult mortality is a reflection of the South African context. Therefore, in the era of HIV/AIDS low fertility among young women and child mortality raise questions that future research needs to address.

Despite numerous studies looking at factors influencing fertility decline, the correlation between HIV/AIDS and fertility is still meagerly scientifically explored. Hence, the significance of this study to examine and pave a way for scientists to shift their focus from exploring proximate determinants of fertility to emerging underlying effects of fertility decline such as the probable impacts of HIV/AIDS on overall reproductive health and childbearing. Without data limitations and time frame, this study would have explored the analysis even more to come up with better results. However, study limitation will also contribute to further research. Therefore, limitations of study and recommendations for future work and ideas for institutional intervention derived from the findings will be discussed in the section that follows.

CHAPTER 7

7.0 LIMITATIONS OF STUDY AND RECOMMENDATIONS

7.1 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FUTURE DATA COLLECTION

The study used DSS data to analyse the effect of age and period on the likelihood of progressing to a second birth within 5 years. While DSS apply effective data accuracy systems and that data is collected at household level to capture all individuals in a given population over time, there are limitations encountered on this study emanating from the data. Education status information used in this study was not complete and contraceptive use data was not available for everyone. Marriage data is also recorded for women at first births which make it difficult to tell if the second births were marital or not. These are empirical proximate determinants of fertility which need to be available and accurate for all fertility analysis.

7.1.1 Education

Education status used in this study was limited to how the AHDSS measures education status which is on a five year period. This is not because the analysis of progression in this study is measured in a period of five years, but because education status is a separate module to the annual event updates, only conducted on five year intervals. Hence the closest education information that could be linked to the sampled mothers was their last education level within 2 years of the first birth. While this is a fair proxy at time of first birth as it can be linked to the maternal age at birth as well as knowledge of reproductive health, it is crucial to see how much education status has an effect on progression if mothers continued or did not with schooling after

the first birth and how soon and long they were in school after the first birth and before the second birth. Although Marks and Potts (2001) argue that any education status matters in fertility analysis, in this study there were 31% of mothers missing education status which made it difficult to drop them or allocate them in any of the education status categories. Creating a dummy variable for missing education to keep the 31% of mothers obtained results that showed missing education was significant in determining the odds of progressing to next birth in 5 years, but what level of education could not be determined.

7.1.2 Marriage

The proximate determinants framework emphansizes marriage as an index used to express reduction in fertility since women are more prone to child bearing when they are married (Stover, 1997). While the index of marriage measures fertility through the period of sexual exposure of a woman expressed by the proportion married, fertility in South Africa is mostly non-marital. This index is therefore not easily applicable in the South African fertility trends due to the nature of marriage patterns influenced by the past policies. The marriage status data in this study are also week, with missing marital status at first births all presumed to be non-marital. Using this limited data the study also reveals comparable findings in that 65% of the first births are non-marital. It appears that the importance of marriage is increasing in that the relative odds of married women having a second birth compared to unmarried women are increasing. However, this may be a data artefact with improved collection of marriage data over time. Nevertheless, the measure of marriage is not enough to produce results that can justify the index of marriage as a fertility determinant since data on marriage for this study is limited to marital status at first birth and marital unions include informal unions such as cohabitation which

confound decisions of family formations. Therefore, there remain a number of social effects that affect marriage as determinant.

7.1.3 Contraceptive use

Contraceptive use is regarded as the first major effect on fertility transition in rural South Africa considering the history of fertility transition in the country, especially among black women (Bongaarts 1978). Therefore it is imperative to have accurate contraceptive use data of all maternal data to enable in-depth analysis of maternal behaviour, in particular, how progression of births is affected by voluntarily and involuntarily use of contraceptives. Unfortunately the institutional enforced use of contraceptives among black South African could not reach the rural women in marginalised areas like the Agincourt due to its intended motives which made vital registration impractical (Camlin, et al., 2004). Even the 1974 national planning programmes only reached the DSA at the early years of its establishment when health services systems were decentralized. Given that fertility data is not effectively documented in South Africa, the AHDSS couldn't get retrospective data to record at the baseline surveillance lack of vital events registration prior to the start of the DSS. Also, prospective data has cultural barriers association, making disclosure difficult. The DSS only available data would not suffice the expected analysis of the study. Therefore the study findings has a missing index that would provide results on fertility behavior especially one that would help understand the effect of contraceptive use among teenagers, married and non-married women, thereby explaining their relative odds of progressing to second births.

7.2 RECOMMENDATIONS

7.2.1 Future research

Having found that the likelihood of progressing to second births in Agincourt is becoming lower over time and likely to be the major contribution to fertility decline, elaborations of the work presented here needs to be explored in more fertility analyses which can be possible if data on fertility in Agincourt can include maternal health, HIV/AIDS, contraceptive use, socio-economic status, migration and policy or record of enrolment on government initiatives addressing maternal challenges. Availability and analysis of these data will help to uncover the real effects behind early first births, non martial fertility, high marital fertility yet continuing declining fertility. Finding will then bring about understanding of factors affecting the decline and help project and address the desired future fertility trends in the country. A possibility of this argument lies in collaborated effort between the scientific and institutional bodies. It is therefore recommended that government policy makers and research institutions work closely together.

As a body of knowledge, research offer guide at individual, population and institutional level through information dissemination and policy brief. First, to address data limitations such as outlined above, research institutions need to ensure that data relevant to fertility studies is available and accurate. It is therefore recommended that future research must have better education information to see how knowledge level impact on fertility. Findings that odds of progressing to P_2 for young moms and becoming relatively closer to the odds of teen moms in this study coupled with issues around child and HIV/AIDS related mortality, might have education influence. Also, effective contraceptive use is determined by knowledge of the user. For instance, people might be found to use hormonal contraceptives believing they are

preventing pregnancy and infections or base the use on trust than knowledge. ARVs uptake and adherence also require knowledge. Given that all these effects on fertility points out to education, most of teenage motherhood happens at school going age; young mothers are an age group just after teenage mothers and in African society more likely to be still at school; understanding of HIV/AIDS issues depends on knowledge level. Better education and information can change the age effects found in this study, increased knowledge to discourage teenage and non-marital fertility and ameliorate HIV/AIDS related mortality.

Future research on fertility needs to target the above areas. This should include, first and foremost, establishing sustainable relations and links with national population surveyors such as the DHSs, DSSs, national statistic and other research institutions to have a common database and to enable comparative analysis. Surveys related to fertility conducted by any of the institutions should have follow up surveys that can offer data for event analysis such as understanding what happens in between the non-marital and/or teenage first births and the second births, do people stop at P_1 desirably, schooling, out migrate or do they die before P_2 because of HIV/AIDS. For example, although there is a clear effect of marriage on the odds of having a second birth in five years that could be explained by contraceptive use if married women don't use it while unmarried women do. Data on contraceptive use should be kept accurate to include the methods, uptake and adherence before and in between births.

Second, primary data findings should allow follow up surveys to problem areas and data sources such as schools for teenage pregnancy cases, health facilities for HIV/AIDS cases, prevalence, and interventions, etc. Profoundly, findings from such analysis should not only be intellectual

and economic related, but must always be fed back to the source to improve awareness. Last, more research and documentation of biological correlation with parity progression is required. Further studies and documentation of HIV/AIDS association with maternal health and childbearing is empirical.

7.2.2 Policy implications

This report has outlined three important areas of policy crucial to fertility transition in Agincourt and in South Africa at large. The main issues highlighted for policy intervention are high non-marital early first births, low usage of contraceptives before first birth and high usage among married women, high infant mortality. These areas are a call for the South African government and policy makers to review the existing education and health policies in order to expand fiscal expenditure for efficient and sustainable reallocation to better education services and primary health care services for women and children.

To address early teen fertility and non-marital intercourse and maternal and child mortality , policy makers need to improve strategies and initiatives that will increase the maternal age by keeping girls at school and those that will discourage sexual infidelity. This includes combating early first births by creating safety, supportive and friendly environment for young people through creating cheap, accessible condoms and emergency contraceptives in all areas of socialization including alcohol facilities. Policy makers and government initiatives should also invest on improve family planning methods. The existing long available family planning methods need to be reviewed in line with research findings on usage as well as improved awareness of choice methods and the benefits of family planning. This can be achieved by

improving primary health care including children and infant health care services by promoting basic literacy at primary health care services that will enable training of women attending the services thereby facilitating the uptake and adherence on the services offered and received. Free primary health care services currently available should not happen in isolation of the knowledge, accessibility and dignity of the intended beneficiaries (the poor).

So, in addition to social grants, government should invest in secondary education for girls and ensuring that girls from disadvantaged families have government financing from secondary school until tertiary with extracurricular activities and incentives as well as supporting and monitoring of their school performance and progress. Government incentives should be linked to certain conditions and obligations which will tie up the girls and their parents to commitment, including penalty should the girl falls pregnant while in the programme.

Since teenagers are becoming less likely to move to a second birth, policy makers need to monitor and strengthen initiatives that are currently delaying second births. Initiatives such as legal abortion and improved access of contraceptive use should not be granted in isolation of implementation strategies and adequate capacity for implementation to avoid risks of consequences due to misadministration of the initiatives One possible monitoring and evaluation strategy could be conducting surveys with girls attending antenatal clinic and at schools as well as those who already have first births at schools and when they are enrolled in any of the programmes and follow them up to record and monitor their reproductive behaviour prior to marriage or any consented and legalised union. The government also needs to work more on practices that are more restrictive which will reduce sexual infidelity. This restrictive governance

and better infant and child health programs will help reduce child mortality resulting from maternal health problems since it is becoming more of a factor, keep fertility down and possibly reduce risk of transmission to women and children.

REFERENCES

Advanced maternal age, 2007. Fertility trends and impact of HIV on fertility, Wikipedia, www.africacentre.ac.za/Default.aspx.

Anderson, D.L. and Bean, L.L., 1985. 'Birth Spacing and Fertility Limitation: A Behavioural Analysis of a Nineteenth Century Frontier Population', *Population Association of America,* Vol. 22, No. 2, pp. 169-183

Axinn, W.G., 1993. 'The Effects of Children's Schooling on Fertility Limitation', *Population Studies,* 3, pp. 481-493

Bongaarts J., 2006. 'The Causes of Stalling Fertility Transitions, *Studies in Family Planning, Vol.37, no. 1, March*

Bongaarts, J., 1978. 'A Framework for Analysing the Proximate Determinants of Fertility', *Population and Development Review,* Vol. 4 no. 1 pp. 105-132

Burgard, S. 2004. 'Factors Associated with Contraceptive use in Late- and Post-apartheid South Africa', *Studies in Family Planning* no. 352, pp. 91-104

Caldwell, J. C. & Caldwell P., 1977 'The Role of Marital Sexual Abstinence in Determining Fertility: A Study of the Yoruba in Nigeria', *Population Studies* no. 312 pp. 193-217

Caldwell, J.C. and Caldwell P., 1987. 'The cultural context of high fertility in sub-Saharan Africa', *Population and Development Review,* no. 133, pp. 409-437

Camlin C., Garenne M and Moultrie T.A., 2004, 'Fertility Trend and pattern in a Rural Area of South Africa in the Context of HIV/AIDS', African *Journal of Reproductive Health,* Vol. 82 August, pp. 38-54

Cho, L. and Luther N.Y., 1988. 'Reconstruction of Birth Histories from Census and Household Survey Data', *Population Studies,* no. 423, 441-472

Cohen, B., 1998. 'The emerging fertility transition in sub-Saharan Africa', *World Development* Vol. 268, no. 143 pp. 1-146

Coombe, C., 2000. HIV/AIDS and Education Sector: The Foundation of a Control and Management Strategy in South Africa, June, Pretoria

Davanzo, J., Razzaque, A., Rahman, M., and Hale, L., Ahmed, K., Khan, M., Mustafa, G and Gausia, K., 2004. The Effects of Birth Spacing on Infant and Child Mortality, Pregnancy Outcomes, And Maternal Morbidity And Mortality in Matlab, Bangladesh, Rand Working Paper, October

Delauney V, Marra A, and Lévi Pierre, 2007. Analysing Fertility from Demographic Surveillance System Data, Application to the Niakhar Site, Centre for Population and Development, Senegal

Ekert-Jafte, O., Joshi H., Lanch K., Mougin R., Rendall M. and Shapiro D., 2002. 'Fertility, Timing of First Births and Socio-economic Status in France and Britain,' Social Policies and Occupational Polarization, *Population*, Vol. 57 no. 3, pp. 475-507

Feeney, G. 1983. 'Population Dynamics Based on Birth Intervals and parity Progression.' *Population Studies 371 : 75-89*

Garenne, M., Tollman S. and Kahn K., 2000. 'Premarital Fertility in Rural South Africa, A Challenge to Existing Population Policy', *Studies in Family Planning*, no, 311, pp. 17-54

Garenne, M, Tollman, S., Kahn, K., Collins, T., and Ngwenya, S., 2001. 'Understanding Marital and Premarital Fertility in Rural South Africa, *Journal of Southern African Studies*, Vol. 27, no. 2, pp. 277 – 290

Garenne, M., Tollman S.M., Collinson M.A and Kahn K., 2007. 'Fertility Trends and Net Reproduction in Agincourt, Rural South Africa, 1992 -2004', *Scandinavian Journal of Public Health,* vol. 35 no 69, pp 85-93

Garenne, M. and Joseph, V. 2002. 'The timing of the fertility transition in sub-Saharan Africa', *World Development*, 3010, pp. 1835–1843

Garenne, M., and Zwang, J., 2008. 'Premarital fertility and HIV/AIDS in sub-Saharan Africa', *African Journal of Reproductive Health* Vol. 12 No.2 August, pp. 64-74.

Healthy Timing and Spacing of Pregnancies, A Pocket Guide for Health Practitioners, Program Managers, and Community Leaders, Extending Service Delivery Project, Washington DC., www.esdproj.org

Hosegood, V., McGrath, N., and Moultrie, T., 2009. 'Dispensing with marriage: marital and partnership trends in rural Kwazulu-natal, South Africa, 200-2006', *Demographic research*, vol. 20 (13), 20 March, pp. 279-312, Max Planck Institute for Demographic Research, Germany, www.demographic-research.org

Kahn, K., Garenne, M.L., Collinson, M.A., and Tollman, S.M., 2007, Mortality Trends in a New South Africa: Hard to Make a fresh Start, *Scandinavian Journal of Public health*, Vol. *35*, no. 69, pp. 26-34

Kaufman, C.E., de Wet T. and Stadler J., 2001. 'Adolescent Pregnancy and Parenthood in South Africa', *Studies Family Planning*. 322, pp. 147-160

Lappegård, T., 2000. New Fertility Trends in Norway, Statistics Norway, *Demographic Research*, Vol. 12 no.3, p.15

Makiwane, M. and Udjo E., 2006. Is the Child Support Grant Associated With an Increase in Teenage Fertility in South Africa?, Evidence From National Surveys and Administrative Data', *Human Sciences Research Council*, Pretoria

Mankiwa-Adebusoye, P., 2001. 'Socio-cultural Factors Affecting Fertility in Sub-Saharan Africa, workshop on prospects for fertility decline in high fertility countries, New York, 9-11 July 2001

Marks S., and Potts D., 2001. *Journal of Southern African Studies*, Vol. 27, No. 2 June, School of Oriental and African Studies, London

Mazharul Islam M., and Yadava, R.C.1997. 'On the Estimation of Parity Progression Ratio', *The Indian Journal of Statistics*, Series B, Vol. 59, No. 2 Aug., pp. pp. 200 -208, Indian Statistical Institute Stable.

Moultrie, T.A. and Timaeus I.M. January 2002. Trends in South African fertility between 1970 and 1998. An analysis of the 1996 Census and the 1998 Demographic and Health Survey, MRC, http://www.mrc.ac.za/researchreports/reports.htm

Newell, C., 1988. Methods and Models in Demography, The Guilford Press, New York

Pagano, M., and Gauvreu, K., 2000. Principles of Biostatistics, (2nd Edition), Duxbury, California, USA

Pampel, F.C., 2000. Logistic Regression, A Primer, in Lewis-Beck, M.S., ed., Quantitative Applications in the Social Sciences, University of Iowa, Sage Publications

Pebley, R. A., 1981. 'Age at First Birth and Timing of the Second in Costa Rica and Guatemalan', *Population Studies*, Vol. 35 no. 3 pp. 386-397, Population Investigating Committee

Preston-Whyte, E. and Zondi M., 1992. 'African Teenage Pregnancy: Who's Problem?' in Burman S, and Preston-Whyte, E., (Eds.), Illegitimacy in South Africa, Oxford University Press, Southern Africa

RamaraRao S., Townsend J., and Askew I., 2006. Correlates of Inter-birth intervals: Implications on Spacing Strategies in Mozambique, *Population Council,* March.

Rasekh, A. and Momtaz M., 2007. 'The Determinants of Birth Interval in Ahvaz-Iran: A Graphical Chain Modeling Approach', *Journal of Data Science* Vol. 5, pp. 555-576,

Setswe HIV/AIDS epidemic, 2008. http://www.hsrc.ac.za/research/outputDocuments/5890

Sibanda, A. and Zuberi T., 2005. 'Age at First Birth', in Zuberi T., Sibnada A. and Stover, J., (Eds.), 1997. Revising the Proximate Determinants of fertility Framework: What have We Learned in the Past Twenty Years?, *Population association of America,* Washington

Timaeus, I.M, and Moultrie, T.A. 2008. 'On Postponement and Birth Intervals', *Population Review*, Vol. 34, no.3, September, pp. 483-510 28, Willet Blackwell

Theunissen, I, September 2002. *Science in Africa, Africa's First On-Line Science Magazine*, 'Fertility levels in South AfricaFalling',www.Scienceafrica.co.za/2002September/fertility

Tollman, S, 2008: Closing the gap, Applying Health and Socio-demographic Surveillance to Complex Health Transitions in South and sub-Saharan Africa, Epidemiology and public Health Sciences, Umeå University, Sweden

Udjo, E.O, 2005. Fertility Levels, Differentials, and Trends, in Zuberi T., Sibanda A. and Udjo E., (Eds.), The Demography of South Africa, Armonk, New York, USAID, 2006

Zieh, S.C., 2001. 'Documenting Changing Family Patterns in South Africa: Are Census Data of any value?' *African Sociological Review*, 52, pp. 36-62

Varga, C, A., 2003. 'Fertility, Current South African issues of poverty', HIV/AIDS and youth. *Seminar proceedings, Department of Social Development, in collaboration with the Child, Youth and Family Development Research Programme of the HSRC,* www.hsrcpress.ac.za, pp. 1-6

Zhenechao, Q. 1997. Progression to Second Birth in China: A study of Fourt Rural Countries. Population Studies, 51, p.228

APPENDIX 1: FERTILITY LEVELS AND TRENDS AND HIV PREVALENCE IN RURAL SOUTH AFRICA

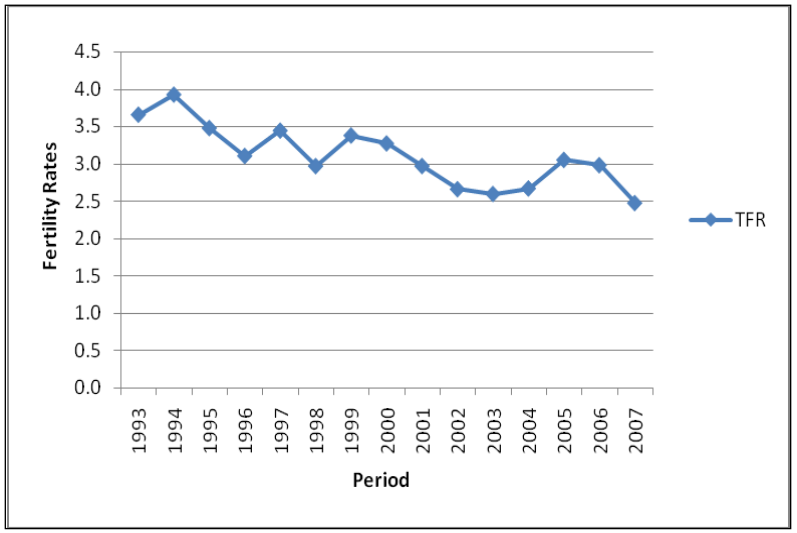


Figure 1 - Total Fertility Rates in Agincourt HDSS, 1993-2007

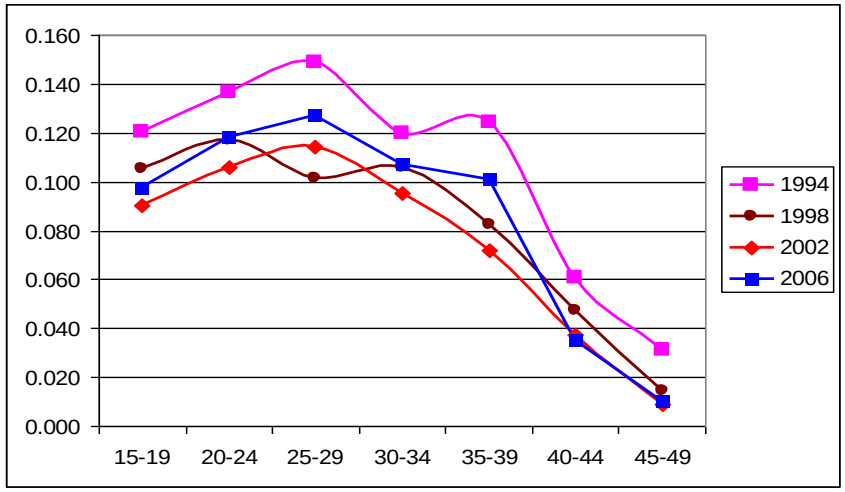
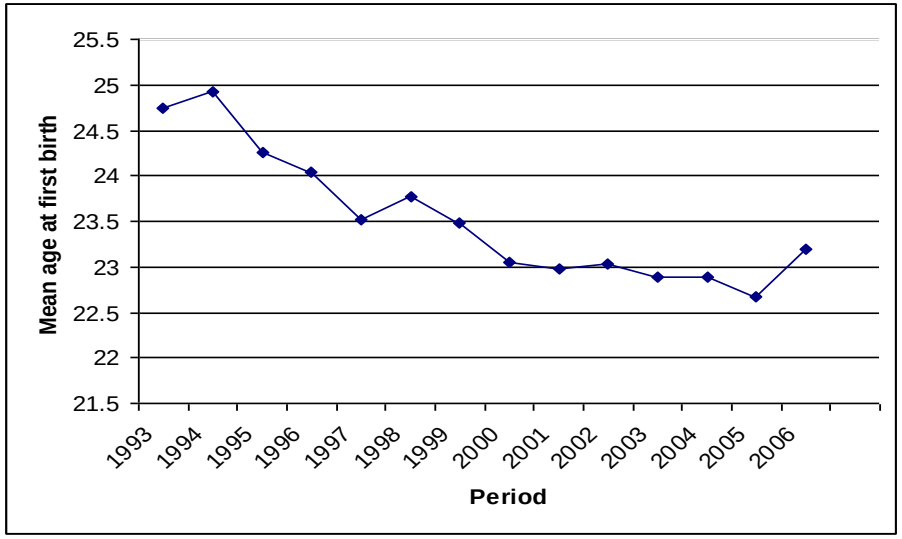
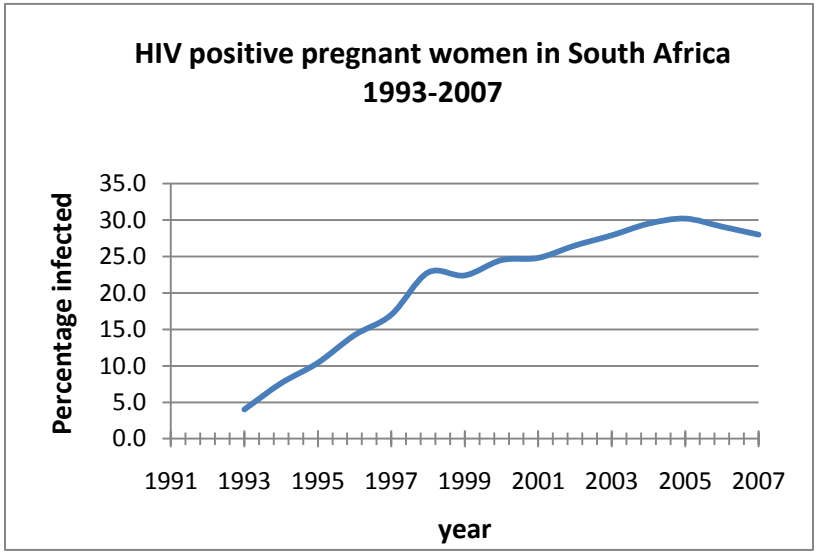


Figure 2 - Age Specific Fertility Rates in Agincourt HDSS, 1993-2007





GM Shabangu 9304855E

APPENDIX 2: LOCATION OF AGINCOURT DSS