Introduction

A review of the demographic literature in Lesotho reveals a very limited exploration of fertility dynamics in Lesotho. Most of the literature is limited to official reports, places greater emphasis on levels and trends in fertility, and offers very little in terms of explaining the trends observed. In addition, despite the availability of data, few efforts have been made to reassess the official fertility estimates. Notwithstanding the paucity of detailed fertility studies in Lesotho, the general consensus is that fertility transition is underway in Lesotho (Bureau of Statistics, 1998; Mturi and Hlabana, 1999; Potts and Marks, 2001).

The Lesotho Population Census of 1996 provided first evidence of a decline in fertility following high and stable fertility for over two decades. The 2004 and 2009 Lesotho Demographic and Health Surveys (LDHS) have shown evidence of further decline in the level of fertility strengthening the view that the fertility transition is underway in Lesotho. The total fertility declined from 4.1 children per woman in 1996 (Bureau of Statistics, 1998) to 3.5 children per woman in 2004 and further to 3.3 children per woman in 2009 (Ministry of Health and Social Welfare [Lesotho], 2005; Ministry of Health and Social Welfare (MOHSW) [Lesotho] and ICF Macro, 2010).

The availability of the 2004 and 2009 birth history data provides an opportunity to bridge the gap in knowledge of fertility dynamics Lesotho. The paper seeks to document patterns of family formation underlying the fertility transition in Lesotho through an assessment of changes over time in parity progression and birth intervals. The paper also investigates whether the Lesotho's fertility transition conforms to the pattern of fertility transition suggested by Caldwell and colleagues (Caldwell, Orubuloye and Caldwell, 1992).

Theoretical Framework

Explaining fertility transitions is one area that has received enormous attention from demographers. The wide variety of explanations, including among others economic development, decline in infant mortality and diffusion of innovations, is therefore of no surprise. Of key relevance to explaining nature and the drivers of the fertility transition in Lesotho is the suggestion that the African fertility transition is unique (Caldwell et al., 1992). The authors suggest that the African fertility transition is characterised by a decline in fertility across all ages simultaneously and significant levels of contraceptive use at all ages and irrespective of marital status. They argue that the motivation for

contraceptive use among unmarried women is to avoid pregnancy and delay marriage while the use of contraceptives among married women is for maintaining birth spacing and limiting patterns formerly achieved through sexual abstinence, an argument that is debatable in view of more recent research (Timæus and Moultrie, 2008).

Timæus and Moultrie (2008) argue that the classification of motivations for contraceptive use into spacing and limiting is flawed and suggest the existence of the third motivation, namely postponement. They further observe that in the fertility transition in South Africa birth intervals have in fact lengthened, and that this could in part be explained by postponement of births. Furthermore, the authors argue that the motivation for use of contraception can be discerned from the birth interval hazard functions, noting that the duration-specific hazards of giving birth vary with motivation.

Data

The primary sources of data for this paper are the maternal birth histories of women aged 15 to 49 years derived from the 2004 and 2009 Lesotho Demographic and Health Surveys.

The 2004 LDHS data are derived from a nationally representative probability sample of 7095 women aged between 15 and 49 years who were present in the selected household on the night before the survey irrespective of whether they were usual residents or visitors. The 2009 LDHS followed the same sampling procedure and interviewed 7624 women aged between 15 and 49 years.

Methods

The analysis in this paper is based on three measures of parity progression namely, parity progression ratios, projected parity progression ratios and Brass and Juarez (1983) method which is an extension of the life table analysis approach proposed by Rodriguez and Hobcraft (1980).

Parity progression ratios refer to "the proportion of women of a given parity who go on to have another child" (Hinde, 1998a; Hinde, 1998b). Parity progression ratios are derived from the data on the distribution of women by their parity. The estimation of these ratios is usually restricted to women aged 45 to 49 years since they are at the end of the reproductive period and therefore have complete data.

The parity progression ratio from a given parity i to parity $i+1$ (denoted here as $a_{(i,i+1)}$ is calculated as follows;

$a_{(i,i+1)}=P_{i+1}/P_i$

Where P_i is the number of women of parity i or greater and P_{i+1} is the number of women of parity $i+1$ or greater.

The main weakness of the parity progression ratios is their data requirements; the data are only complete for women who have reached the end of the reproductive period. Furthermore the data are mainly biased towards past fertility as the impact of recent fertility trends is minimal (Brass, Juárez and Scott, 1997).

The analysis in this paper also employs two approaches proposed by Brass and Juarez (1983) extent the estimation of parity progression measures to cohorts with incomplete fertility namely the(1983) Projected Parity Progression Ratios (PPPRs) and the truncated summary index B_i, the proportion of women having the next birth within i months. The estimation of the projected parity progression ratios, denoted $P_{n,}$ involves relating the proportions of women with n children who go on to have $n+1$ children for two adjacent cohorts. The cohorts are rendered comparable through excluding the births in the five years before the survey for women in the older cohort.

The indices of relative changes are estimated as the proportion for the younger cohort divided by the proportion for the truncated older cohort. The estimation of these indices assumes that the ratio of the values with equivalent censoring is the same as the ratio of the corresponding values without censoring. The indices are then used to estimate the projected parity progression ratios denoted as P_i. The P_i for the age group 45-49 is considered to be the same as the parity progression ratio for this age group and is multiplied by the index of relative change for the age group 40-44 estimate the P_n for the age group 40-44 which in turn is used to estimate the P_n the age group 35-39. A similar approach is used to estimate the P_n values for the younger cohorts. The estimation of the s assumes that the rate of progression to the next parity in the future will be the same as that in the past.

The accuracy of the P_i values depends on the number of women who experience the parity of interest. In general, estimates derived from indices of relative change estimated using parity progression ratio of between 0.65 and 0.8 (i.e. where between 65 and 80 per cent of women have experienced the parity progression of interest) are considered to result in more reliable indices of relative change since a sizeable proportion of women have experienced the event of interest.

Whereas the projected parity progression ratios approach effectively deals with the selection bias, emanating from the fact that parity data are skewed toward fast

breeding women, a problem more acute in the younger cohorts, it does not deal with the problem of censoring effectively. This is adequately addressed in the summary index B_i derived using life table analysis. This method, originally proposed by Rodriguez and Hobcraft (1980), was further developed by Brass and Juarez (1983). The Brass and Juarez approach includes use of the truncated pair wise procedure similar to the one used in estimating projected parity progression ratios (outlined above) to estimate adjusted B_is. This adjustment deals more effectively with the problem of selection bias discussed above.

The assessment of birth intervals is done using an approach outlined in Aoun (1989). In this method median birth intervals are estimated using the life table analysis and the truncated pair wise procedure proposed by Brass and Juarez (1983) is used to estimate projected median birth intervals.

Level of total fertility

Current fertility estimates derived from the two surveys are presented in Table 1. The data suggest a seven per cent decline in the level of total fertility between the two surveys. This fertility decline increases with age and cuts across all age groups. This pattern of fertility decline is consistent with that derived from the analysis of the 1976, 1986 and 1996 censuses data (not presented).

Table 1 Fertility estimates and percentage change by age group, 2004 and 2009

Age Group	*2004LDHS*	*2009 LDHS*	*Percentage change*
15-19	0.092	0.096	5.3
20-24	0.177	0.171	-3.2
25-29	0.160	0.155	-3.5
30-34	0.122	0.117	-3.8
35-39	0.102	0.074	-27.6
40-44	0.046	0.040	-12.5
45-49	0.009	0.007	-24.8
TFR	3.54	3.3	-6.8

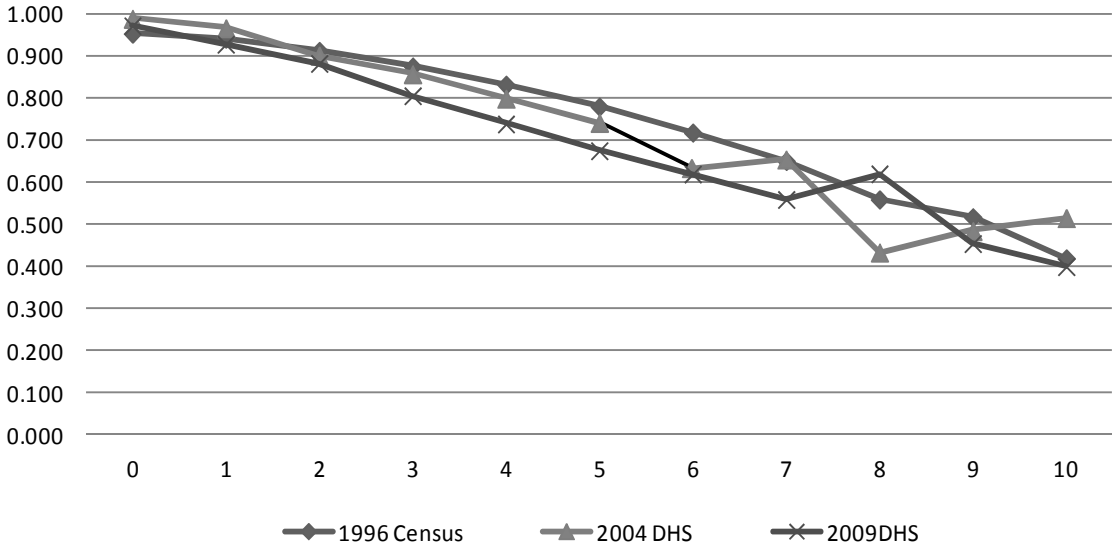
Sources: Ministry of Health and Social Welfare [Lesotho] (2005) and Ministry of Health and Social Welfare (MOHSW) [Lesotho] and ICF Macro (2010)

Parity Progression (selected results)

Parity progression ratios for aged 45 to 49 years are presented in Figure 1. The figure shows an increase in parity dependent fertility control over time. The parity progression ratios derived from the 1996 census data are high until parity 2, and then fall rapidly with parity indicating increase in fertility control as parity increases. The pattern depicted by the parity progression ratios derived from the 2004 LDHS data imply

increase in fertility control beyond parity 3. As is the case in the 1996 parity progression ratios derived from the 2004 LDHS and from the 2009 DHS fall with parity. The proportions of women progressing to higher parity are relatively low in the 2004 LDHS compared to the 1996 census and decline further in the 2009 LDHS.

Figure 1 Parity progression ratios for ever-married women aged 45-49, 1996 Census, 2004 DHS and 2009 DHS



The P_i values derived from the 2004 and 2009 LDHSs are presented in Table 2. The projected parity progression ratios from parity three to four and beyond are in general higher in the 1977 LFS than in the 2004 LDHS. A comparison of corresponding cohorts in the two surveys shows a slight variation for parity progression ratios for parity zero to one and parity one to two. For parity progression ratios from parity two to three and beyond the percentage of women progressing to a higher parity is higher in the 1977 LFS compared to the 2004 LDHS. The differences in projected parity progression ratios between the two surveys point to a decline in family size over time.

The *Pi* values based on the 2004 and LDHS and presented in Table 2 show no variation among cohorts in terms of progression from zero to one birth. The parity progression ratios remain high (80 per cent and above for the cohorts 30-34 to 40-44 and 90 per cent for the cohort 45-49) until parity three and begin to fall significantly for progression from parity three to four for all cohorts. The table shows a decline in progression to higher order births over time indicated by increases in parity progression as the cohorts get older. About 89 per cent of women aged 30 to 34 with at least one birth are expected to go on to have a second birth and the corresponding figure for the women aged 45 to 49 is about 97 per cent. The gap in parity progression ratios increases

with birth order indicating increasing preference for smaller families over time. About 70 per cent of women aged 30 to 34 with parity four are expected to progress to parity five compared to 80 per cent for women aged 45 to 49.

Table 2 Projected parity progression ratios, 2004 LDHS and 1977 LFS

2004 LDHS			*Parity progression*						
Age group	*0-1*	*1-2*	*2-3*	*3-4*	*4-5*	*5-6*	*6-7*	*7-8*	*8-9*
25-29	0.917	0.769							
30-34	0.966	0.858	0.792	0.651	0.693				
35-39	0.972	0.907	0.853	0.674	0.714				
40-44	0.969	0.937	0.887	0.784	0.727	0.672			
45-49	0.987	0.964	0.900	0.856	0.798	0.741	0.633	0.654	0.433
2009 LDHS			*Parity progression*						
Age group	*0-1*	*1-2*	*2-3*	*3-4*	*4-5*	*5-6*	*6-7*	*7-8*	*8-9*
25-29	0.922	0.790							
30-34	0.949	0.846	0.736						
35-39	0.953	0.890	0.795	0.708					
40-44	0.961	0.914	0.864	0.761	0.678				
45-49	0.971	0.927	0.881	0.805	0.738	0.674	0.620	0.559	

Projected parity progression ratios based on the 2009 LDHS reveal a similar pattern to that observed in the 2004 LDHS. Over 90 per cent of women in the survey that are expected to have at least one birth and about 80 per cent of women in cohorts 25-29 and 30-34 with one birth will go on to have a second birth. The projected parity progression ratios fall with age and parity. Progression to high parities (parity 5 to 6) is expected to remain as high as 70 per cent for the 45-49 cohort. For the cohorts 30-34 to 45-49 the projected parity progression ratios are expected to fall significantly beyond parity three indicating a shift to smaller families over time.

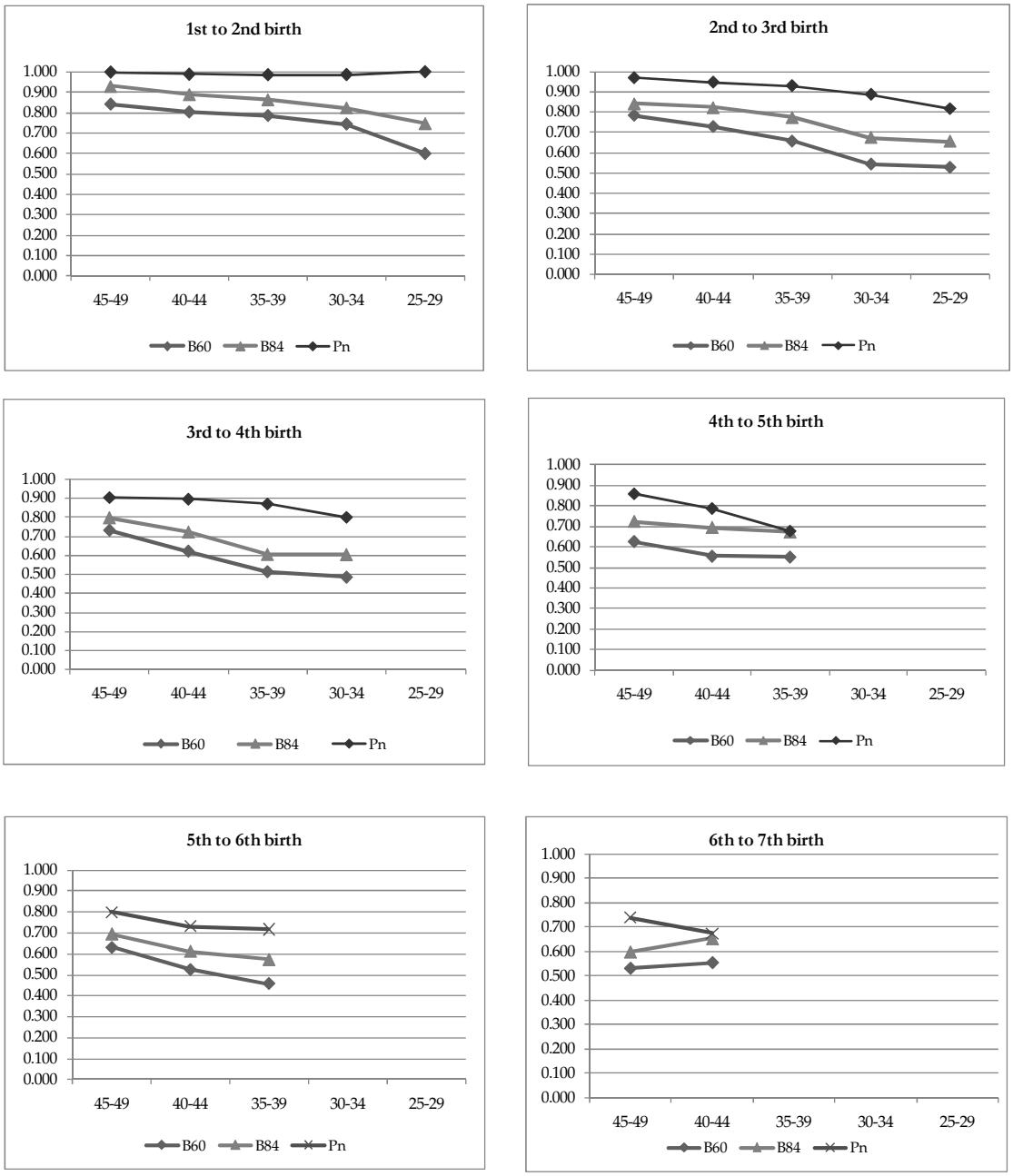
Table 3 Projected completed fertility of ever-married by cohort, 2004 LDHS and 1977 LFS

Age group	*30-34*	*35-39*	*40-44*	*45-49*
2004 LDHS	3.17	3.47	4.08	5.12
2009 LDHS	2.92	3.27	3.81	4.49

The P_i values can be used to estimate the projected completed fertility of each cohort. This is estimated as the sum of the $P_{(i,i+1)}$ values for the respective age groups.

The projected completed fertility estimates derived from the 2004 LDHS and the 2009 LDHS data are presented in Table 3. The cohort fertility rates based on the 2004 LDHS increase with age cohort indicating falling fertility over time. A similar pattern is observed for the 2009 LDHS. The projected cohort fertility rates for 2009 are much lower than the 2004 rates for all cohorts indicating a decline in fertility between the two periods.

Figure 2 Indices of parity progression by birth cohort and parity for ever married women, LDHS 2004



The indices of parity progression P_n, adjusted B_{60} and adjusted B_{84} derived from the 2004 LDHS data are presented in Figure 2. The indices of parity progression P_n,

adjusted B_{60} and adjusted B_{84} derived from the 2004 LDHS are all consistent. The indices decline as the cohorts get younger for all parity progressions except for the progression from sixth to seventh birth where the indices are rather erratic, most probably due to smaller number of women experiencing the event of interest. The indices imply declining fertility at all ages. The indices fall gradually with cohort implying that there is no specific preferred family size. The indices show evidence of fertility control across all cohorts.

Birth Intervals (selected results)

The projected median birth intervals derived from 2004 LDHS are presented in Table 4. The projected median birth intervals are expected to lengthen within each parity progression and the cohorts get younger. The projected median birth intervals are expected to be above five years for parity progressions from the third to the fourth births and higher for the younger cohorts (25-29 up to 35-39). The projected median birth intervals are also expected to lengthen with parity progression within cohorts indicating that women in all cohorts are less likely to progress to high-order births.

Table 4 Projected median birth intervals (months), 2004 LDHS

2004 LDHS	*Parity progression*					
Age Group	*1-2*	*2-3*	*3-4*	*4-5*	*5-6*	*6-7*
25-29	43.4	61.2	69.0	82.5		
30-34	38.4	56.4	64.1	64.2		
35-39	36.2	49.7	60.7	59.2	62.4	70.2
40-44	34.2	41.7	48.4	54.1	49.8	49.9
45-49	35.6	36.4	41.6	44.7	46.7	54.2

Conclusion

The foregoing analysis of patterns of family formation implied by the data from the 2004 LDHS are consistent with the fertility trends implied by official estimates of fertility.

The indices derived from the 2004 LDHS lend to support to the view that fertility in Lesotho is declining. The present analysis indicates that lengthening birth intervals and increasing preference for smaller family sizes are some the factors underlying the observed decline in fertility. The socially acceptable family size is however not immediately discernable.

References

Aoun, Samar. 1989. *An assessment of the paired comparison procedure for measuring early changes in fertility in Syria, Tunisia and Yemen Arab Republic*. CPS Research Paper 89-2. London: Centre for Population Studies, London School of Hygiene and Tropical medicine.

Brass, William and Fatima Juárez. 1983. "Censored cohort parity progression ratios from birth histories", *Asian and Pacific Census Forum* **10**(1):5-12.

Brass, William, Fatima Juárez and Anne Scott. 1997. "An Analysis of parity-dependent fertility falls in Tropical Africa", in Jones, G.W., R.M. Douglas, J.C. Caldwell and R.M. D'Souza (eds). *The Continuing Demographic Transition*. Oxford: Clarendon Press, pp. 80-93.

Bureau of Statistics. 1998. *1996 Population census analytical report Volume IIIA*. Maseru: Government of Lesotho and UNFPA.

Caldwell, John C., I. O. Orubuloye and Pat Caldwell. 1992. "Fertility decline in Africa: A new type of transition?", *Population and Development Review* **18**(2):211-242.

Hinde, Andrew. 1998a. *Demographic Analysis*. London: Arnold.

Hinde, Andrew. 1998b. *Demographic Methods* London: Arnold.

Ministry of Health and Social Welfare (MOHSW) [Lesotho] and ICF Macro. 2010. *Lesotho Demographic and Health Survey 2009*. Maseru: MOHSW and ICF Macro.

Ministry of Health and Social Welfare [Lesotho], Bureau of Statistics [Lesotho] and ORC Macro. 2005. *Lesotho Demographic and Health Survey 2004*. Calverton, Maryland: MOH, BOS and ORC Macro.

Mpiti, A.M. and I. Kalule-Sabiti. 1985. *The proximate determinants of fertility in Lesotho*. WFS Scientific Reports 78. Voorburg, Netherlands: International Statistical Institute.

Mturi, Akim J. and Thandie A. Hlabana. 1999. "Fertility in Lesotho: Recent trends and proximate determinants" in Third African Population Conference. Durban, South Africa: Union for African Population Studies, pp. 145-162.

Potts, Deborah and Shula Marks. 2001. "Fertility in Southern Africa: The quiet revolution", *Journal of Southern African Studies* **27**(2):189-205.

Rodriguez, German and John Hobcraft. 1980. *Illustrative analysis: Life table analysis of birth intervals in Columbia*. WFS Scientific Reports No 16. Voorburg: International Statistical Institute.

Timæus, Ian and Tom A. Moultrie. 2008. "On postponement and birth intervals ", *Population and Development Review* **34**(3):483-510.