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The Effect of HIV and AIDS Interventions on Future Fertility of Kenya

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ABSTRACT

While there are clear indications that fertility transition is taking place in Kenya at large, at regional level huge differentials in total fertility rate continue to persist. This is happening at a time when Kenya has adopted devolved system of governance. Since fertility plays a key role in population growth and is largely affected by HIV and AIDS, this study seeks to examine the effects of HIV and AIDS intervention on the future fertility at county level in Kenya. Four data sets are utilized in this study. These are: the 1999 and 2009 Kenya population and housing data, the 2014 Kenya demographic and health survey and the 2012 Kenya AIDS indicator survey. Extrapolation and epidemiological models are fitted into the data to obtain trends in TFR overtime. The results indicated that HIV will lead to fertility reduction across all the counties. Counties with relatively high HIV prevalence are projected to record the highest percent reduction in TFR while counties with relatively low HIV prevalence are projected to experience the lowest percent reduction in TFR. The study also established that, the HIV and AIDS related program interventions are indeed affecting population change in all counties in Kenya. However, the effectiveness of these programs varies considerably by counties. Counties characterized by low uptake of HIV related interventions are projected to record the highest percent reduction in fertility by 2030. On the other hand, counties characterized by high uptake of HIV related interventions are projected to witness the lowest percent reduction in fertility.

Based on the finding of this study, it is recommended that the county governments in conjunction with NACC and NASCOP should scale up the uptake of interventions geared towards addressing HIV/AIDS as a strategy to curb population growth at county level.

Keywords: *Total fertility rate, HIV and AIDS, HIV prevalence, Projections*

INTRODUCTION

Studies have linked HIV/AIDS to fertility change (Zaba et al., 2007; Clark et al., 2008 and Gregson et al., 2007). HIV and AIDS can either lead to fertility increase or fertility reduction among fecund women (Lewis et al., 2004). HIV leads to fertility increase especially when infected persons try to speed up their reproduction decisions fearing that they may not live long (Setel 1995). Studies have also shown that HIV/AIDS may lead to fertility decline in a variety of ways such as fear of being infected which may prompt people to engage in protected sexual intercourse or to abstain all together (Sneeringer and Logan, 2009). This in effect reduces considerably the odds of conception. Second, HIV/AIDS causes progressive damages to sperms morphology and functions in men (Krieger et al., 1991; Setel, 1995).

OBJECTIVE OF THE STUDY

The main objective of this study is to examine future fertility levels in Kenya taking into account the effect of HIV and AIDS and the associated program interventions.

Past Studies on the Relationship between HIV/AIDS and Fertility Change

HIV and AIDS have been shown to affect men and women in a variety of ways. Biomedical studies indicate that, although during the initial stages of HIV infections many HIV positive men may still retain seminal parameters consistent with fertility, in the long run they experience low sperm count. This ultimately leads to fertility reduction. As the disease progresses, the quality and motility sperms reduces. Existing studies also point that, high rates of seminal deformities are more likely to affect fertility in men as HIV/AIDS disease

becomes more severe (Gresenguet et al., 1992). HIV positive men are more likely to suffer from inflamed testicles and on average they experience high relative risk of producing inadequate testosterone levels when compared to HIV negative men. HIV infected men on average have reduced sex urge because HIV infection lowers CD4 (white blood cell) count. These conditions affect fertility to a large extent (Clayton, 2011).

Among women, it is indicated that, HIV positive women may experience negative fertility outcomes such as miscarriages, spontaneous abortions, and stillbirths which eventually lowers their fertility rates (De Cock et al., 1994; Temmermanet al., 1994). As the disease progresses, HIV positive women are more likely to experience unstable menstrual periods when compared to their HIV negative counterparts (strecker et al., 1993). The HIV virus in women damages the placenta, embryo or even the fetal thymus gland. This makes the mother susceptible to opportunistic infections during pregnancy and consequently lead to miscarriage (Zaba et al 1998). HIV/AIDS increases the likelihood polymenorrhea (short menstrual cycles) and oligomenorrhea (prolonged menstrual cycles) in women. Women who suffer from these conditions on average have high risk of tubal infertility (Frankel et al., 1997; Sobel, 2000). HIV positive women are more likely to have an anovulatory cycle and amenorrhea. An anovulatory is medical condition characterized by a woman receiving menstrual cycles but the ovaries fail to release an egg. Amenorrhea on the other hand is characterized by complete failure to receive menstrual cycles among women of reproductive ages (Vitaly and William, 2011).

HIV/AIDS affects post-partum behaviors among women affected by the disease. This occurs particularly when HIV infected women stop breastfeeding fearing that they may pass the virus to the child. The same concern may also apply to non-infected section of the population who don't know their HIV sero-status or those who suspect that they may be HIV sero-positive. In Kenya for example; HIV/AIDS has been linked to reduction in the duration of breastfeeding. The link between HIV/AIDS and duration of breast feeding is thought to be a factor that contributed to stall in fertility witnessed in Kenya (Magadi and Agwanda, 2010). HIV/AIDS lead to premature death of women in reproductive age, their spouses and their children. Consequently, this lead to population level changes in fertility rates. In fact, HIVAIDS is among the leading causes of maternal mortality globally (Vitaly and William, 2011).

Data and Methods

The study makes use of secondary data drawn from the 1999 and 2009 Kenya population and housing census, the 2014 Kenya demographic and survey data and the 2012 Kenya AIDS Indicator survey data. Data on fertility is drawn from the 2009 Kenya Population and housing censuses (KNBS, 2010). HIV prevalence data is obtained from the 2012 Kenya AIDS indicator surveys (KAIS) while the 2014 Kenya Demographic and Health Surveys (KDHS) are used in this study for the purpose of obtaining contraception prevalence rates and to model sex activity function(KNBS and ICF macro, 201) . Sex activity is modeled because HIV transmission is not only a function of the age at first sexual intercourse but also of the frequency of condom use during sexual acts.

Fertility Projections

Fertility is concerned with population increase through births. It is measured using a number of indices, the commonest of all being the total fertility rate (TFR).TFR in essence is the number of children a woman of child bearing age is expected to give birth to if she was to be subjected to the prevailing age specific fertility rates. To produce fertility projections, the trend extrapolation methods are applied to the observed TFR in 2009 and 2014. Then, the TFRs produced are translated into age specific fertility rates. To incorporate HIV/AIDS in fertility projections, HIV prevalence's are introduced per county. Then, a set of age specific incidence parameters are used to infect people who are HIV negative, transitioning them to the first HIV positive category in the shortest possible duration. The main mode of HIV transmission in Kenya is via heterosexual union. Consequently, HIV is introduced into fertility projections by modeling sexual activities in each county. Sex activity is a function of average age at first sexual intercourse, prevalence of the infection in the age group and probability of infection within an age group. Thus, for an individual aged x years in a given county, probability of HIV infection according to Dorrington et al., 2010, is modeled as:

$$S(x) = \frac{(x-c)e^{-b(x-a)^2}}{c} \quad \ldots\ldots\ldots (1)$$

Where:

S(x) is the probability of HIV infection for an individual aged x years in a province.

a is the median age of first sexual contact

b is the prevalence of HIV by age

c is a scale factor so set such that s(x)=1

To start the projection, the population is first categorized in terms of duration of HIV infection. Five HIV duration groups are identified. The first four groups namely: less than 5 years, 5 to 9 years, 10 to 14 years, and 15 and above years represents those people who are already HIV sero positive. The fifth category includes individuals who are HIV sero negative. In addition, the population is further categorized into seventeen age groups (0 to 4, 5 to9,.., 80+).Then, the probability of transmission of HIV in a particular risk group is computed. These probabilities are then related to fertility to give the influence of the epidemic on fertility.

HIV infection depends on the risk of exposure to the virus. Hence, based on the level of exposure, individual are classified into four risky groups based on the risk of exposure to the virus namely: High exposure, medium exposure, low exposure and not exposed. Highly exposed persons are those in high level of exposure like commercial sex workers while not exposed persons are those not engaged in sex at all.

If an individual belong to risk group *i* and is aged x years, then the odds of that person being infected with HIV in the year is modeled as:

$$1-\left\{1-a(x)\left(1-\sum_{j=1}^{4}w_{ij}\sum_{y=14}^{59}h(y/x)\sum_{t=1}^{6}P_{tj}(y)\left[1-T_{tij}(y)\right]^{n_{ij}\sqrt{s(y)D_t}}-\left(1-\sum_{j=1}^{4}w_{ij}\sum_{y=14}^{59}P_j(y)h(y/x)\ \right)\ \right)\right\}^{m_i\sqrt{s(x)}} \quad (2)$$

In equation 2:

a(x) =1 for women aged over 25 and for men it is a factor denoting the increase in probability of HIV infection per partnership in women aged x years.

$w_{ij:}$ proportion of partners in risk group j.

$P_j(y)$: proportion of persons aged y-year old who are HIV positive and are in risk group j.

$P_{tj}(y)$: proportion of persons aged y-year old who are in risk group *j*, are HIV sero positive and in stage *t* of the disease.

t: represent the stage of the disease. Six stages of HIV are defined in this study. The first four stages are similar to those stated in the WHO Clinical Staging System. Stage 5 includes those people receiving anti-retroviral treatment (ART) while the 6thstage includes persons who have discontinued ART.

$h(y/x)$: Proportion of partners aged y.

n_{ij}: Number of sexual acts a person is likely to have with each partner in risk group j.

S(x): Sex activity index as at age x.

m_i: Number of sexual partners a person has per year.

D_t: Factor by which the amount of sex is reduced in stage t of disease.

$T_{tij}(y)$: Probability of an HIV positive person aged y-years, in stage t of the disease and in risk group *j* transmitting the virus to a partner in risk group *i*, during a single act of sexual contact.

$T_{tij}(y)$ is computed as follows:

$$T_{tij}(y)=r_{ij}.I_t\left[1-(1-\left[1-f_j(y)\right]R_t)e\ \right] \quad \ldots(3)$$

In equation 3,

r_{ij} Represent the odds of an individual i being infected with HIV during a single act of

Unprotected sex with a person in risk group j.

$f_j(y)$: Odds of condom use by a partner

e: Effectiveness of condom in preventing transmission of HIV

I_t: Factor denoting the increase in the hazard of HIV transmission in each single act of unprotected sex in stage *t* of the disease.

R_t: Factor signifying the reduction in acts of unprotected sex in stage t of the disease (Dorrington et al., 2010).

Five HIV intervention programs are included in the model for projecting future fertility level. These program interventions include: improvement in the treatment of sexually transmitted infections; information and education campaigns (IEC) and social

marketing; voluntary HIV counseling and testing (VCT); mother to child transmission prevention (MTCTP) and anti-retroviral treatment (ART). The rate at which these programs are introduced per county and in the whole country is modeled in this study.

HIV is incorporated into fertility projections by multiplying non-HIV fertility rates by a fertility adjustment factor. The adjustment factor is determined as follows:

$$\text{Fertility adjustment factor} = (a-b)c^{d} \quad \text{---(4)}$$

Where:

a is a factor so set to imply that those getting pregnant are only those having sex without use of condoms

b denote the initial impact of the virus on fertility

c denote the impact of the virus on fertility overtime

d denote the duration of infection.

To isolate the effect of HIV/AIDS on future fertility in Kenya, three scenarios are created. In the first scenario, the effect of HIV/AIDS on fertility is held constant. In the second scenario, HIV prevalence per county is incorporated into fertility projections. In the third scenario, both HIV and uptake of HIV program interventions are introduced in fertility projections.

RESULTS AND DISCUSSIONS

Fertility in this study refers to the average number of children a woman is likely to give birth to in her entire reproductive period. Whereas a number of measures can be calculated to symbolize the fertility experience of a cohort, in this study fertility projections are done by projecting total fertility rates (TFR) in each of the forty seven counties. The year 2009 is taken as the launch year. 2009 is the year when the most current census data in Kenya was collected. The projections are extended to the year 2030 which is set as the deadline for achieving Kenyan Blue print for economic development.

The 1999 and 2009 censuses, the 2008/2009 and the 2014 Kenya demographic and Health Survey (KDHS) fertility estimates were used as input data. The projections are based on the assumption that TFR may not necessary plateau at 2.6 as envisioned in sessional Paper No. 3 of 2012 on population policy for national development. However, steady decline in TFR will continue to be witnessed since the health function has been devolved to the counties. Analysis is done using the Rural Urban Projections software developed the US Census Bureau and the 2008 ASSA software developed by the Actuarial Society of South Africa..

The results of the analysis showed that, if the observed fertility patterns were to continue uninterrupted, then in absence of HIV/AIDS all counties would experience substantial fertility decline between 2009 and 2030 as indicated in Table 1

County	Base year TFR 2009	Projected TFR in 2030
Nairobi	2.9	2.28
Kirinyaga	3.3	2.47
Kiambu	3.4	2.52
Nyandarua	3.4	2.52
Mombasa	3.4	2.52
Embu	3.7	2.66
Nyeri	3.8	2.71
Tana River	4.7	3.14
Lamu	4.7	3.14
Taita Taveta	4.7	3.14
Nyamira	4.7	3.14
Kisii	4.8	3.19
Machakos	4.9	3.24
Kajiado	4.9	3.24
Nakuru	4.9	3.24
Muranga	5.0	3.29
Kisumu	5.0	3.29
Laikipia	5.0	3.29
Vihiga	5.1	3.34
Uasin Gishu	5.2	3.39
Kericho	5.4	3.48
Tharaka Nithi	5.7	3.63
Siaya	5.7	3.63
Kakamega	5.7	3.63
Makueni	5.8	3.67
Meru	5.8	3.67
Migori	5.9	3.72
Kilifi	6.0	3.77
Kwale	6.0	3.77
Isiolo	6.0	3.77
Nandi	6.0	3.77
Homabay	6.1	3.82
Trans Nzoia	6.1	3.82
Busia	6.1	3.82
Kitui	6.2	3.87
Turkana	6.3	3.91
Garisa	6.4	3.96
Bungoma	6.4	3.96
Marsabit	6.6	4.06
Bomet	6.6	4.06
Elgeyo Marakwet	6.7	4.11
Baringo	7.0	4.25
Wajir	7.1	4.3

Narok	7.2	4.35
Samburu	7.2	4.35
West Pokot	7.5	4.49
Mandera	7.6	4.54

The results show that TFR is projected to be lowest in counties which previous studies have showed to exhibit relatively high contraceptive prevalence and highest in the counties with relatively low contraceptive prevalence (KNBS, 2015) .

When HIV was incorporated in fertility projections, the results showed that the HIV/AIDS epidemic will lead to fertility reduction across all the counties as shown in Table 2.

The results demonstrated that counties with relatively high HIV prevalence and low uptake of contraception showed higher percent reduction in TFR than those with low HIV prevalence and high contraceptive prevalence. When HIV and AIDS programs were incorporated into fertility projections, the results indicated that these programs are indeed effective in reducing fertility. However, their effectiveness varied considerably by county. The results are presented in Table 3:

Table2. *Projected Fertility change due to HV and AIDS*

County	HIV PREVALENCE IN 2014	Base year TFR in 2009	Projected TFR in 2030 incorporating HIV	% reduction in TFR due to HIV
Nairobi	6.8	2.9	2.22	1.99
Kirinyaga	3.3	3.3	2.24	6.98
Kiambu	3.8	3.4	2.28	7.02
Nyandarua	3.8	3.4	2.23	8.49
Mombasa	7.4	3.4	2.16	10.54
Embu	3.7	3.7	2.35	8.46
Nyeri	4.3	3.8	2.30	10.82
Tana River	1.0	4.7	3.14	0.09
Lamu	2.3	4.7	3.01	2.86
Taita Taveta	6.1	4.7	2.90	5.20
Nyamira	6.4	4.7	2.91	4.99
Kisii	8.0	4.8	2.67	10.89
Machakos	5.0	4.9	3.09	3.08
Kajiado	4.4	4.9	2.97	5.53
Nakuru	5.3	4.9	3.21	0.63
Muranga	5.2	5.0	3.10	3.78
Kisumu	19.3	5.0	2.96	6.58
Laikipia	3.7	5.0	3.10	3.78
Vihiga	3.8	5.1	3.09	4.84
Uasin Gishu	4.3	5.2	3.17	4.14
Kericho	3.4	5.4	3.31	3.18
Tharaka Nithi	4.3	5.7	3.14	8.53
Siaya	23.7	5.7	2.97	11.51
Kakamega	5.9	5.7	3.28	6.07
Makueni	5.6	5.8	3.24	7.48
Meru	3.0	5.8	3.42	4.38
Migori	14.7	5.9	3.24	8.17
Kilifi	4.4	6.0	3.22	9.17
Kwale	5.7	6.0	3.40	6.17
Isiolo	4.2	6.0	3.30	7.84
Nandi	3.7	6.0	3.38	6.51
Homabay	25.7	6.1	3.12	11.45
Trans Nzoia	5.1	6.1	3.50	5.22
Busia	6.8	6.1	3.24	9.48
Kitui	4.3	6.2	3.32	8.82
Turkana	7.6	6.3	3.35	8.97
Garisa	2.1	6.4	3.51	7.08
Bungoma	3.2	6.4	3.34	9.73
Marsabit	1.2	6.6	3.86	3.02
Bomet	5.8	6.6	3.34	10.90

Elgeyo Marakwet	2.5	6.7	3.87	3.54
Baringo	3.0	7.0	3.68	8.17
Wajir	0.2	7.1	4.25	0.70
Narok	5.0	7.2	3.56	10.95
Samburu	5.0	7.2	3.64	9.84
West Pokot	2.8	7.5	3.82	8.97
Mandera	1.7	7.6	4.16	5.01

Table3. *Fertility change due to HIV and AIDS interventions.*

County	HIV PREVALENCE IN 2014	Base year TFR in 2009	Projected TFR in 2030 incorporating HIV and effect of Interventions	% reduction in TFR due to HIV interventions
Nairobi	6.8	2.9	2.17	1.72
Kirinyaga	3.3	3.3	2.18	1.82
Kiambu	3.8	3.4	2.23	1.47
Nyandarua	3.8	3.4	2.17	1.76
Mombasa	7.4	3.4	2.11	1.47
Embu	3.7	3.7	2.26	2.43
Nyeri	4.3	3.8	2.23	1.84
Tana River	1.0	4.7	2.80	7.23
Lamu	2.3	4.7	2.83	3.83
Taita Taveta	6.1	4.7	2.72	3.83
Nyamira	6.4	4.7	2.75	3.40
Kisii	8.0	4.8	2.55	2.50
Machakos	5.0	4.9	2.83	5.31
Kajiado	4.4	4.9	2.77	4.08
Nakuru	5.3	4.9	2.93	5.71
Muranga	5.2	5.0	2.84	5.20
Kisumu	19.3	5.0	2.83	2.60
Laikipia	3.7	5.0	2.89	4.20
Vihiga	3.8	5.1	2.87	4.31
Uasin Gishu	4.3	5.2	2.94	4.42
Kericho	3.4	5.4	3.06	4.63
Tharaka Nithi	4.3	5.7	2.91	4.04
Siaya	23.7	5.7	2.85	2.11
Kakamega	5.9	5.7	3.00	4.91
Makueni	5.6	5.8	2.97	4.66
Meru	3.0	5.8	3.09	5.69
Migori	14.7	5.9	3.08	2.71
Kilifi	4.4	6.0	2.95	4.50
Kwale	5.7	6.0	3.18	3.67
Isiolo	4.2	6.0	3.09	3.50
Nandi	3.7	6.0	3.13	4.17
Homabay	25.7	6.1	2.99	2.13
Trans Nzoia	5.1	6.1	3.23	4.43
Busia	6.8	6.1	3.04	3.28
Kitui	4.3	6.2	3.07	4.03
Turkana	7.6	6.3	3.12	3.65
Garisa	2.1	6.4	3.11	6.25
Bungoma	3.2	6.4	2.97	5.78
Marsabit	1.2	6.6	3.47	5.91
Bomet	5.8	6.6	3.11	3.48
Elgeyo Marakwet	2.5	6.7	3.51	5.37
Baringo	3.0	7.0	3.36	4.57
Wajir	0.2	7.1	3.40	11.97
Narok	5.0	7.2	3.30	3.61
Samburu	5.0	7.2	3.44	2.78
West Pokot	2.8	7.5	3.45	4.93

Mandera	1.7	7.6	3.49	8.82

The results revealed that the lowest projected percent decline in TFR will be evident in counties with relatively high uptake of HIV related programs. This scenario was expected since counties saturated with HIV related programs are unlikely to witness substantial change in the same before 2030. Counties currently experiencing relatively low uptake of HIV related interventions showed the highest projected decline in TFR by 2030. This could be explained by the fact that in the long run, these counties will strife to increase social marketing activities and strategies targeting behavior change so as to be at par with the other counties. Increase in uptake of interventions will in the long run inhibit fertility. For example, increase in condom use will prevent not only HIV transmission but also conception among fecund women.

Conclusions and Implications for Policy

Based on the results of the analysis, it is evident that HIV and AIDS interventions will continue to affect future fertility patterns in Kenya. If there were no HIV and AIDS, all counties in Kenya would record fertility decrease over the years. The rate of fertility decline would vary considerably by counties. TFR would continue to be lowest in counties with the highest contraceptive prevalence while counties with the lowest contraceptive prevalence would continue to record the highest TFR.

The study also established that HIV and AIDS will affect the future fertility patterns across all the counties. However, its effect on fertility will vary considerably by counties. Counties with relatively high HIV prevalence will record the highest percent reduction in TFR while counties with the lowest HIV prevalence will record the lowest percent increase in TFR.

The study further established that HIV and AIDS programs are indeed affecting fertility patterns across all the counties. However, the effectiveness of these HIV and AIDS programs vary across the counties. Counties with low uptake of HIV/AIDS control and prevention programs are projected to record relatively high reduction in TFR since it is expected that the respective county governments will scale up campaigns targeting the HIV scourge. On the other hand, counties with relatively high uptake of HIV prevention and control programs will record the lowest percent reduction in TFR since nothing much is expected to change in as far as uptake of HIV control and prevention strategies is concerned.

Based on the findings of this study, it is recommended that the National AIDS Control Council and NASCOP in conjunction with the ministry of health should accelerate their efforts in disseminating HIV related programs across all counties in a bid to speed up fertility transition in Kenya. This is because the study established that both HIV and AIDS interventions are affecting fertility patterns in Kenya.

References

[1] Clark, S.J., Eaton, J.W., Elmquist, M.M., Ottenweiller, N.R., & Snavely, J.K.(2008).Demographic consequences of HIV epidemics and effects of different male circumcision intervention designs: Suggestive findings from micro simulation. Seattle: Center for Statistics and the Social Sciences.

[2] Clayton, A., (2011). HIV and Antiretroviral Therapy May Affect fertility. The AIDS Beacon.

[3] De Cock, K.M., F. Zadi, G. Adjorlolo, et al. (1994). Retrospective study of maternal HIV-1 and HIV-2 infections and child survival in Abidjan. British Medical Journal 308, 6926: 441-443.

[4] Dorrington RE, Moutrie TA & Daniel T (2006). The Demographic impact of HIV/AIDS in Botswana, Gaborone, UNDP and NACA, Botswana.

[5] Dorrington R.E., Bradshaw D, Johnson L, & Budlender D (2006). The Demographic Impact of HIV/AIDS in South Africa, National Indicators for 2006. Cape Town: Centre for Actuarial Research, South African Medical Research Council.

[6] Dorrington, Rob. Johnson, Leigh & Budlender Debbie (2010).ASSA2008 AIDS and Demographic Model User Guide.

[7] Gregson, Simon. Nyamukapa, Constance., Lopman, Ben., Mushati Phyllis., Garnett, G.P. Chandiwana, Stephen K., & Anderson, Roy M.(2007). Critique of early models of the demographic impact of HIV/AIDS in Sub-Saharan Africa based on contemporary empirical data from Zimbabwe. Department of Infectious Disease Epidemiology, Imperial College London.

[8] Gresenguet, G., L. Belec, V.M. Herve, M. Massanga and P.M. Martin (1992). Anomalies quantitatives et qualitatves du sperme chez des individus Africains infectzs par le VIH. Bulletin de la sociZtZ de pathologie Exotique et de Ses Filiales 85, 3: 205-207.

[9] Government of Kenya. (2014). Kenya HIV Estimates. Ministry of Health. Nairobi
[10] Gregson, S. (1994). Will HIV become a major determinant of fertility in Sub- Saharan Africa? Journal of Development Studies 30, 3: 650-679.
[11] Gresenguet, G., Belec, L., &Herve, V.M. (1992). Anomalies quantitatives et qualitatives du. Sperme chez des individus Africains.
[12] John stone, f. 1994. HIV and fertility. British journal of family planning 20, 2:45- 46.
[13] Johnson F and Dorrington E (2006). "Modeling the Demographic impact of HIV/AIDS in South Africa and the likely impact of interventions." Demographic Research, Max Planck institute for Demographic research.
[14] KNBS (2015). Kenya Demographic and Health Survey 2014. Key Indicators.
[15] Lewis, J.J.C., Ronsmans, C., Ezeh, A., and Gregson, S. (2004). The population impact of HIV on fertility in sub-Saharan Africa. AIDS 18: S35–S43.
[16] Magadi, M. A & Agwanda, A.O. (2010). "Investigating the Association between HIV/AIDS and Recent Fertility Patterns in Kenya." Journal of Social Science and Medicine 71: 335-44.
[17] Mutuku, A., (2013). Fertility Transition and its Determinants in Kenya:2003-2008/2009.ICF International Calverton, Maryland, USA.
[18] NACC & NASCOP (2016). Kenya HIV County Profiles. Ministry of Health. Nairobi.
[19] NCPD (2012). Sessional Paper No.3 of 2012 on Population Policy for National Development. Ministry of State for Planning, National Development and Vision 2030. Government of Kenya.
[20] Setel Philip (1995). The effect of HIV/AIDS on fertility in East and central Kenya, Health Transition review.
[21] Sneeringer, Stacy E., and Trevon Logan (2009). A Closer Examination of the HIV/Fertility Linkage. DHS Working Papers No.63. Calverton, Maryland: ICF Macro.
[22] Strecker, W., L.Gurtler, M. Binibangili and K. Strecker (1993). Clinical Manifestations of HIV infection in Northern Zaire.AIDS 7, 4: 597-598.
[23] Temmerman, M., E.N. Chomba and P. Piot (1994). HIV-1 and reproductive health in Africa. International journal of Gynecology and Obstetrics 44, 2: 107-112
[24] Terceira, N., Gregson, S., ˙ Zaba, B., & Mason, P.R. (2003). The contribution of HIV to fertility decline in rural Zimbabwe, 1985-2000. Population Studies 57(2): 149–164.
[25] United Nations (2002). HIV/AIDS and Fertility in Sub-Saharan Africa: A review of the Research literature, population division, department of economic and social Affairs, United Nations Secretariat, New York.
[26] Vitaly, A. Kushnir, & William Lewis (2011). HIV/AIDS and infertility: Emerging Problems on the Era of Highly Active Antiretroviral. National Institute of Health.
[27] Zaba, B. & Gregson, S. (1998). Measuring the impact of HIV on fertility in Africa. AIDS12 (1): S41–S50.

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