Differences in the Nonuse of any Contraception and Use of Specific Contraceptive Methods in HIV Positive and HIV Negative Rwandan Women

Adebola A. Adedimeji,1, 2 Donald R. Hoover,3 Qiuhu Shi,4 Mardge H. Cohen,5 Tracy Gard,6, 7 and Kathryn Anastos2, 7

1 Centre for Public Health Sciences, Albert Einstein College of Medicine, Mazer 515, 1300 Morris Park Avenue, Bronx, NY 10461, USA
2 Department of Epidemiology and Population Health, Albert Einstein College of Medicine, Bronx, NY 10461, USA
3 Department of Statistics and Institute for Health, Health Care Policy and Aging Research, Rutgers University, New Brunswick, NJ 08901, USA
4 New York Medical College, Valhalla, NY 10595, USA
5 Department of Medicine, Stroger (Cook County) Hospital and Rush University, Chicago, IL 60612, USA
6 Department of Psychiatry and Behavioral Sciences, Albert Einstein College of Medicine, Bronx, NY 10461, USA
7 Department of Medicine, Montefiore Medical Centre, Bronx, NY 10467, USA

Correspondence should be addressed to Adebola A. Adedimeji, adebola.adedimeji@einstein.yu.edu

Received 21 March 2012; Accepted 25 October 2012

Copyright © 2012 Adebola A. Adedimeji et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Contraception can reduce the dual burden of high fertility and high HIV prevalence in sub-Saharan Africa, but significant barriers remain regarding access and use. We describe factors associated with nonuse of contraception and with use of specific contraceptive methods in HIV positive and HIV negative Rwandan women. Data from 395 HIV-positive and 76 HIV-negative women who desired no pregnancy in the previous 6 months were analyzed using univariate and multivariate logistic regression models to identify clinical and demographic characteristics that predict contraceptive use. Differences in contraceptive methods used were dependent on marital/partner status, partner’s knowledge of a woman’s HIV status, and age. Overall, condoms, abstinence, and hormonal methods were the most used, though differences existed by HIV status. Less than 10% of women both HIV+ and HIV− used no contraception. Important differences exist between HIV-positive and HIV-negative women with regard to contraceptive method use that should be addressed by interventions seeking to improve contraceptive prevalence.

1. Background

Sub-Saharan (SSA) Africa has the highest population growth rate and the greatest burden of HIV infection in the world. Barrier and hormonal contraceptive methods offer feasible means to address the dual burden of high fertility and high HIV prevalence in the region. While contraceptive use among SSA women has increased in the past decade, disparities remain between and within countries and use still remains below 20% in many countries [1]. Barriers to higher usage include poor access, cost, inadequate health infrastructure, and sociocultural values supporting high fertility [1–3].

Rwanda, the most densely populated country in Africa has an HIV prevalence rate of 2.9% [4], mostly among child-bearing age women [5]. Expanded access to free antiretroviral therapy contributed to significant gains in health and quality of life of people living with HIV/AIDS (PLHA). These gains in health, coupled with a low risk of mother-to-child transmission to less than 1% [6] and the high value on fertility have altered the context of fertility decision making...
for many PLHAs. This context is mediated by individual, interpersonal, medical, structural, and cultural factors [7–12] thus making fertility control a major policy and service delivery issue in the care of PLHA [13].

Rwandan women face significant obstacles to access and use of contraception. Ayad and Hong [14] reported that while contraceptive prevalence rate among Rwanda women increased substantially between 2005 and 2008 from 13% to 36%, the level of unmet need also increased within the same period. Other studies also reported low use and high levels of unmet need [3, 15–17] despite a prevalent desire to limit fertility [18–20].

Unintended pregnancy accounts for 15–58% of births in countries with high HIV burden [21] including Rwanda [22]. Unintended pregnancies, which may directly result from unmet needs underscore the importance of understanding contraceptive decision-making among HIV positive (HIV+) women who may be more interested in preventing pregnancy than in preserving their own health and eliminating the risk of transmitting the virus to their sex partners [15, 23–25]. Therefore access to and use of safe, effective contraception, as advocated in the Gion Call to Action [5] is critical for this population. Indeed, the effectiveness of voluntary contraception among HIV+ women has been well documented in literature [21, 26–28] with some estimates suggesting that current contraceptive use among HIV+ women may already be preventing as many as 220,000 HIV+ births annually in high prevalent countries.

There is a low but increasing rate of modern contraceptive use among Rwandan women, however little is known about the predictors of contraceptive practice. To aid policy and program planning in meeting the reproductive needs and rights of HIV+ Rwandan women [15], it is important to identify and understand factors that influence contraceptive choices and use and how this is similar to or different from those of HIV negative (HIV−) women. This paper explores and describes the factors associated with nonuse of any contraception and use of specific contraceptive methods between HIV+ and HIV− Rwandan women. We hypothesized that HIV status would significantly determine the type of contraceptive methods favored by Rwandan women, for instance that HIV+ women would prefer barrier methods such as condoms while HIV− women will prefer hormonal methods.

2. Methods

The Rwanda Women’s Interassociation Study and Assessment (RWISA) is a prospective observational cohort study of HIV infected and uninfected Rwandan women. Details of the study methods (including participants, recruitment methods, eligibility criteria, and informed consent process) have been previously described [29, 30]. In 2005, 710 HIV+ and 226 HIV− women enrolled in RWISA, recruited through grassroots women’s associations and HIV care sites in Kigali. Eligibility criteria included living in Rwanda and aged >15 years during the 1994 genocide, agreeing to be tested for HIV and willingness to travel to the study site to participate in follow-up visits. The Rwandan National Ethics Committee and the Montefiore Medical Center Institutional Review Board approved the study protocol and procedures.

By design, 50% of both HIV+ and HIV− participants reported rape during the 1994 genocide. During the enrollment visit, participants provided historical information, underwent physical and gynecological examination, and provided blood, urine and gynecological specimens. Interviews were conducted in Kinyarwanda by trained interviewers with nursing or trauma counseling backgrounds. The population for this consisted of 395 HIV+ and 76 HIV− women who reported at enrollment that they desired not to become pregnant.

2.1. Measures. Participants provided demographic, medical, psychosocial, and behavioral information regarding clinical status, disease progression, HIV-1 exposure risks, quality of life, symptoms of depression and posttraumatic stress disorder (PTSD), contraceptive practice, and trauma experience during the 1994 genocide.

The following variables were created for this analysis: HIV/CD4 Status (HIV−, HIV+ and CD4 < 200, HIV+ and CD4 200–350, and HIV+ and CD4 > 350); partner knowledge of HIV status (HIV+ participant whose partner knows her status, HIV+ participant whose partner does not know, HIV− participant whose partner knows, and HIV− participant whose partner does not know). Women were asked if they had used each of the following contraceptive methods at least once in the previous six months; oral contraceptives, implantable or depot/injected progesterone, intrauterine device, diaphragm or cervical cap, vaginal creams/jellies/foams, or the sponge, rhythm or withdrawal, emergency contraception, male or female condoms, and abstinence. The following methods were combined together to form “hormonal contraception”: oral contraceptives, implantable, or depot progesterone. Respondents were not required to report frequency of contraceptive usage.

2.2. Statistical Analysis. We compared HIV+ and HIV− women by categorized characteristics using exact tests for statistical significance. Univariate and multivariate logistic regression models were fit to determine associations with the probability of (i) not practicing at least one contraceptive method and (ii) practicing contraceptive methods in the following categories: abstinence, hormonal, and condoms. Multivariate models were fit using stepwise selection among all variables in Table 2 with a P value for entry of 0.05 and a P value for removal of >0.1.

3. Results

Table 1 shows demographic and clinical characteristics for 471 participants. Among HIV+ women, nearly one-third had a CD4 cell count of less than 200 cells/µL. Forty-seven percent of all respondents were married or currently living with a partner. The majority was of low socioeconomic status; 37% of HIV− women and 27% of HIV+ women were employed and on a monthly income of less than 10,000 Rwandan Franc (~US$17.40). Sixty percent of HIV− and
Table 1: Demographic and clinical characteristics of 471 women who reported wanting to prevent pregnancy.

| Characteristics                        | HIV-negative n = 76 | HIV-positive n = 395 | P value |
|----------------------------------------|---------------------|----------------------|---------|
| Age                                    |                     |                      |         |
| <30                                    | 17 (22.4%)          | 97 (24.6%)           | 0.001   |
| 30–40                                  | 34 (44.8%)          | 245 (62.0%)          |         |
| >40                                    | 25 (32.9%)          | 53 (13.4%)           |         |
| Married and living with partner        |                     |                      |         |
| Yes                                    | 39 (51.3%)          | 183 (46.3%)          | 0.425   |
| No                                     | 37 (38.7%)          | 212 (53.7%)          |         |
| Currently pregnant                     |                     |                      |         |
| Yes                                    | 1 (1.3%)            | 2 (0.5%)             | 0.419   |
| No                                     | 75 (98.7%)          | 391 (99.5%)          |         |
| Employment status                      |                     |                      |         |
| Yes                                    | 27 (37.0%)          | 103 (26.6%)          | 0.071   |
| No                                     | 46 (63.0%)          | 284 (73.4%)          |         |
| Monthly income                         |                     |                      |         |
| <10,000                                | 25 (34.2%)          | 121 (28.1%)          | 0.033   |
| 10–35,000                              | 28 (38.4%)          | 208 (52.8%)          |         |
| >35,000                                | 20 (27.4%)          | 65 (16.5%)           |         |
| Experienced genocidal rape             |                     |                      |         |
| Yes                                    | 46 (61.3%)          | 193 (49.3%)          | 0.055   |
| No                                     | 29 (38.7%)          | 199 (50.7%)          |         |
| Number of living children              |                     |                      |         |
| 0                                      | 13 (17.2%)          | 111 (28.1%)          | 0.001   |
| 1–2                                    | 16 (21.0%)          | 136 (34.4%)          |         |
| 3–4                                    | 31 (40.8%)          | 108 (27.4%)          |         |
| 5+                                     | 16 (21.0%)          | 40 (10.1%)           |         |
| HIV/CD4 Status                         |                     |                      |         |
| HIV−                                    | 76 (100.0%)         | 0                    |         |
| HIV+ CD4 < 200                         | 0                   | 106 (26.8%)          | 0.001   |
| HIV+ CD4 200–350                       | 0                   | 152 (38.5%)          |         |
| HIV+ CD4 > 350                         | 0                   | 137 (34.7%)          |         |
| Partner knowledge of HIV status        |                     |                      |         |
| HIV+ Partner knows                     | 0                   | 222 (58.4%)          |         |
| HIV+ Partner does not know             | 0                   | 158 (41.6%)          | 0.001   |
| HIV− Partner knows                     | 43 (60.6%)          | 0                    |         |
| HIV− Partner does not know             | 28 (39.4%)          | 0                    |         |
| Ever had sex for cash                  |                     |                      |         |
| Yes                                    | 14 (18.4%)          | 94 (23.9%)           | 0.302   |
| No                                     | 62 (81.6%)          | 300 (76.1%)          |         |

58% of HIV+ women reported that partners were aware of their HIV sero-status.

Table 2 presents univariate and multivariate analyses of demographic and clinical characteristics associated with the use of abstinence as a contraceptive method in the prior 6 months. Abstinence was a commonly used method, reported by about 40% of HIV+ and HIV− women. Use of abstinence was significantly associated with partner’s knowledge of respondent’s HIV status, being married or living with a partner, income and ever having had sex for cash. HIV+ women whose partners were not aware of their status were more likely (OR = 3.83) than HIV+ women whose partners were aware of their status to use abstinence as a method of contraception; women who were married or living with a partner were significantly less likely to report using abstinence (OR = 0.06) than those who were not married or living with a partner. Women who had ever exchanged sex for cash were also more likely than those who had not to report abstinence as a means of contraception (OR = 1.61).

In the final stepwise multivariate model, marital status, HIV status/partner’s knowledge of status, and ever exchanging sex for money were independently associated with abstinence. Women who were married or living with a partner were 20-fold less likely to report using abstinence: adjusted
### Table 2: Univariate and multivariate analysis of demographic and clinical characteristics associated with abstinence.

| Variable                        | Proportion practicing method n (%) | Univariate OR (95% CI) | Multivariate Adjusted OR (95% CI) |
|---------------------------------|-----------------------------------|------------------------|----------------------------------|
| HIV Status                      |                                   |                        |                                  |
| HIV−                            | 32 (42.1%)                        | (r)                   |                                  |
| HIV+                            | 152 (38.7%)                       | 0.87 (0.53–1.43)      |                                  |
| HIV/CD4 Status                  |                                   |                        |                                  |
| HIV−                            | 32 (42.1%)                        | (r)                   |                                  |
| HIV+ CD4 < 200                  | 31 (44.8%)                        | 0.57 (0.31–1.06)      |                                  |
| HIV+ CD4 on [200, 500]          | 60 (39.7%)                        | 0.91 (0.52–1.59)      |                                  |
| HIV+ CD4 ≥ 350                  | 61 (29.2%)                        | 1.12 (0.63–1.97)      |                                  |
| Number of living children       |                                   |                        |                                  |
| 0                               | 55 (44.7%)                        | (r)                   |                                  |
| 1-2                             | 63 (41.7%)                        | 0.89 (0.55–1.43)      |                                  |
| 3-4                             | 48 (34.5%)                        | 0.65 (0.40–1.07)      |                                  |
| 5+                              | 18 (32.1%)                        | 0.59 (0.30–1.14)      |                                  |
| HIV Status/Partner knowledge    |                                   |                        |                                  |
| HIV+ Partner knows              | 50 (22.6%)                        | (r)                   |                                  |
| HIV+ Partner does not know      | 92 (58.6%)                        | 3.83 (2.50–5.87)***   | 1.89 (1.13–3.16)*                |
| HIV− Partner knows              | 19 (44.2%)                        | 2.14 (1.10–4.17)*     | 2.83 (1.22–6.56)*                |
| HIV− Partner does not know      | 8 (28.6%)                         | 1.08 (0.45–2.58)      | 0.68 (0.25–1.87)                 |
| Age                             |                                   |                        |                                  |
| >30                             | 40 (35.1%)                        | 0.57 (0.32–1.02)      |                                  |
| 30–40                           | 106 (38.3%)                       | 0.65 (0.39–1.08)      |                                  |
| 40+                             | 38 (48.7%)                        | (r)                   |                                  |
| Married or living with partner  |                                   |                        |                                  |
| No                              | 162 (65.3%)                       | (r)                   |                                  |
| Yes                             | 22 (9.9%)                         | 0.06 (0.04–0.10)***   | 0.05 (0.03–0.09)                 |
| Genocidal rape                  |                                   |                        |                                  |
| No                              | 89 (39.2%)                        | (r)                   |                                  |
| Yes                             | 35 (39.9%)                        | 1.03 (0.71–1.49)      |                                  |
| Employed                        |                                   |                        |                                  |
| No                              | 128 (39.0%)                       | (r)                   |                                  |
| Yes                             | 60 (38.5%)                        | 0.98 (0.64–1.48)      |                                  |
| Income                          |                                   |                        |                                  |
| 0–10,000                        | 79 (54.5%)                        | (r)                   |                                  |
| 10,001–35,000                   | 85 (36.1%)                        | 0.46 (0.30–0.70)***   |                                  |
| 35,001+                         | 17 (20.0%)                        | 0.20 (0.11–0.38)***   |                                  |
| Ever had sex for cash           |                                   |                        |                                  |
| No                              | 120 (35.9%)                       | (r)                   |                                  |
| Yes                             | 63 (47.4%)                        | 1.61 (1.07–2.41)*     | 0.59 (0.35–0.98)*                |

*Models built by stepwise selection among all variables in this table with a P value for entry of 0.05 and a P value for removal of >0.1.

*P < 0.05, **P < 0.01, ***P < 0.001.

odds ratio (aOR = 0.05). Compared to HIV+ women whose partners knew their HIV status, HIV+ women whose partners did not know their status (aOR = 1.89) and HIV− women whose partners did know their status (aOR = 2.83) were more likely to use abstinence. Ever exchanging sex for money which was associated with less abstinence in unadjusted analysis was now significantly associated with more abstinence in the multivariate model. This change in direction of the association occurred because one variable in the model, married/living with a partner, was strongly negatively associated with both abstinence and having exchanged sex for money.

Overall, condom use (both male and female) was the most frequently reported method of contraception. While condom use differed by HIV status (58% of HIV+ versus 18% of HIV− OR = 6.06) due to differences in male condom usage, female condom use reported by only 8 women did not differ by HIV status, although with the small number of
Table 3: Univariate and multivariate analysis of demographic and clinical characteristics associated with condom use.

| Variable                                      | Condom Proportion practicing method n (%) | Univariate OR (95% CI) | Multivariate Adjusted OR (95% CI)* |
|-----------------------------------------------|------------------------------------------|------------------------|-----------------------------------|
| HIV Status                                    |                                          |                        |                                   |
| HIV−                                          | 14 (18.4%)                               | (r)                    |                                   |
| HIV+                                          | 227 (57.8%)                              | 6.06 (3.28–11.18)***   |                                   |
| HIV/CD4 Status                                |                                          |                        |                                   |
| HIV−                                          |                                          |                        |                                   |
| HIV+ CD4 < 200                                | 84 (46.1%)                               | (r)                    |                                   |
| HIV+ CD4 on [200, 500]                        | 93 (61.6%)                               | 1.87 (1.21–2.90)**     | 1.19 (0.67–2.14)                  |
| HIV+ CD4 ≥ 350                                | 64 (47.1%)                               | 1.04 (0.66–1.62)       | 0.62 (0.35–1.11)                  |
| Number of living children                     |                                          |                        |                                   |
| 0                                             | 78 (62.9%)                               | (r)                    |                                   |
| 1-2                                           | 74 (49.0%)                               | 0.57 (0.35–0.92)       |                                   |
| 3-4                                           | 62 (44.9%)                               | 0.48 (0.29–0.79)*      |                                   |
| 5+                                            | 27 (48.2%)                               | 0.55 (0.29–1.04)**     |                                   |
| HIV Status/Partner knowledge                  |                                          |                        |                                   |
| HIV+ Partner knows                            | 160 (72.4%)                              | (r)                    | (r)                               |
| HIV+ Partner does not know                    | 60 (38.2%)                               | 0.27 (0.18–0.41)*****  | 0.34 (0.21–0.55)*****             |
| HIV− Partner knows                            | 11 (25.6%)                               | 0.15 (0.07–0.31)*****  | 0.15 (0.06–0.35)*****             |
| HIV− Partner does not know                    | 2 (7.1%)                                 | 0.03 (0.01–0.14)*****  | 0.03 (0.01–0.13)*****             |
| Age                                           |                                          |                        |                                   |
| >30                                           | 67 (58.8%)                               | 3.63 (1.96–6.73)*****  | 3.59 (1.75–7.34)                  |
| 30–40                                         | 152 (54.9%)                              | 3.10 (1.79–5.35)*****  | 2.24 (1.20–4.20)                  |
| 40+                                           | 22 (28.2%)                               | (r)                    | (r)                               |
| Married or living with partner                |                                          |                        |                                   |
| No                                            | 101 (40.7%)                              | (r)                    | (r)                               |
| Yes                                           | 140 (63.3%)                              | 2.52 (1.73–3.65)       | 3.05 (1.86–5.00)*****             |
| Genocidal rape                                |                                          |                        |                                   |
| No                                            | 114 (50.0%)                              | (r)                    |                                   |
| Yes                                           | 125 (52.7%)                              | 1.12 (0.78–1.61)       |                                   |
| Employed                                      |                                          |                        |                                   |
| No                                            | 165 (50.1%)                              | (r)                    | (r)                               |
| Yes                                           | 74 (57.4%)                               | 1.34 (0.89–2.02)       | 1.86 (3.05)*                      |
| Income                                        |                                          |                        |                                   |
| 0–10,000                                      | 60 (41.4%)                               | (r)                    |                                   |
| 10,001–35,000                                 | 135 (57.4%)                              | 2.00 (1.32–3.04)**     |                                   |
| 35,001+                                       | 46 (54.1%)                               | 1.75 (1.02–3.00)*      |                                   |
| Ever had sex for cash                         |                                          |                        |                                   |
| No                                            | 160 (47.9%)                              | (r)                    | (r)                               |
| Yes                                           | 80 (60.1%)                               | 1.64 (1.09–2.47)       | 2.54 (1.51–4.26)                  |

*Models built by stepwise selection among all variables in this table with a P value for entry of 0.05 and a P value for removal of >0.1.  
*P < 0.05, **P < 0.01, ***P < 0.001.

users there was no power to detect any difference. Univariate analysis in Table 3 shows significant associations between condom use in the previous six months and HIV status, number of living children, partner’s knowledge of HIV status, age, and income. For example, HIV+ women were 3-fold more likely than HIV− women to report condom use; women with higher incomes were significantly more likely (OR = 2.00) to report condom use than were women with lower incomes. HIV+ women whose partners knew their sero-status were more likely to report condom use than HIV+ women whose partners did not know their status and HIV− women regardless of partners’ knowledge of their status. Women who had no children were more likely to report condom use than were those with at least one child (P < 0.001 for all previous associations).

Clinical and demographic characteristics that were significantly associated independently with condom use in adjusted models included marital status (aOR = 3.13 for
Table 4: Univariate and multivariate analysis of demographic and clinical characteristics associated with hormonal contraceptive use.

| Variable                                           | Proportion practicing method n (%) | Hormonal Proportion practicing method n (%) | Univariate OR (95% CI) | Multivariate adjusted OR (95% CI)* |
|----------------------------------------------------|------------------------------------|--------------------------------------------|------------------------|-----------------------------------|
| HIV Status                                         |                                    |                                            |                        |                                   |
| HIV−                                               | 16 (21.6%)                         |                                            | (r)                    | (r)                               |
| HIV+                                               | 40 (10.2%)                         |                                            | 0.41 (0.22–0.79)**     |                                   |
| HIV/CD4 Status                                     |                                    |                                            |                        |                                   |
| HIV−                                               | 16 (21.6%)                         |                                            | (r)                    | (r)                               |
| HIV+ CD4 < 200                                     | 15 (14.1%)                         |                                            | 0.60 (0.27–1.30)       |                                   |
| HIV+ CD4 on [200, 500]                             | 13 (8.7%)                          |                                            | 0.34 (0.16–0.76)**     |                                   |
| HIV+ CD4 ≥ 350                                     | 12 (8.9%)                          |                                            | 0.35 (0.16–0.80)*      |                                   |
| Number of living children                          |                                    |                                            |                        |                                   |
| 0                                                  | 10 (8.1%)                          |                                            | (r)                    | (r)                               |
| 1-2                                                | 19 (5.7%)                          |                                            | 1.63 (0.73–3.64)       |                                   |
| 3-4                                                | 7 (16.7%)                          |                                            | 1.97 (0.88–4.38)       |                                   |
| 5+                                                 | 7 (12.5%)                          |                                            | 1.61 (0.58–4.49)       |                                   |
| HIV Status/Partner knowledge                       |                                    |                                            |                        |                                   |
| HIV+ Partner knows                                 | 30 (13.6%)                         |                                            | (r)                    | (r)                               |
| HIV+ Partner does not know                         | 9 (5.8%)                           |                                            | 0.41 (0.19–0.89)*      | 0.60 (0.27–1.34)                  |
| HIV− Partner knows                                 | 7 (16.7%)                          |                                            | 1.35 (0.55–3.30)       | 1.40 (0.57–3.48)                  |
| HIV− Partner does not know                         | 9 (33.3%)                          |                                            | 3.37 (1.39–8.17)**     | 4.13 (1.65–10.37)**               |
| Age                                                |                                    |                                            |                        |                                   |
| >30                                                | 15 (13.2%)                         |                                            | 1.31 (0.53–3.25)       |                                   |
| 30–40                                              | 33 (12.0%)                         |                                            | 1.18 (0.52–2.67)       |                                   |
| 40+                                                | 8 (10.4%)                          |                                            | (r)                    | (r)                               |
| Married or living with partner                      |                                    |                                            |                        |                                   |
| No                                                 | 17 (6.9%)                          |                                            | (r)                    | (r)                               |
| Yes                                                | 39 (17.9%)                         |                                            | 2.95 (1.61–5.38)***    | 2.67 (1.40–5.08)**                |
| Genocidal rape                                      |                                    |                                            |                        |                                   |
| No                                                 | 27 (11.9%)                         |                                            | (r)                    | (r)                               |
| Yes                                                | 27 (11.5%)                         |                                            | 0.96 (0.54–1.69)       |                                   |
| Employed                                           |                                    |                                            |                        |                                   |
| No                                                 | 36 (11.0%)                         |                                            | (r)                    | (r)                               |
| Yes                                                | 19 (14.5%)                         |                                            | 1.40 (0.77–2.55)       |                                   |
| Income                                             |                                    |                                            |                        |                                   |
| 0–10,000                                           | 12 (8.3%)                          |                                            | (r)                    | (r)                               |
| 10,001–35,000                                      | 25 (10.8%)                         |                                            | 1.26 (0.62–2.56)       |                                   |
| 35,001+                                            | 18 (21.4%)                         |                                            | 2.85 (1.32–6.17)**     |                                   |
| Ever had sex for cash                              |                                    |                                            |                        |                                   |
| No                                                 | 41 (12.4%)                         |                                            | (r)                    | (r)                               |
| Yes                                                | 15 (11.4%)                         |                                            | 0.91 (0.48–1.70)       |                                   |

*Models built by stepwise selection among all variables in this table with a P value for entry of 0.05 and a P value for removal of >0.1.

*P < 0.05, **P < 0.01, ***P < 0.001.

those married or living with a partner compared to those not and age (aOR = 3.35 for those less than 30 and aOR = 2.15 for those between 30 and 40 years, resp., compared to women >40 years). Similarly, current employment (aOR = 1.88 compared to women not employed) and history of trading sex for cash (aOR = 2.53 compared to no history) were independently associated with increased likelihood of condom use. Compared to HIV+ women whose partners knew their status, all other groups were independently less likely to report condom use for contraceptive purposes: (aOR = 0.35 for HIV+ women whose partners did not know their HIV status; aOR = 0.16 for HIV− women whose partners knew their status and aOR = 0.03 for HIV− women whose partners did not know their status), respectively.

About 10% of HIV+ and 20% of HIV− women reported use of hormonal methods. In Table 4, univariate analysis shows that use of hormonal contraception was significantly associated with a woman’s HIV/CD4 status category, her HIV status/partner’s knowledge of that status, being married or living with a partner, and having an income of at least
Table 5: Univariate and multivariate analysis of demographic and clinical characteristics of nonuse of contraception.

| Variable                              | Proportion practicing method n (%) | Univariate OR (95% CI) | Multivariate adjusted OR (95% CI) |
|---------------------------------------|-----------------------------------|------------------------|----------------------------------|
| HIV Status                            |                                   |                        |                                  |
| HIV−                                  | 4 (5.6%)                          | (r)                    |                                  |
| HIV+                                  | 28 (7.2%)                         | 1.30 (0.44–3.81)       |                                  |
| HIV/CD4 Status                        |                                   |                        |                                  |
| HIV−                                  | 4 (5.6%)                          | (r)                    |                                  |
| HIV+ CD4 < 200                        | 9 (8.5%)                          | 1.55 (0.46–5.25)       | 2.06 (0.58–7.34)                 |
| HIV+ CD4 on [200, 500]                | 4 (2.7%)                          | 0.46 (0.11–1.89)       | 0.57 (0.13–2.40)                 |
| HIV+ CD4 ≥ 350                        | 15 (11.2%)                        | 2.11 (0.57–6.62)       | 3.13 (0.94–10.43)                |
| Number of living children             |                                   |                        |                                  |
| 0                                     | 6 (4.9%)                          | (r)                    |                                  |
| 1-2                                   | 9 (6.1%)                          | 1.26 (0.44–3.65)       |                                  |
| 3-4                                   | 12 (8.8%)                         | 1.87 (0.68–5.15)       |                                  |
| 5+                                    | 5 (8.9%)                          | 1.90 (0.55–6.50)       |                                  |
| HIV Status/Partner knowledge          |                                   |                        |                                  |
| HIV+ Partner knows                    | 15 (6.8%)                         | (r)                    |                                  |
| HIV+ Partner does not know            | 13 (8.4%)                         | 1.39 (0.64–3.01)       |                                  |
| HIV− Partner knows                    | 1 (2.3%)                          | 0.36 (0.05–2.79)       |                                  |
| HIV− Partner does not know            | 3 (13.0%)                         | 2.26 (0.60–8.47)       |                                  |
| Age                                   |                                   |                        |                                  |
| >30                                   | 5 (4.5%)                          | 0.35 (0.11–1.08)       | 0.27 (0.08–0.87)★                |
| 30–40                                 | 18 (6.6%)                         | 0.53 (0.23–1.22)       | 0.37 (0.15–0.92)★                |
| 40+                                   | 9 (11.8%)                         | (r)                    |                                  |
| Married or living with partner        |                                   |                        |                                  |
| No                                    | 14 (6.2%)                         | (r)                    |                                  |
| Yes                                   | 17 (7.3%)                         | 2.25 (1.06–4.78)★      | 2.55 (1.17–5.58)★                |
| Genocidal rape                        |                                   |                        |                                  |
| No                                    | 14 (6.2%)                         | (r)                    |                                  |
| Yes                                   | 17 (7.3%)                         | 1.18 (0.57–2.46)       |                                  |
| Employed                              |                                   |                        |                                  |
| No                                    | 23 (7.1%)                         | (r)                    |                                  |
| Yes                                   | 7 (5.5%)                          | 0.75 (0.31–1.80)       |                                  |
| Income                                |                                   |                        |                                  |
| 0–10,000                              | 11 (7.7%)                         | (r)                    |                                  |
| 10,001–35,000                         | 14 (6.0%)                         | 0.80 (0.35–1.81)       |                                  |
| 35,001+                               | 7 (8.4%)                          | 1.14 (0.42–3.06)       |                                  |
| Ever had sex for cash                 |                                   |                        |                                  |
| No                                    | 27 (8.3%)                         | (r)                    |                                  |
| Yes                                   | 5 (3.8%)                          | 0.44 (0.16–1.16)       |                                  |

aModels built by stepwise selection among all variables in this table with a P value for entry of 0.05 and a P value for removal of >0.1.

bEven though all 95% CIs contain 1, the overall P value for significance of HIV CD4 status considering all categories simultaneously is <0.1 by Wald test.

★P < 0.05, ★★P < 0.01, ★★★P < 0.001.

1Thus category excludes women who use surgical methods in addition to the other methods in the previous tables; condoms, hormones, and abstinence.

35,000 FRW. Women who were HIV+ and whose CD4 was greater than 200 cells/µL were less likely than HIV− women to report using hormonal contraceptive methods (OR = 0.34 and 0.35 for women with 200–350 and >350 cells/µL, resp.). In multivariate analysis, hormonal contraceptive use was independently more common in women who were married or living with a partner (aOR = 2.67) and in HIV− women whose partners knew their status (aOR = 4.13 compared to HIV+ women whose partners know their status, resp.). Table 5 shows few women (5.6% of HIV− and 7.2% of HIV+) reported using no contraceptive method during the previous 6 months. Being married or living with a partner was significantly associated with no contraceptive use in the past 6 months (OR = 2.25) compared to women not married...
or living with a partner. Age and marital status had significant independent associations with no contraceptive use in the multivariate analysis. Women reporting no contraceptive use were independently more likely to be married or living with a partner (aOR = 2.55) compared with those who were not. Women younger than 30 years were more likely to report no contraceptive use compared to women 30–40 (aOR = 0.27) and ≥40 (aOR = 0.37), respectively. It should be noted that 11 women (4 HIV+, 7 HIV−) had a surgical method (hysterectomy, tubal ligation, and ovary removal). While this usage was higher for HIV− women (P = 0.0003), the numbers were too small to allow further analysis.

A little over 10% of participants reported using multiple methods but these did not statistically differ by HIV status; 9.2% of HIV− compared with 14.7% of HIV+ women (P = 0.21 exact test). Condoms were almost always one of the multiple methods reported; 47 women reported using condoms and abstinence while 21 women reported using condoms and hormonal methods. This perhaps reflects that abstinence was used if condoms were not available and that condoms were most likely used as a backup to hormonal methods as well as to prevent STD transmission.

4. Discussion

In this study of Rwandan women desiring not to become pregnant we found that over 90% of both HIV infected and uninfected women described using some form of contraception, with condoms being the most prevalent method used. We also found that HIV status combined with partner knowledge of status was more strongly associated with the type of contraceptive method used than HIV status alone or CD4 count. Specifically, HIV+ women whose partners knew their status were two to ten times more likely to report condom use when compared to other groups. This suggests that disclosure of a positive HIV status to a partner may be an important contributor to pregnancy prevention through condom use in addition to partner protection from HIV. Marital status and age were also significantly associated with contraceptive method used.

We also found that older women were less likely to use condoms, suggesting perhaps a need to educate older women on condom use to prevent HIV transmission as well as pregnancy, in addition to or instead of using other methods. Apart from providing effective contraception, condoms also reduce the risk of HIV transmission and can be used concurrently with other contraceptive methods. The effectiveness of condoms, however, depends on correct and consistent use as well as acceptance by male partners. Previous studies have highlighted several socioeconomic, cultural and behavioral factors that inhibit condom use. For instance, in the case of male condoms, many men in SSA may interpret a request to use condoms as an insult, a sign of mistrust, and a hindrance to sexual fulfillment [31–35]. Additional determinants of condom use are female decision-making power [36, 37], socioeconomic factors, access to and availability of condoms [38, 39] technical issues with substandard condoms [40–43], and myths and misconceptions about condoms and fertility aspirations. It is important therefore that efforts to increase condom use address the barriers that have been highlighted in the literature.

Studies of HIV discordant couples have shown a marked increase in the proportion using condoms, following behavioral interventions, to prevent transmitting the virus between partners [3, 44–46], and not to prevent pregnancy. These studies also show that condom use was more consistent when the man was HIV− compared to when the woman was HIV−. In the current study, the strong association observed between condom use and HIV status, number of living children, partners’ knowledge of HIV status, and socioeconomic status also suggests that disease prevention not pregnancy prevention may be the primary reason for condom use. For example, condom use was significantly higher among HIV+ women whereas it was lower among women who already had one or more children. Women with a history of sex in exchange for cash were also more likely to use condoms, which may indicate a desire to prevent disease and perhaps pregnancy to limit the number of dependents. Furthermore, that income status was associated with condom use could point to issues of access and affordability among those with low or no income.

Hormonal contraceptive methods are among the most effective contraception available to women who desire to control when and how to have children. Despite their effectiveness, only 21% of HIV− women and 10% of HIV+ women reported using hormonal methods. Some studies [47] have suggested that among Rwandan women, low use of hormonal contraceptive methods may be due to lack of access and availability, low knowledge, and cost. In the case of HIV+ women, studies [48–52] suggest that the low use of hormonal methods may be due to misconceptions leading to inconsistent use, concerns regarding hormonal methods’ possible contribution to HIV transmission to sex partners or accelerated HIV disease progression and possible interaction with antiretroviral agents. The concerns on the interaction between hormonal methods with HIV acquisition and HIV-associated disease progression are areas of active research [53, 54]. Prior literature has been contradictory with some studies finding higher rates of HIV-acquisition [55, 56] and more rapid disease progression [57, 58] in users of hormonal contraception, and some finding no effect [59, 60]. However, since the efficacy of estrogen-containing contraception can be compromised by many of the antiretrovirals [59], it is understandable that HIV+ women are less likely to use hormonal methods.

Respondents were not asked about the frequency of contraceptive use, especially of self-reported condom use and abstinence, therefore this is one limitation of the study. It is also not possible to separate use of abstinence and condoms to prevent pregnancy from the use of these methods to prevent STD, although all of the study participants stated that they did not want to become pregnant. While generalizability of this population to other women is not certain, this group represents an important group of HIV infected and uninfected women.

Of note, about 10% of the HIV+ and HIV− women in this analysis did not use any method of contraception despite expressing a desire to not get pregnant. Younger age and
being married or living with a partner were predictors of nonuse of any contraceptive method in univariate and/or multivariate models. Although there is evidence, which suggests that an increasing number of Rwandan women now have access to and use modern contraceptive methods [1, 61], a considerable proportion of women may still experience barriers to access and use. Further studies should explore the characteristics and reasons why women in this population are not using contraception.

5. Conclusion

There is abundant literature [62–70] describing the pathways through which the HIV epidemic has contributed to population declines or indeed, a demographic transition in SSA, resulting in a fall in demand for children, significantly lowered fertility desires and increased contraceptive use. The Rwanda Demographic and Health Surveys [61] show that the proportion of women reporting contraceptive use rose from 17% in 2005 to 36% in 2008. About 90% of women in this study reported using contraception although the population is by no means representative since they were recruited from grass roots organizations and HIV clinics.

Condoms and abstinence were the most commonly used methods of contraception among the women in this study. Women who were married or living with their partners were far less likely to abstain and far more likely to use condoms. Older women were far less likely to use condoms. Women who were HIV+ and whose partners were aware of this were far more likely to use condoms. Despite their effectiveness, use of hormonal methods is still low, highlighting issues of availability, access or cost and possibly concerns about the side effects of hormonal methods, especially among HIV+ women. Moreover, the different contraceptive needs of HIV+ and HIV− women including preventing transmission of HIV and sexually transmitted diseases should be recognized when planning interventions to improve contraceptive use.

Acknowledgments

This study was supported by supplements from the National Institute of Allergy and Infectious Diseases to the Bronx/Manhattan Women’s Interagency HIV Study (WIHS), which is funded by the National Institute of Allergy and Infectious Diseases (U01-AI-35004). This work was also supported in part by the AIDS International Training and Research Program (Fogarty International Center, NIH D43-TW001403) and the Center for AIDS Research of the Albert Einstein College of Medicine and Montefiore Medical Center funded by the National Institutes of Health (NHAI-51519) and by the National Institute of Diabetes and Digestive and Kidney Disease (DK54615).

References

[1] World Health Organization, Guidelines on the use of Antiretroviral drugs for treating pregnant women and preventing HIV infection in infants, 2010, http://www.who.int/hiv/topics/mtc/en/index.html.

[2] K. R. Culwell, M. Vekemans, U. de Silva, M. Hurwitz, and B. B. Crane, “Critical gaps in universal access to reproductive health: contraception and prevention of unsafe abortion,” International Journal of Gynecology and Obstetrics, vol. 110, pp. S13–S16, 2010.

[3] K. Grabbe, R. Stephenson, B. Vwalika et al., “Knowledge, use, and concerns about contraceptive methods among serodiscordant couples in Rwanda and Zambia,” Journal of Women’s Health, vol. 18, no. 9, pp. 1449–1456, 2009.

[4] Central Intelligence Agency, World Fact Book, 2011, https://www.cia.gov/library/publications/the-world-factbook/geos/rw.html.

[5] United Nations, Glion Call to Action on Family Planning and HIV/AIDS in Women and Children, New York, NY, USA, 2004.

[6] C. Thorne, “Mother-to-child transmission of HIV infection in the era of highly active antiretroviral therapy,” Clinical Infectious Diseases, vol. 40, no. 3, pp. 458–465, 2005.

[7] D. Cooper, J. Moodley, V. Zweigenthal, L. G. Bekker, I. Shah, and L. Myer, “Fertility intentions and reproductive health care needs of people living with HIV in Cape Town, South Africa: implications for integrating reproductive health and HIV Care services,” AIDS and Behavior, vol. 13, no. 1, pp. S38–S46, 2009.

[8] D. Cooper, J. Harries, L. Myer, P. Orner, and H. Bracken, “‘Life is still going on’: reproductive intentions among HIV-positive women and men in South Africa,” Social Science and Medicine, vol. 65, no. 2, pp. 274–283, 2007.

[9] N. Rutenberg, A. E. Biddlecom, and F. A. D. Kaona, “Reproductive decision-making in the context of HIV and AIDS: a qualitative study in ndola, Zambia,” International Family Planning Perspectives, vol. 26, no. 2, pp. 124–130, 2000.

[10] N. L. Stanwood, S. E. Cohn, J. R. Heiser, and M. Pugliese, “Contraception and fertility plans in a cohort of HIV-positive women in care,” Contraception, vol. 75, no. 4, pp. 294–298, 2007.

[11] A. Da Silveira Rossi, G. A. Fonsechi-Carvasan, M. Y. Makuch, E. Amaral, and L. Bahamondes, “Factors associated with reproductive options in HIV-infected women,” Contraception, vol. 71, no. 1, pp. 45–50, 2005.

[12] B. Nattabi, J. Li, S. C. Thompson, C. G. Orach, and J. Earnest, “A systematic review of factors influencing fertility desires and intentions among people living with HIV/AIDS: implications for policy and service delivery,” AIDS and Behavior, vol. 13, no. 5, pp. 949–968, 2009.

[13] J. E. Mantell, J. A. Smit, and Z. A. Stein, “The right to choose parenthood among HIV-infected women and men,” Journal of Public Health Policy, vol. 30, no. 4, pp. 367–378, 2009.

[14] M. Ayad and R. Hong, “Levels and trends of contraceptive prevalence and estimate of unmet need for family planning in Rwanda: further analysis of the Rwandan demographic and health surveys, 2000-2007-2008,” DHS Further Analysis Reports 67, ICF Macro, Calverton, Md, USA, 2009.

[15] B. Pulvirenti, S. E. Cohn, A. Van de Ven, and J. Earnest, “Pregnancy desires, and contraceptive knowledge and use among prevention of mother-to-child transmission clients in Rwanda,” AIDS, vol. 23, supplement 1, pp. i9–i26, 2009.

[16] D. M. Ndahire, T. Albrecht, P. Hooimeijer, “Demand and unmet need for means of family limitation in Rwanda,” International Perspectives on Sexual and Reproductive Health, vol. 35, no. 3, pp. 122–130, 2009.

[17] N. Dhont, F. G. Ndayisaba, C. A. Peltier, A. Nzabonimpa, M. Temmerman, and J. van de Wijgert, “Improved access increases postpartum uptake of contraceptive implants among HIV− women in Rwanda: further analysis of the Rwandan demographic and health surveys, 2000-2007-2008,” AIDS, vol. 23, supplement 1, pp. S19–S26, 2009.
[18] F. Taulo, M. Berry, A. Tsui et al., “Fertility intentions of HIV-1 infected and uninfected women in Malawi: a longitudinal study,” *AIDS and Behavior*, vol. 13, supplement 1, pp. S20–S27, 2009.

[19] D. McCarraher, C. Cuthbertson, D. Kung’U, C. Otterness, L. Johnson, and G. Magiri, “Sexual behavior, fertility desires and unmet need for family planning among home-based care clients and caregivers in Kenya,” *AIDS Care*, vol. 20, no. 9, pp. 1057–1065, 2008.

[20] S. M. Mutisso, J. Kinuthia, and Z. Qureshi, “Contraceptive use among HIV infected women attending comprehensive care centre,” *East African Medical Journal*, vol. 85, no. 4, pp. 171–177, 2008.

[21] H. W. Reynolds, B. Janowitz, R. Homan, and L. Johnson, “The value of contraception to prevent perinatal HIV transmission,” *Sexually Transmitted Diseases*, vol. 33, no. 6, pp. 350–356, 2006.

[22] R. Wilcher, T. Petruney, H. W. Reynolds, and W. Cates, “From effectiveness to impact: contraception as an HIV prevention intervention,” *Sexually Transmitted Infections*, vol. 84, supplement 2, pp. ii54–ii60, 2008.

[23] K. B. Johnson, P. Akwara, S. O. Rutstein, and S. Bernstein, “Fertility preferences and the need for contraception among women living with HIV: the basis for a joint action agenda,” *AIDS*, vol. 23, supplement 1, pp. S7–S17, 2009.

[24] H. W. Reynolds, M. J. Steiner, and W. Cates, “Contraception’s proved potential to fight HIV,” *Sexually Transmitted Infections*, vol. 81, no. 2, pp. 184–185, 2005.

[25] L. V. D. Paal, L. A. Shafer, B. N. Mayanja, J. A. G. Whitworth, and H. Grosskurth, “Effect of pregnancy on HIV disease progression and survival among women in rural Uganda,” *Tropical Medicine and International Health*, vol. 12, no. 8, pp. 920–928, 2007.

[26] D. T. Halperin, J. Stover, and H. W. Reynolds, “Benefits and costs of expanding access to family planning programs to women living with HIV,” *AIDS*, vol. 23, supplement 1, pp. S123–S130, 2009.

[27] A. B. Spaulding, D. B. Brickley, C. Kennedy et al., “Linking family planning with HIV/AIDS interventions: a systematic review of the evidence,” *AIDS*, vol. 23, supplement 1, pp. S79–S88, 2009.

[28] H. W. Reynolds, B. Janowitz, R. Wilcher, and W. Cates, “Contraception to prevent HIV-positive births: current contribution and potential cost savings in PEPFAR countries,” *Sexually Transmitted Infections*, vol. 84, supplement 2, pp. ii49–ii53, 2008.

[29] M. H. Cohen, M. Fabri, X. Cai et al., “Prevalence and predictors of posttraumatic stress disorder and depression in HIV-infected and at-risk Rwandan women,” *Journal of Women’s Health*, vol. 18, no. 11, pp. 1783–1791, 2009.

[30] J. M. Lazar, X. Wu, Q. Shi et al., “Arterial wave reflection in HIV-infected and HIV-uninfected rwandan women,” *AIDS Research and Human Retroviruses*, vol. 25, no. 9, pp. 877–882, 2009.

[31] D. P. Baker, J. Leon, and J. M. Collins, “Facts, attitudes, and health reasoning about HIV and AIDS: explaining the education effect on condom use among adults in sub-sahara Africa,” *AIDS and Behavior*, vol. 15, no. 7, pp. 1319–1327, 2011.

[32] K. Michielsen, M. F. Chersich, S. Luchtens, P. De Koker, R. Van Rossem, and M. Temmerman, “Effectiveness of HIV prevention for youth in sub-Saharan Africa: systematic review and meta-analysis of randomized and nonrandomized trials,” *AIDS*, vol. 24, no. 8, pp. 1193–1202, 2010.

[33] K. Peltzer and S. Ramlagan, “Safer sexual behaviours after 1 year of antiretroviral treatment in KwaZulu-Natal, South Africa: a prospective cohort study,” *Sexual Health*, vol. 7, no. 2, pp. 135–141, 2010.

[34] N. Hearst and S. Chen, “Condom promotion for AIDS prevention in the developing World: is it working?” in *Studies in Family Planning*, vol. 35, no. 1, pp. 39–47, 2004.

[35] G. M. Wingood and R. J. DiClemente, “Gender-related correlates and predictors of consistent condom use among young adult African-American women: a prospective analysis,” *International Journal of STD and AIDS*, vol. 9, no. 3, pp. 139–145, 1998.

[36] L. M. Williamson, K. Buston, and H. Sweeting, “Young women and limits to the normalisation of condom use: a qualitative study,” *AIDS Care*, vol. 21, no. 5, pp. 561–566, 2009.

[37] A. A. Onayade, T. C. Abiona, C. Ugba, G. Alozie, and O. Adetuyi, “Determinants of consistent condom use among adolescents and young adults attending a tertiary educational institution in Ille-Ife, Nigeria,” *The Nigerian Postgraduate Medical Journal*, vol. 15, no. 3, pp. 185–191, 2008.

[38] K. Awusab–Asare and S. K. Annim, “Wealth status and risky sexual behaviour in Ghana and Kenya,” *Applied Health Economics and Health Policy*, vol. 6, no. 1, pp. 27–39, 2008.

[39] N. J. Heard, A. A. Adedimeji, T. Mitsunaga, and U. Larsen, “Barriers to condom use among Nigerian men: attitude, cost and physical access,” in *Population Association of America Annual Conference*, Philadelphia, Pa, USA, March 2005.

[40] R. A. Crosby, W. L. Yarber, C. A. Graham, and S. A. Sanders, “Does it fit okay? Problems with condom use as a function of self-reported poor fit,” *Sexually Transmitted Infections*, vol. 86, no. 1, pp. 36–38, 2010.

[41] R. A. Crosby, C. A. Graham, W. L. Yarber, and S. A. Sanders, “Problems with condoms may be reduced for men taking ample time to apply them,” *Sexual Health*, vol. 7, no. 1, pp. 66–70, 2010.

[42] S. C. Kalichman, L. C. Simbayi, D. Cain, and S. Jooste, “Condom failure among men receiving sexually transmissible infection clinic services, Cape Town, South Africa,” *Sexual Health*, vol. 6, no. 4, pp. 300–304, 2009.

[43] M. J. Sparrow and K. Lavill, “Breakage and slippage of condoms in family planning clients,” *Contraception*, vol. 50, no. 2, pp. 117–129, 1994.

[44] K. E. Mark, J. Meinzen-Derr, R. Stephenson et al., “Contraception among HIV discordant and discordant couples in Zambia: a randomized controlled trial,” *Journal of Women’s Health*, vol. 16, no. 8, pp. 1200–1210, 2007.

[45] S. H. Kapiga, E. F. Lyamuya, G. K. Lwihula, and D. J. Hunter, “The incidence of HIV infection among women using family planning methods in Dar es Salaam, Tanzania,” *AIDS*, vol. 12, no. 1, pp. 75–84, 1998.

[46] S. Allen, J. Tice, P. Van de Perre et al., “Effect of sero testing with counselling on condom use and serocconversion among HIV discordant couples in Africa,” *British Medical Journal*, vol. 304, no. 6842, pp. 1605–1609, 1992.

[47] S. Allen, A. Serufilira, V. Gruber et al., “Pregnancy and contraception use among urban Rwandan women after HIV testing and counseling,” *American Journal of Public Health*, vol. 83, no. 5, pp. 705–710, 1993.
11

[48] H. J. Ahrendt, D. Adolf, and K. J. Buhlbing, "Advantages and challenges of oestrogen-free hormonal contraception," Current Medical Research and Opinion, vol. 26, no. 8, pp. 1947–1955, 2010.

[49] R. D. Merkh, P. G. Whittaker, K. Baker, L. Hock-Long, and K. Armstrong, "Young unmarried men’s understanding of female hormonal contraception," Contraception, vol. 79, no. 3, pp. 228–235, 2009.

[50] H. Kibuuka, D. Guwatudde, R. Kimutai et al., "Contraceptive use in women enrolled into preventive HIV vaccine trials: experience from a phase II/II trial in East Africa," PLoS ONE, vol. 4, no. 4, Article ID e5164, 2009.

[51] P. M. Leclerc, N. Dubois-Colas, and M. Garenne, "Hormonal contraception and HIV prevalence in four African countries," Contraception, vol. 77, no. 5, pp. 371–376, 2008.

[52] E. J. Kongnyuy, V. Soskolne, and B. Adler, "Hormonal contraception, sexual behaviour and HIV prevalence among women in Cameroon," BMC Women’s Health, vol. 8, article 19, 2008.

[53] K. Nanda, E. Amaral, M. Hays, M. A. M. Viscola, N. Mehta, and L. Bahamondes, "Pharmacokinetic interactions between depot medroxyprogesterone acetate and combination antiretroviral therapy," Fertility and Sterility, vol. 90, no. 4, pp. 965–971, 2008.

[54] D. H. Watts, J. G. Park, S. E. Cohn et al., "Safety and tolerability of depot medroxyprogesterone acetate among HIV-infected women on antiretroviral therapy: ACTG A5093," Contraception, vol. 77, no. 2, pp. 84–90, 2008.

[55] C. S. Morrison, B. A. Richardson, F. Mmiro et al., "Hormonal contraception and the risk of HIV acquisition," AIDS, vol. 21, no. 1, pp. 85–95, 2007.

[56] J. M. Baeten, L. Lavreys, M. Sagar et al., "Effect of contraceptive methods on natural history of HIV: studies from the Mombasa cohort," Journal of Acquired Immune Deficiency Syndromes, vol. 38, supplement 1, pp. S18–S21, 2005.

[57] L. Lavreys, J. M. Baeten, V. Chohan et al., "Higher set point plasma viral load and more-severe acute HIV type 1 (HIV-1) illness predict mortality among high-risk HIV-1-infected African women," Clinical Infectious Diseases, vol. 42, no. 9, pp. 1333–1339, 2006.

[58] E. M. Stringer, C. Kaseba, J. Levy et al., "A randomized trial of the intrauterine contraceptive device vs hormonal contraception in women who are infected with the human immunodeficiency virus," American Journal of Obstetrics and Gynecology, vol. 197, no. 2, pp. 144.e1–144.e8, 2007.

[59] H. E. Cejtin, L. Jacobson, G. Springer et al., "Effect of hormonal contraceptive use on plasma HIV-1-RNA levels among HIV-infected women," AIDS, vol. 17, no. 11, pp. 1702–1704, 2003.

[60] B. A. Richardson, P. A. Otieno, D. Mbori-Ngacha, J. Overbaugh, C. Farquhar, and G. C. John-Stewart, "Hormonal contraception and HIV-1 disease progression among postpartum Kenyan women," AIDS, vol. 21, no. 6, pp. 749–753, 2007.

[61] Ministry of Health, National Institute of Statistics of Rwanda, and ICF Macro, Rwanda Interim Demographic and Health Survey 2007-08, MOH, NISR and ICF Macro, Calverton, Md, USA, 2009.

[62] M. A. Magadi and A. O. Agwanda, "Investigating the association between HIV/AIDS and recent fertility patterns in Kenya," Social Science and Medicine, vol. 71, no. 2, pp. 335–344, 2010.

[63] S. Sneeringer and T. Logan, "A closer examination of the HIV/Fertility linkage," DHS Working Papers 63, ICF Macro, 2009.

[64] M. L. Garenne, S. M. Tollman, M. A. Collinson, and K. Kahn, "Fertility trends and net reproduction in Agincourt, rural South Africa, 1992–2004," Scandinavian Journal of Public Health, vol. 35, no. 69, pp. 68–76, 2007.

[65] A. Young, "In sorrow to bring forth children: fertility amidst the plague of HIV," Journal of Economic Growth, vol. 12, no. 4, pp. 283–327, 2007.

[66] S. Gregson, T. Zhuwau, R. M. Anderson, and S. K. Chandiwana, “HIV and fertility change in rural Zimbabwe,” Health Transition Review, vol. 7, supplement 2, pp. 89–112, 2007.

[67] C. S. Camlin, M. Garenne, and T. A. Moultrie, “Fertility trend and pattern in a rural area of South Africa in the context of HIV/AIDS,” African Journal of Reproductive Health, vol. 8, no. 2, pp. 38–54, 2004.

[68] C. M. Noel-Miller, “Concern regarding the HIV/AIDS epidemic and individual childbearing: evidence from rural Malawi,” Demographic Research 2003 Special Collection 1, Article 10, http://www.demographic-research.org/special/1/10/S1-10.pdf.

[69] J. P. M. Ntozi, “Impact of HIV/AIDS on fertility in sub-sahara Africa,” African Population Studies, vol. 17, no. 1, pp. 103–124, 2002.

[70] S. Gregson, B. Zaba, and S. Catherine-Hunter, “The impact of HIV-1 on fertility in sub-sahara Africa: causes and consequences,” 2002, http://www.un.org/esa/population/publications/completingfertility/RevisedZabapaper.PDF.