HIV and Injectable Hormonal Contraceptives in Sub-Saharan Africa

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Introduction

Studies highlight a possible association between HIV-1 transmission and acquisition and use of injectable hormonal contraceptives (Hel, Mestecky et al. 2010; Polis, Wawer et al. 2010; Belluck 2011; Morrison and Nanda 2011). The most common such contraceptive is depot medroxyprogesterone acetate (DMPA) - a non-permanent progestin-based contraceptive taken by injection every three months. Empirical studies have found contradictory results on the role of DMPA contraceptives on HIV acquisition, transmission and progression. In this study, we have two objectives. First, we seek to describe the ecological relationship between use of progestin-based injectable hormonal contraceptives and HIV in Africa using cross-sectional data collected since 2003. We also use regression models to show how different model specifications determine direction of the observed correlation between prevalence of HIV and injectables. This study, being a cross-sectional study, is not able to show causality. However, the study uses data from huge surveys across a large number of countries, in which data on sexual and contraceptive use histories are collected in a standardized manner.

Data and Methods

In this paper we test the hypothesis that women who use injectable hormonal contraceptives have higher prevalence of HIV than women who do not use injectable contraceptives. We test the hypothesis in a two-tier process. First, we construct thematic maps using ArcGIS ArcMap, which show the respective distributions of HIV prevalence and use of injectables by country in African countries for which data are available. We use HIV prevalence statistics from the UNAIDS website, and contraceptive use statistics from DHS and other surveys (the Multiple Indicator Cluster surveys (MICS) and other national level surveys). The thematic maps do not take into account confounders of the relationship between HIV prevalence and prevalence of use of injectable hormonal contraceptives. As such, we fit regression models which control for confounders, using DHS data from 18 African countries1 which conducted at least one DHS survey with HIV testing since 2002.

We use two-level random-intercept logit models to investigate the relationship between HIV status and use of injectables in these data. The first level represents individual women, and the second level the clusters from which the women were sampled. A technical consideration is determining the group of women to use as a comparison for women using injectables. As such, we fit a variety of model specifications in these analyses using different control groups. First, we fit a model in which we predict the HIV status of women using any form of hormonal contraceptives (injectables, pills, and the IUD) compared with non-users of hormonal contraceptives. Next, we fit a regression in which we predict the HIV status for women who have ever used injectables in reference to non-users of injectables. In the third model, we will run the same regression as the second, but comparing women who have ever used injectables, and regressing on the same control variables. A detailed presentation of the model estimation is not provided here, but is available from the authors on request.

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1 Burkina Faso (BF), Cameroon (CM), Democratic Republic of the Congo (DRC), Ethiopia (ET), Kenya (KE), Lesotho (LS), Liberia (LB), Ghana (GH), Guinea (GN), Malawi (MW), Mali (ML), Niger (NI), Rwanda (RW), Senegal (SN), Sierra Leone (SL), Swaziland (SZ), Zambia (ZM), Zimbabwe (ZW)
injectables with non-users of all contraception. These two different reference groups investigate the gross effect of ever using hormones against the net effect over that of women who have ever used other forms of contraception, because the other methods might have unobserved effects on HIV-1 infection (Kapiga, Shao et al. 1994). To disentangle the effects of ever having used of multiple types of contraception on HIV risk, in the fourth model we predict HIV status for ever users vs. non-users of injectables, but restricting the sample to women using only one method of birth control. This way we hope to capture the effect of use of the particular contraceptive method, not the effect when ever use of injectables is confounded by ever use of other contraceptives. In the final regression, we will predict HIV status for women who have ever used both injectables and condoms in reference to women who have only ever used condoms. By controlling for condom use, we will make a comparison of women with the same levels of risk during sexual encounters (we am using condom use as a proxy for the risk factors which are not captured by the other controls).

Preliminary Results

Figure 1 shows that the countries in Southern and East Africa with high rates of injectable contraceptive use also have high HIV prevalence - all except Botswana and Madagascar. In this respect, we see that there is a positive association between HIV prevalence and prevalence of use of injectables. The relationship, however, is not a dose response relationship. For instance, Namibia has higher contraceptive use prevalence than Swaziland, but Swaziland has a higher HIV prevalence rate than Namibia. Outside of the Southern and East African region, we observe Egypt to have a very low prevalence of HIV. Although Ghana has higher contraceptive use compared to its neighbors, it does not have higher HIV prevalence than neighbouring countries.

In all but one model, women who have ever used injectables have statistically higher odds of being HIV positive than non-users (of both injectables and contraception in general). When we compare women using only injectables with non-users of injectables among women using only one form of birth control, there is no statistically significant difference in women’s odds of becoming HIV positive. This might suggest that using other contraceptive methods might be increasing women’s chances of being HIV positive. In particular, users of only condoms have higher odds of an HIV positive status than non-users of condoms. Comparing women using DMPA contraceptives with women not using any form of contraception attenuates the relationship between DMPA use and HIV-status compared to using non-users of DMPA as the control group. The odds of being HIV positive are lower among users of both the pill and injectables (OR = 0.77). Women using condoms and injectables have 68% higher odds of being HIV positive compared to women using only condoms. What this means is that the observed differences in the odds of being HIV positive between users and non-users of injectables might not entirely be related to higher levels of high-risk behavior among users of injectables. Even after we remove these differences, the effect of injectables on HIV-1 infection still remains.

A positive correlation exists between ever use of injectables and being HIV positive. This relationship seems to persist even when we control for high-risk behavior. The relationship between HIV and use of injectables might be positively mediated by use of other contraceptive methods - when the sample is restricted to women who have only ever used one method, there appears to be no difference in the odds of being HIV positive for users of DMPA and non-users.
References


Figure 1: Prevalence of injectables and HIV, respectively, in Africa


HIV – UNAIDS (http://www.unaids.org/en/regionscountries/countries/). The HIV statistics used here are obtained from the latest UNAIDS statistics. The results are the same (relationally) if I use HIV prevalence in the year corresponding to the contraceptive prevalence survey year. The size of the dots used is proportional to the size of the epidemic.

Countries in white did not have sufficient or any data.