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ABSTRACT

Aims and Objectives: To investigate the relationship between fertility decisions, to have already had a child or to desire to have one in the future, and the prognostic factors of; access to antiretrovirals, the time since these became widely available (year of the study) and relationship status.

Background: There have been significant advances in the treatment of Human Immunodeficiency Virus (HIV) with the advent of antiretroviral therapy which has been used to successfully reduce the rate of mother to child transmission; leading researchers to hypothesise that HIV positive women may desire to have children more so now than in the past. However, this topic is often not discussed in healthcare consultations.

Methods: A systematic search was conducted on CINAHL and Medline, using the key terms 'fertility decisions' and 'HIV positive'. A meta-analysis of proportions and a meta-regression were conducted using a random effects model and a logit transformation to normalise the data. Heterogeneity was assessed using Q , I^2 and R^2 values and p-values were produced for each regressed variable.

Findings: There was no statistically significant relationship between a desire to have children in the future and any of the prognostic variables. Although, there were statistically significant relationships between already having had at least one child; being on antiretroviral therapy; wanting a child in the future; and being in a cohabiting partnership or marriage.

Conclusion: There are no reliable prognostic variables which can be used to predict fertility intentions in HIV positive women. There are, however, a significant proportion of women who wish to have children or who have already had children and are in need of reproductive counselling from their healthcare providers.

Relevance to Clinical Practice: A greater knowledge of factors which may influence reproductive decisions amongst HIV positive position will allow healthcare professionals to individualise the care they provide.

WHAT DOES THIS PAPER CONTRIBUTE TO THE WIDER GLOBAL CLINICAL COMMUNITY?

- Approximately half of HIV positive women in high income countries desire to have children
- It is not possible to predict from access to HAART, cohabiting partnership status, or the year of the study whether or not woman will want children in the future
- Healthcare professionals often don't discuss fertility issues, however, consideration of this should become routine in the care of women with HIV

KEYWORDS

Childbearing, Fertility, HIV, Pregnancy

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Introduction & Background

Following isolated case reports of the rare conditions *Pneumocystis carinii* (now known as *Pneumocystis jirovecii*) pneumonia and Kaposi sarcoma in otherwise healthy young men in 1981, a new syndrome 'Acquired Immunodeficiency Syndrome' (AIDS) was recognised (Fauci, 2008). However, the causative agent remained unknown until 1983 when the Human Immunodeficiency Virus (HIV) was officially identified (Stine, 2007). Since then, HIV has evolved from a death sentence to a manageable life-long condition, in large part thanks to the advent of combination therapy (also known as Highly Active Antiretroviral Therapy or HAART) (Adler et al, 2012).

Originally conceptualised as a disease singularly affecting men who engage in sex with men (Altman, 1998), it is estimated that women now constitute 51% of global infections (UN Women, 2016). Furthermore, according to the World Health Organisation (WHO, 2016) more than half of these cases are accounted for in women of childbearing age meaning that a significant method by which HIV can be spread is through the vertical transmission from mother to child (WHO, 2016). Therefore, in conjunction with the Joint United Nations Programme on HIV/AIDS (UNAIDS, 2015), a Global Plan was launched in 2011 to eliminate new infections among children by 2015. Whilst the outcomes of this plan have not been as far reaching as was originally hoped, substantial progress has been made, for example the WHO validated Cuba as the first nation in the history of the virus to eliminate MTCT (WHO, 2015) and in the UK it is reported that rates of transmission are less than 1% thanks to successful antenatal screening programmes, timely commencement on HAART, education to avoid breastfeeding and planned Caesarean delivery when necessary (Terrence Higgins Trust, 2015).

Although successful initiation of HAART has removed the immediate fear of death for most people with HIV, a significant issue in the persistence of MTCT is the stigma

associated with HIV, whereby an individual is blamed or shamed for an illness which is perceived as largely preventable (Deacon, 2006). As such, HIV positive women can be said to suffer stigmatisation because HIV maintains strong links to sexuality (Anderson et al, 2008) and therefore is often associated with promiscuous or 'loose moral' behaviour (Turan & Nyblade, 2013). Infected women have also been described as suffering from multiple levels of stigmatisation based not only on their diagnosis but also as a result of sexism which is thought to significantly increase their vulnerability as these factors can limit access to healthcare in some countries (Logie, 2011). HIV positive women who choose to start a family have been perceived as irresponsible parents due to the risk of vertical transmission (Levine & Dubler, 1990). These attitudes are not restricted to the general population; there is evidence to suggest that healthcare professionals across the world, including in high income countries, are also prejudiced to HIV positive women due to their perceived immoral life choices (Nyblade et al, 2009).

Given the positive impact that HAART has had on the prognosis of HIV and the success in preventing MTCT (Terrence Higgins Trust, 2015), it is thought that many women may be reconsidering their options regarding relationships and fertility (Loutfy et al, 2009). However, the stigma surrounding HIV positive women conceiving can be shown to have endured, as a meta-synthesis of the literature by Sandelowski et al (2004) found 20% of women continued to experience "pressure not to reproduce".

Even prior to the introduction of HAART in 1996, Zidovudine was licensed for use with both mothers and their infants in 1994, which effectively reduced the risk of vertical transmission from 25% to 8% (Tuuli et al, 2011). Since then, HAART and education programmes to avoid breastfeeding as well as planned caesarean section deliveries are thought to have reduced this risk even further to be less than 1% in the UK (Maartens et al, 2014). This is because HIV is transmitted via the exposure of mucous membranes to infected

bodily fluids, notably blood and cervical secretions, and can occur at any point between a mother and child during pregnancy, labour, childbirth and breastfeeding, with the highest risk being during delivery (Adler et al, 2012). Therefore, as the viral load in the mothers' plasma decreases, so does her infectiousness and in turn the risk of infection for the infant (Padian et al, 2011).

Before the introduction of routine antenatal testing for HIV in the UK, it was estimated that in 1999 380 infants were born to HIV-infected mothers of whom 70% were unaware of their status (Zulueta & Boulton, 2007). This public health initiative to identify HIV in early pregnancy is generally understood to have been a treatment as prevention policy success because it has led to an increase in diagnoses as well as treatment (Zulueta & Boulton, 2007) which is significant as the majority of HIV diagnoses in the developed world, as defined by the World Bank (2016), are made late in disease progression (Kozak et al, 2013).

In order to provide effective reproductive counselling to HIV positive women, it is important to have an understanding of what proportion of this population may desire to have children and what factors may affect their decision to do so. A greater knowledge of the factors which influence these reproductive decisions will allow healthcare professionals to cater the care they deliver to individuals dependent on their circumstances. Also, this will allow for the more appropriate allocation of resources at an institutional level, for example when planning public health policies. This is significant because annually women are thought to comprise 22% of new infections in Europe and North America and 56% of new infections in the global epicentre of the disease, Sub-Saharan Africa (UN Women, 2016).

Objectives:

Therefore, this literature review aims to inform this by examining studies that have looked at women's wishes and decision making around fertility, in particular: the proportion of women who want children; the proportion of women who have had children in relation to their access to HAART; and any association between these and the year in which the study was conducted and relationship status. This has been done in order to investigate the potential effect over the years since HAART was first licensed for use, to the present day when increasingly high quality drugs with fewer side effects are available to a greater number of individuals (Fauci, 2008). Furthermore, relationship status was included in the analysis because previous literature reviews have suggested that spousal attitude to children has a significant influence on HIV positive women's desire to have children, or decision to have had children with that partner in the past (Nattabi et al, 2009). As access to healthcare is more equitable and often more affordable for women in high income countries (Garimoi Orach, 2009) this review will focus on research conducted in North America and Europe only.

Methodology

Eligibility Criteria:

Study design:

Primary quantitative research was selected, including surveys, cross-sectional surveys and one mixed methods design. Qualitative papers were excluded.

Participants and setting:

The aims and objectives of the review pertained to adult female human subjects exclusively and only research conducted in high income countries was considered, which in

this case equated to studies from North America and Europe. The definition of high income countries was sourced from the World Bank (2016) as areas with a gross national income per capita of \$12, 736 or more.

Year and Language:

The articles accessed were published after 1996, and written in English, because this was the year when HAART became widely available in developed countries, and there were not the resources available to translate articles written in another language.

Information Sources:

A systematic search was conducted on two electronic databases, Medline and the Cumulative Index of Nursing and Allied Health Literature (CINAHL) between 1996 and 2015. So as to maintain the relevance of the articles retrieved to the research question, the searches on both databases were limited using the same inclusion and exclusion criteria.

Search Strategy:

Two key terms were identified, 'reproductive choices' and 'HIV positive'. See Table S1 in the supplementary data for full search details. Both the subheading and free text keywords were used in CINAHL, whereas in Medline only the equivalent MeSH Terms were used. Truncation was used to increase the number of articles retrieved from one key term by adding an asterisk to replace the suffix of the word (Glasper & Rees, 2013). The Boolean operator 'OR' was used to combine the results for each variation of the key term to amplify the number of results by including those results which were tagged with multiple keywords. Then the Boolean operation 'AND' was used to combine the two keyword searches to limit and refine the results.

Study Selection:

Duplicates were excluded as well as those from which sufficient data could not be extracted and those that were conducted in low income countries or investigated both men and women. A summary of the final 12 studies analysed can be seen in Table 1.

Risk of Bias:

A Risk of Bias appraisal was completed on all twelve of the studies analysed, the results of which can be seen in Table S2 (see supplementary data), using an adapted version of the Cochrane Risk Of Bias Assessment Tool: for Non-Randomized Studies of Interventions (ACROBAT-NRSI) (Higgins & Green, 2011). The ‘risk of bias in measurements of interventions’ was replaced with the ‘risk of bias in measurements of observations’ and the domain of ‘bias due to departure from intended interventions’ was discounted entirely as there is no equivalent alternative which would be applicable for descriptive studies.

Data Extraction:

Data were extracted regarding; the geographic location of the research, year of publication, the total number of participants, the number of participants who desired to have children, the number who already had children, the number of participants on HAART and the number of participants married to or cohabiting with a partner. Women were included as wanting children both if they were actively trying to become pregnant at the time of the study and if they expressed a desire to become pregnant at some point in the future. Furthermore, fertility was identified as women having given birth to one or more living children at any point in the past and as such women who were pregnant at the time of the study, had suffered a miscarriage or chosen to have an abortion were not counted in this category. Papers were checked for meeting the inclusion criteria and data were independently extracted by both authors and differences checked together against the papers.

Analysis:

Data were analysed using the metaprop and metareg functions in the R package meta (R Core Team 2016, Schwarzer, 2015) and rma.uni in the metafor package (Viechtbauer, 2015). In addition to calculation of the pooled proportions, the individual proportions of women who had already had children in the past and then women who wanted children in the future were regressed against the chosen explanatory variables.

Results

The total number of studies retrieved was 2, 096, of which 12 met the criteria for inclusion. Full details of the selection process are shown in the PRIMSA Flow Diagram in Figure S1 of the supplementary data.

The total proportion of women who already had at least one child was 74% (95% CI 64 to 83%, $df = 11$, $p = <0.0001$). However, there was also a significant heterogeneity in this analysis with an I^2 of 97%, which was also statistically significant ($Q = 421.64$, $p < 0.0001$) suggesting variation between the studies. The forest plot for this is shown in Figure 1. The meta-regression of proportion of women who already had at least one child against the proportion on HAART produced a statistically significant relationship of -1.4474 (95% CI -2.7067 to -0.1881, $p = 0.0243$). The proportion of women on HAART explained the majority of this heterogeneity (between studies variance) with an R^2 of 83%; however the I^2 remained high at 83%.

The meta-regression of proportion of women with a child against the proportion of women who wanted a child in the future, suggesting that they were willing to repeat the birthing experience, also produced a significant relationship of -2.1162 (95% CI -3.2616 to -0.9707, $p = 0.0003$). This also explained some of the heterogeneity ($R^2 = 83$, $I^2 = 83\%$). The meta-regression of the proportion with a child against the proportion of women cohabiting

likewise produced a significant relationship of 2.6915 (95% CI 1.0220 to 4.3610, $p = 0.0016$). However, the meta-regression of the proportion of women with a child against the year of the study produced a non-significant result, with a relationship of -0.0340 (95% CI -0.1024 to 0.0344, $p = 0.3299$).

There is therefore some evidence that the factors of HAART, a desire to have more children and cohabiting with a partner do have a relationship with HIV positive women's decision to have had children in the past; the former two variables being correlated negatively and the latter being correlated positively. However, no relationship was found between the year of the study and women having made the decision to have children.

The total proportion of women who reported a desire to have a child at some point in the future was 42% (95% CI 31 to 53%, $df = 11$, $p < 0.0001$). However, there was a significant amount of heterogeneity, with an I^2 of 97%, which was also statistically significant ($Q = 383.4$, $p < 0.0001$). The forest plot for this is shown in Figure 2. The meta-regression of proportion of women wanting a child against the proportion on HAART produced a non-significant relationship of -1.1827 (95% CI -4.7788 to 2.4135, $p = 0.5192$), therefore the proportion of women on HAART explained none of the heterogeneity with an R^2 of 0.00% and a residual I^2 of 98%. The meta-regression of the proportion wanting a child against the proportion of women who already had at least one child also produced a non-significant relationship of 0.0005 (95% CI 0.0047 to 0.0056, $p = 0.8616$) and also did not explain any of the heterogeneity ($R^2 = 0.00\%$, $I^2 = 98\%$). The meta-regression of proportions wanting a child against the proportion of women cohabiting (-0.7001, 95% CI -4.6261 to 3.2258, $p = 0.7267$) and the regression against the year of the study (0.0230, 95% CI -0.1466 to 0.1925, $p = 0.7905$) both produced non-significant relationships which likewise did not explain the heterogeneity ($I^2 = 98\%$, $R^2 = 0.00$).

The funnel plots (see supplementary data) in Figures S2 and S3 display a scatter plot of the proportional estimates from the individual studies included in the review against the standard error of those studies (Higgins & Green, 2011). Funnel plots have been generated to assess publication bias as the effect estimates from smaller studies will scatter more widely at the bottom of the graph, so that in the absence of bias the plot should approximately resemble an inverted funnel (Higgins & Green, 2011), although there is some asymmetry as it is not possible to ascribe this to publication bias directly.

Discussion

This review found that overall 42% of women with HIV intend to have children in the future, and 74% have already had at least one child in the past. This has implications for clinicians and health services; the former must ensure that consideration of this forms part of the assessment of women who can have children and the latter need to consider how services to enable this might best be provided. This is significant because there is evidence that this is not currently done in many cases leaving many women with inadequate support (Finocchiaro-Kessler et al, 2012a).

Although it was hypothesised that the desire to have children might be positively affected by: year, with desire increasing over time; the availability of HAART; the proportion of women cohabiting, and already having had a child, none of these factors were statistically significant. Therefore, there is no evidence that any of the factors investigated in this meta-regression have any influence on HIV positive women's desire to have children in the future and they cannot be used to predict reproductive decision making. There was a statistically significant relationship between HAART availability and having had children in the past, however the clinical significance of this is unclear and it is not known how many of these

children were conceived before the woman became infected. Furthermore, the results are complicated by the significant heterogeneity in all analyses which were not explained well by any of the models tested.

In the analysis examining the proportion of women who had already had at least one child, the proportion on HAART, those who wanted to have children in the future, and the proportion cohabiting were all statistically significant variables. Only the year was not significant, with this predictor variable being negative. However, as this analysis is retrospective in terms of intention to have had children in the past, limited conclusions can be drawn. Furthermore, there were high levels of heterogeneity in all analyses suggesting that it is not possible to predict which women might want a child based on the group-level characteristics investigated here making it essential that all involved in the care of women with HIV consider fertility issues in their assessment.

One possible explanation for these findings that emerged from the individual studies analysed is that the desire to have children is related to being of a younger age. However, age was not included in this review because it was not possible to extract these data in a consistent manner for every study. Furthermore, the use of mean age as a predictive factor in meta-analyses may lead to a unit of analysis error if it is used to make inferences regarding individuals. It is also important to consider a recent study by Laar et al (2015) which suggests that in fact childbearing desire is higher in older HIV positive women who may feel that their time to have children is running out.

A significant theme found in most of the research retrieved from the search, is that it was conducted largely in sub-Saharan Africa which, whilst being the epicentre of the global HIV epidemic (AVERT, 2015), this may not be generalizable to high income countries. This is thought to be largely due to the inherent differences in social and economic infrastructure

which makes the distribution of healthcare less equitable in those countries (Garimoi Orach, 2009) contributing to their higher fertility rates. Further to this, there are differences in the nature of the epidemic and levels of stigmatisation of certain high-risk groups, such as sex workers and intra-venous drug users (AVERT, 2016). However, although at group level the access to health services is more comprehensive in high income countries, in certain places inequality persists. For example, Squires et al (2011) identified the inequalities present in the American private healthcare system which are such that poverty and lack of adequate medical insurance often hinders HIV positive women's access to healthcare and therefore to HAART. Consequently, the fact that this review considered only studies conducted in high income countries means that whilst it can be said to have gone some way to account for the heterogeneity, there are many socio-economic variables which remain unaccounted for.

An interesting observation that was made in all of the studies which may add to the influence of extraneous socioeconomic factors was the effect of ethnicity on women's reproductive decision making. This factor was not analysed in this review as it was not possible to extract data on ethnicity from all the studies included, however, the majority conclude that immigrant women from African countries in particular have a greater desire to have children than other participants. This is explained by Loutfy et al (2009) and Badell et al (2012) as being the result of a cultural significance that childbearing and motherhood may hold for women of African origin as opposed to women of Northern European or North American origin. This is significant because even though this review has aimed to account for the effects of cultural differences between high and low income countries, the fact that the majority of the participants in the majority of the studies, excluding Wessman et al (2015), were either African-American or immigrants from lower income countries, may in fact mean that cultural differences between the participants have not been accounted for. Whilst it is important to understand that in a modern secular society, cultural diversity is the norm, it

must also be considered that large populations of immigrants often form sub-cultures within their new countries that promote different values and health beliefs from those of the dominant culture (Andrews & Boyle, 2008).

Only one study, conducted in the UK by Cliffe et al (2011) found a strongly positive relationship between increased access to HAART and a desire to have children which was described as 41% of the participants having changed their mind regarding their original reproductive choices on diagnosis following advances in HIV care. However, Sowell et al (2002) identified that in fact being asymptomatic of HIV or experiencing low levels of symptoms was correlated with an increased desire to have children. Additionally Stanwood et al (2007) identified that a higher CD4+ count and not being on HAART was similarly correlated to an increased desire to have children. Therefore it may be more accurate to postulate that living well with HIV has more of an influence on fertility desire than the diagnosis of the disease or its treatment does.

Furthermore, Hernando et al (2014) states that the factors associated with HIV positive women's reproductive decision making are not significantly different from the general population's, and that actually having children can help these women to cope with the stigma and the adverse consequences of living with HIV. As such, one of the statistically significant findings of this review was that being in a cohabiting partnership or marriage was a predictor for having had at least one child at some point in the past. This finding is also replicated in the general population of the UK (Wellings et al, 2013). Therefore, the assumption that HAART is the variable which has had the most significant impact on the fertility options that are now available to women may be a simplistic interpretation that accounts only for the medical aspects of the disease, not taking into account the patients perspective or the daily realities of living with the psychosocial impact that an HIV diagnosis can have on women (Steiner et al, 2013).

The overarching conclusion from all the papers was that healthcare providers did not engage in gender sensitive conversations with women regarding their fertility and that when these conversations did occur they were not individualised or fulfilling for the patients (Finocchario-Kessler et al, 2010). In fact, Finocchario-Kessler et al (2010) reported that 56% of participants had unmet reproductive counselling needs and of those who had had counselling from their healthcare providers, 64% of the conversations were patient initiated. Furthermore, research has demonstrated that healthcare professionals do not feel confident initiating sensitive conversations both within the HIV clinical context (Finocchario-Kessler et al, 2010) and the wider healthcare system (Akers et al, 2010).

Limitations of the Review:

The main limitation of this review is the generally low level of evidence, consisting mainly of cross-sectional studies, and the fact that only a relatively small number of studies included were conducted outside of the United States of America which may reduce generalisability. The use of different study designs in the meta-analysis may have had some effect on the results; also there was not consistent information about potentially important variables such as age and year of diagnosis that could explain some of the heterogeneity. As such, the high levels of heterogeneity which could not be explained by the variables tested makes interpretation of the findings difficult.

Recommendations for Future Research:

The findings of this review add to the findings of a previous meta-analysis by Berhan & Berhan (2013), demonstrating a significant amount of evidence which has not found a relationship between future reproductive intentions and access to HAART. However, the findings demonstrated correlations between the decision to have had children in the past and

the variables of access to HAART, being in a relationship and the intention to have children in the future.

The lack of predictive factors found suggests that further quantitative research in this area will not significantly add to the current body of knowledge on the subject. As such, it may be more productive to research the lived experience of HIV positive women using qualitative thematic analysis to understand their perspectives. The studies presented here have identified some key themes which would be significant to investigate; such as the impact of ethnicity on the importance of motherhood as highlighted by Badell et al (2012), and the issues that healthcare professionals perceive as barriers to their initiating sensitive conversations with patients as highlighted by Finocchiaro-Kessler et al (2010).

Conclusion:

This review has found that a high proportion of women with HIV wish to have children, although this is not predictable at the group levels studied here. Because having children is now a viable option for many women with HIV, and because none of the moderating variables studied here were reliable indicators of the desire to have children, this issue needs to be considered with all women of child-bearing age.

The fact that no reliable prognostic factors could be identified in relation to fertility decisions may mean that the complexity of these decisions goes far beyond a diagnosis of HIV and is influenced by other more complex socio-economic factors (Miralles et al, 2013). A gap was identified in service provision whereby HIV positive women may benefit from reproductive counselling, but do not always receive it. The findings presented here indicate that sensitive conversations should be initiated by healthcare professionals with all HIV positive women of childbearing age, irrespective of their HAART status or personal situation. This conclusion is supported by the fact that before the era of HAART, women still desired to

have children despite suffering from more AIDS defining illnesses and there being a much poorer prognosis for the condition (Levine & Dubler, 1990). Therefore it may be said that whilst HIV Positive women are concerned about the risks of vertical transmission, it is not their only concern.

References

- Adler M. W., Edwards S. G., Miller R. F., Sethi G. & Williams I. G. (2012) *ABC of HIV and AIDS*. 6th ed. BMJ Books Wiley-Blackwell, Chichester.
- Akers A. Y., Gold M. A., Borrero S., Santucci A. & Schwarz E. B. (2010) Providers' Perspectives on Challenges to Contraceptive Counselling in Primary Care Settings. *Journal of Women's Health* **19**(6), 1163-1170.
- Altman D. (1998) HIV, Homophobia, and Human Rights. HIV/AIDS and Human Rights. Part I: The Roots of Vulnerability. *Health and Human Rights* **2**(4), 15-22.
- Anderson M., Elam G., Gerver S., Solarin L., Fenton K. & Easterbook P. (2008) HIV/AIDS-Related Stigma and Discrimination: Accounts of HIV-Positive Caribbean People in the United Kingdom. *Social Sciences & Medicine* **67**, 790-798
- Andrews M. M., Boyle J. S. & Carr T. J. (Eds) (2008) *Transcultural Concepts in Nursing Care*. 5th ed. Lippincott William & Williams, Philadelphia.
- AVERT (2015) *HIV and AIDS in Sub-Saharan Africa Regional Overview*. Available at <http://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/overview> accessed on 30th January 2016

AVERT (2016) *Key Affected Populations*. Available at <http://www.avert.org/professionals/hiv-social-issues/key-affected-populations> accessed on 30th January 2016.

Badell M. L., Lathrop E., Haddad L. B., Goedken P., Nguyen M. L. & Cwiak C. A. (2012) Reproductive Healthcare Needs and Desires in a Cohort of HIV-Positive Women. *Infectious Diseases in Obstetrics and Gynaecology*, 2012;2012:107878. doi:10.1155/2012/107878 (Citation as instructed).

Berhan Y. & Berhan A. (2013) Meta-analyses of Fertility Desires of People Living with HIV. *BMC Public Health* **13**(1), 409.

Cliffe S., Townsend C. L. Cortina-Borja M., Newell M. (2011) Fertility Intentions of HIV-Infected Women in the United Kingdom. *AIDS Care* **23**(9), 1093-1101.

Deacon H. (2006) Towards a Sustainable Theory of Health-Related Stigma: Lessons from the HIV/AIDS Literature. *Journal of Community & Applied Social Psychology* **16**(6), 418-425.

Fauci A. S. (2008) 25 Years of HIV. *Nature* **453**(15), 289-290.

Finocchiaro-Kessler S., Bastos F. L., Malta M., Anderson J., Goggin K., Sweat M., Dariotis J., Bertoni N. & Kerrigan D. (2012a) Discussing Childbearing with HIV-Infected Women of Reproductive Age in Clinical Care: A Comparison of Brazil and the US. *AIDS Behaviour* **16**(1), 99-107.

Finocchiaro-Kessler S., Sewat M. D., Dariotis J. K., Anderson J. R., Jennings J. M., Keller J. M., Vyas A. A. & Trent A. E. (2012b) Childbearing Motivations and Pregnancy Desires Among Urban Female Youth: Does HIV-Infection Status Make a Difference? *AIDS Care* **24**(1), 1-11.

- Finocchiaro-Kessler S., Dariotis J. K., Sweat M. D., Trent M. E., Keller J. M., Hafeez Q. & Anderson J. R. (2010) Do HIV-Infected Women Want to Discuss Reproductive Plans with Providers and Are Those Conversations Occurring? *AIDS Patient Care and STDs* **24**(5), 317-323
- Garimoi Orach C. (2009) Health Equity: Challenges in Low Income Countries. *African Health Sciences* **9**(2), S49-S51.
- Glasper A. & Rees C. (2013) *How to Write Your Nursing Dissertation*. Wiley-Blackwell, Chichester.
- Haddad L. B., Machen L. K., Cordes S., Huylebroeck B., Delaney A., Ofotokun I., Nguyen M. L. & Jamieson D. J. (2015) Future Desire for Children Among Women Living with HIV in Atlanta, Georgia. *AIDS Care* **28**(4), 455-459.
- Hernando V., Alejos B., Álvarez D., Montero M., Pérez-Elías M. J., Blanco J. R., Masiá M., Romero J., Santos I., Rio I. Llácer A. & CoRIS (2014) Reproductive Desire in Women with HIV Infection in Spain, associated Factors and Motivations: A Mixed Methods Study. *BMC Pregnancy and Childbirth* **14**(194), 1-11.
- Higgins J. & Green S. (2011) *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updates March 2011]*. Available at www.cochrane-handbook.org accessed on 13th February 2016.
- Kozak M., Zinski A., Leeper C., Willing J. H. & Mugavero M. J. (2013) Late Diagnosis, Delayed Presentation and Late Presentation in HIV: Proposed Definition, Methodological Considerations and Health Implications. *Antiviral Therapy* **18**, 17-23.

Laar A. K., Taylor A. E. & Akasoe B. A. (2015) HIV Seropositivity is Not Important in Childbearing Decision-making Among HIV-positive Ghanaian Women Receiving Antiretroviral Therapy. *AIDS Care* **27**(7), 870-875.

Levine C. & Dubler N. N. (1990) Uncertain Risks and Bitter Realities: The Reproductive Choices of HIV-Infected Women. *The Milbank Quarterly* **68**(3), 321-351.

Logie C. H., James L., Tharao W. & Loutfy M. R. (2011) HIV, Gender, Race, Sexual Orientation and Sex Work: A Qualitative Study of Intersectional Stigma Experienced by HIV-Positive Women in Ontario, Canada. *PLoS Medicine* **8**(11).

Loutfy M. R., Hart T. A., Mohammed S. S., DeSheng Su, Ralph E. D., Walmsley S. L., Soje L. C., Muchenje M., Rachlis A. R., Smaill F. M., Angel J. B., Raboud J. M., Silverman M. S., Tharao W. E., Gough K., Yudin M. H. (2009) Fertility Desires and Intentions of HIV-Positive Women of Reproductive Age in Ontario Canada: A Cross-Sectional Study. *PLoS ONE* **4**(12).

Maartens G., Celum C. & Lewin S. R. (2014) HIV Infection: Epidemiology, Pathogenesis, Treatment and Prevention. *The Lancet* **384**(9939), 258-271.

Miralles C., Mardarescu M. & Sherr L. (2013) What do we know about the situation of women living with HIV in Europe? *Antiretroviral Therapy* **18**(Suppl. 2), 11-17.

Nattabi B., Li J., Thompson S. C., Orach C. G. & Earnest J. (2009) A Systematic Review of Factors Influencing Fertility Desires and Intentions Among People Living with HIV/AIDS: Implications for Policy and Service Delivery. *AIDS Behaviour* **13**(5), 949-968.

Nyblade L., Stangl A., Weiss E. & Ashburn K. (2009) Combating HIV Stigma in Health Care Settings: What Works? *Journal of the International AIDS Society* **12**(1), 15.

Padian N. S., McCoy S. I., Karim A. A., Hasen N., Kim J., Bartos M., Katabira E., Bertozzi S., Schwartländer B. & Cohen M. S. (2011) HIV Prevention Transformed: The New Prevention Research Agenda. *The Lancet* **378**(9787), 269-278.

R Core Team, R (2016) *A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. Available at <http://R-project.org/> accessed on 13th December 2015.

Sandelowski M., Lambe C. & Barroso J. (2004) Stigma in HIV-Positive Women. *Journal of Nursing Scholarship* **36**(2), 122-128.

Schwarzer G. (2015) *Meta: General Package for Meta-Analysis*. Available at <https://cran.r-project.org/web/packages/meta/index.html> accessed on 13th December 2015.

Sowell R. L., Murdaugh C. L., Addy C. L., Moneyham L. & Tavokoli A. (2002) Factors Influencing Intent to Get Pregnant in HIV-Infected Women Living in the Southern USA. *AIDS Care* **14**(2), 181-191.

Squires K. E., Hodder S. L., Feinberg J., Bridge D. A., Abrams S., Storfer S. P. & Aberg J. A. (2011) Health Needs of HIV-Infected Women in the United States: Insights from the Women Living Positive Survey. *AIDS Patient Care* **25**(5), 279-285

Stanwood N. L., Cohn S. E., Heiser J. R. & Pugliese M. (2007) Contraception and Fertility Plans in a Cohort of HIV-Positive Women in Care, *Contraception* **75**(4), 294-298.

Steiner R. J., Finocchiaro-Kessler S., & Dariotis J. K. (2013) Engaging HIV Care Providers in Conversations With Their Reproductive-Age Patients About Fertility Desires and Intentions: A Historical Review of the HIV Epidemic in the United States. *American Journal of Public Health* **103**(8), 1357-1366.

Stine G. J. (2007) *AIDS Update 2007*. McGraw Hill Higher Education, New York.

Terrence Higgins Trust (2015) *Mother to Baby*. Terrence Higgins Trust, London.

The World Bank (2016) *World Development Indicators 2016 Maps*. Retrieved from <http://data.worldbank.org/products/wdi-maps> on 23rd July 2016.

Turan J. M. & Nyblade L. (2013) HIV-Related Stigma as a Barrier to Achievement of Global PMTCT and Maternal Health Goals: A Review of the Evidence. *AIDS Behaviour* **17**(7), 2528-2539.

Tuuli M. G., Duong T. H., Yost N. P., Ellis J., Burke C. V. Basanta-Henry P. L. & Lindsay M. (2011) Postpartum Contraceptive Preferences of HIV-Infected Women in the Era of Highly Active Antiretroviral Therapy (HAART) and Scheduled Caesarean Deliveries. *Contraception* **84**(2), 150-154.

UNAIDS (2015) *2015 Progress Report on the Global Plan*. UNAIDS Joint United Nations Programme on HIV/AIDS, Geneva.

UN Women (2016) *Facts and Figures: HIV and AIDS: Prevalence and New Infections*. Available at <http://www.unwomen.org/en/what-we-do/hiv-and-aids/facts-and-figures> accessed on 3rd December 2016.

Viechtbauer W. (2015) *metafor: Meta-Analysis Package for R*. Available at <https://cran.r-project.org/web/packages/metafor/index.html> accessed on 13th December 2015.

Wellings K., Jones K. G., Mercer C. H., Tanton C., Clifton S., Datta J., Copas A. J., Erens B., Gibson L. J., Masdowall W., Sonnenberg P., Phelps A. & Johnson A. M. (2013) The Prevalence of Unplanned Pregnancy and Associated Factors in Britain: Findings from the Third National Survey of Sexual Attitudes and Lifestyles (Natsal-3). *The Lancet* **382**(9907), 1807-1816.

Wessman M., Aho I., Thorsteinsson K., Storgaard M., Johansen I. S., Lunding S., Pedersen G., Lebech A., Kivelä P., Helleberg M., Katzenstein T. L. & Weis N. (2015) Perception of Sexuality and Fertility in Women Living with HIV: A Questionnaire Study From Two Nordic Countries. *Journal of the International AIDS Society* **18**(1).

WHO (2015) WHO News Release: WHO Validates Elimination of Mother-to-Child Transmission of HIV and Syphilis in Cuba. *Saudi Medical Journal* **36**(8), 1018-1019.

WHO (2016) *Prevention of Mother-to-Child Transmission of HIV (PMTCT and Family Planning (FP): Empowering Women Living with HIV*. Available at <http://www.who.int/reproductivehealth/topics/linkages/pmtct/en/> accessed on 30th December 2015.

Zulueta P. & Boulton M. (2007) Routine Antenatal HIV Testing: The Responses and Perceptions of Pregnant Women and the Viability of Informed Consent. A Qualitative Study. *Journal of Medical Ethics* **33**(6), 329-336.

Table 1: Summary of Studies Included in the Meta-analysis

Author	Year	Total Women	Women wanting children	Fertility >1 child	on HAA RT/A RV	Married/ Cohabiting	Country	Study Type	Methodological Quality – Risk of Bias*
O ₁ : Sowell et al (2002)	2002	322	117	259	181	68	USA	Survey	Serious
O ₂ : Stanwood et al (2007)	2007	118	24	107	70	80	USA	Survey	Serious
O ₃ : Loutfy et al (2009)	2009	465	226	354	356	208	Canada	Cross-sectional Survey	Moderate
O ₄ : Finocchari o-Kessler et al (2010)	2010	181	107	117	120	100	USA	Cross-sectional ACASI (audio computer-assisted self-interview)	Serious
O ₅ : Cliffe et al (2011)	2011	450	336	326	304	233	UK	Survey	Serious
O ₆ : Squires et al (2011)	2011	700	239	273	700	196	USA	Survey	Serious
O ₇ : Finocchari o-Kessler et al BALTIMORE (2012a)	2012	181	99	118	127	63	USA	Survey	Serious
O ₈ : Finocchari o-Kessler et al (2012b)	2012	46	37	20	18	12	USA	Survey	Serious
O ₉ : Badell et al (2012)	2012	127	7	102	96	60	USA	Survey	Serious
O ₁₀ : Hernando et al (2014)	2014	134	66	116	114	90	Spain	Mixed Methods (Questionnaires)	Serious
O ₁₁ : Wessman et al (2015)	2015	560	141	470	501	363	Denmark & Finland	Survey	Serious
O ₁₂ : Haddad et al (2015)	2015	181	62	149	124	121	USA	ACASI	Serious

*See Table S2 in supplementary data

Table 2: Findings of the meta-analysis of proportions and the meta-regression where the outcomes were either women who already have at least one child or women wanting children

Women Who Already Have At Least One Child (based on the proportion who have children)						
	Estimates	Confidence Interval (CI)	P-Value	Heterogeneity (Q) & [P-value]	Heterogeneity (I ²)	Heterogeneity Accounted for (R ²)
Pooled	74%	64%-83%	<0.0001	421.64 [<0.0001]	97%	-
Percent on HAART	-1.4474	-2.7067 – -0.1881	0.0243	42.1130 [<0.0001]	83%	83%
Percent Wanting Children	-2.1162	-3.2616 – -0.9707	0.0003	42.1130 [<0.0001]	83%	
Percent Cohabiting	2.6915	1.0220 – 4.3610	0.0016	42.1130 [<0.0001]	83%	
Year	-0.0340	-0.1024 – 0.0344	0.3299	42.1130 [<0.0001]	83%	
Women Wanting Children (based on the proportion who wanted children)						
	Estimate	CI	P-Value	Q & [P-value]	I ²	R ²
Pooled	42%	31%-53%	<0.0001	383.4 [<0.0001]	97%	-
Percent on HAART	-1.1827	-4.7788 – 2.4135	0.5192	345.0944 [<0.0001]	98%	0.00%
Percent with >1 Child	0.0005	-0.0047 – 0.0056	0.8616	345.0944 [<0.0001]	98%	
Percent Cohabiting	-0.7001	-4.6261 – 3.2258	0.7267	345.0944 [<0.0001]	98%	
Year	0.0230	-0.1466 – 0.1925	0.7905	345.0944 [<0.0001]	98%

Figure 1: Forest Plot of Women Who Already Have At Least One Child

Figure 2: Forest Plot of Women Who Want To Have A Child