STOCKHOLM UNIVERSITY
Dept of Sociology, Demography Unit / www.suda.su.se

War effect on fertility behavior in the Democratic Republic of Congo

Elina Elveborg Lindskog

**Stockholm
Research Reports
in Demography
2016: 4**

War effect on fertility behavior in the Democratic Republic of Congo

Elina Elveborg Lindskog
Stockholm University Demography Unit (SUDA)

Abstract:
Wartime fertility decline and post-war rebound in fertility have been found in both Western societies after the World Wars as well as in war-affected areas in developing countries. The Democratic Republic of Congo (DRC) seems to deviate from this pattern, maintaining a high total fertility rate despite the Congolese wars of 1996-2003 and lingering conflict in East DRC. This study explores the relationship between war and fertility by linking individual reproductive life courses to the occurrence and intensity of war. Geo-referenced conflict data are liked to women's exposure to the risk of a first or subsequent birth. The first birth risk increased during the Congolese war and in the period immediately following. Higher-order birth risks plateaued during the war but decreased thereafter. Taken together, the results are consistent with a postponement and eventual onset of a fertility transition in the DRC.

Keywords: Congolese war, fertility transition, first birth, parity-specific fertility, the DRC.

Introduction

In the late 1960s and 1970s fertility started to decline in urban areas in many sub-Saharan countries and 10 years later in rural areas (Garenne & Joseph, 2002). The Democratic Republic of Congo (DRC) deviates from this pattern with consistent high fertility to the end of the 20th century (Romaniuk 2011). Although the DRC has since experienced a slow fertility decline (Shapiro & Tambashe 2001), its fertility remains well above that of other sub-Saharan countries.

Although the DRC's high fertility and delayed fertility transition can be attributed to long-standing and slowly changing economic and social conditions, delays in fertility response may also have resulted from the devastating Congolese Wars from 1996 to 2003 and residual conflicts in Eastern DRC that continued beyond the peace accords. Although some research suggests that fertility declines during wartime and rebounds thereafter (Winter, 1992; Avogo & Agadjanian, 2008), the context of the DRC – where fertility was high, modern contraceptives used only by a few, and women vulnerable to rape as a weapon of war – could produce higher rather than lower fertility where conflicts were especially intense.

Most previous research on the association between war and fertility is based on relatively crude indicators of both. Exposure to war is often based simply on time during which conflicts were ongoing and fertility is often measured only at the aggregate level. The study reported herein is an improvement on both counts and therefore offers a better possibility for detecting conflict effects. First, the frequency and intensity of violent conflict, not just its occurrence, is measured with reports from the Uppsala Conflict Data program-Georeferenced Event Dataset (UCDP GED 2013). Second, these data are linked by time and place to women's reproductive histories from the 2013/2014 the DRC Demographic and Health Survey. Third, fertility is disaggregated into the risk of a first birth and risk of higher-order births in order to identify potential variation across the life course in conflict effects.

War and Fertility

Fertility results from a sequence of behavioral and biological characteristics known as the "proximate determinants" (Bongaarts et al., 1994). Marriage frequency and patterns of sexual intercourse, separation through death or divorce, contraceptive use, abortion, breast-feeding practices, postpartum abstinence and sterility combine to determine the number and spacing of births (Ibid; de Bruijn 2006). The influence of reproductive goals and of structural or cultural contexts on fertility must operate through one or more of these behavioral or biological pathways.

War alters the structural contexts that underlie reproductive health and reproductive goals and behaviors. Some of the effects may lead to fertility decline, others to fertility increase. A review by Caldwell (2004) covering thirteen social upheavals, most in Europe, shows that economic shocks have a negative effect on fertility. The effect of war is generally entangled with economic and political disorder (Mock et al. 2004) and as economic shocks are negatively associated with fertility it is possible that an outbreak of war may have a similar effect on fertility (Urdal & Chen, 2013). Reduced economic resources at the household level and uncertainty about the future may reduce the demand for children or delay births. A study on the conflict in Sarajevo noted that health staff reported an increase of abortions due to insecurity and fear (Carballo et al. 1996). Agadjanian and Prata (2002) found evidence of a wartime fertility decline and a post-war rebound effect in Angola. Woldemicael (2008) found similar results related to the border conflict in Eritrea, with a decline in the total fertility rate (TFR) during a period of military conflict at the end of the 1990s, the conflict being strongly associated with foremost decline in first births. Lindstrom and Berhanu (1999) report that the years of major political and economic upheaval in Ethiopia were linked to short-term declines in conception probabilities followed by a rebound effect and that fertility declined steadily in the second decade of conflict. The authors suggest that the Ethiopian couples postponed births as a coping strategy during periods of economic hardship.

However, war may also be associated with an increase in the desire for children as the result of strengthening the group identity; this may be particular true when violent conflicts have ethnic components. The war between Iran and Iraq (1980-1988) provides an example of a pronatalist atmosphere among Iranian couples who were encouraged to replace expected civilian deaths by having more children (Abbasi-Shavazi, 2002). The Iranian government considered high fertility and population growth to be of comparative advantage to Iran. Nevertheless, fertility started to slowly decline by the mid-1980s despite the post-revolutionary pronatalist ideology and population policy; the total fertility rate was 5.5 in 1988 and then fell sharply to below 2.8 in 1996 (Ladier-Fouladi, 1997). Another example is the long-lasting state of belligerence between Arab Palestinians and Jews that is argued to be the reason for the high pretransition levels of TFR of Palestinians living in Gaza compared to the TFR of Palestinians living in Israel and in the West Bank (Fargues, 2000).

Pronatal forces related to old-age security, i.e. children as insurance during conditions of economic insecurity (Verwimp & van Bavel, 2005) may also increase fertility during war. Urdal and Chen (2013) assert that the use of children for generating additional income may be encouraged when declines in the formal economy decrease the opportunity cost for parents of having an additional child. Parents may choose the short-term benefits from having many children compared to the long-term benefits of fewer children with a better chance of receiving education (Ibid).

High levels of infant and child mortality during violent conflict may also generate a replacement effect. Verwimp and van Bavel (2005) used a nationally representative household survey including the number of children ever born and their migration status and found support for a replacement effect among Rwandan refugee women. Fertility was higher among these women but their children had lower chances of survival. Similarly, Schindler and Brücker (2011) found strong support for a replacement effect using three cross-sectional Rwandan Demographic Health Surveys, encompassing the civil war and genocide (1990-1994) and proxies for the likelihood of exposure to conflict.

This finding is also supported by Jayaraman et al. (2009) as their research show that Rwandan women were more likely to have their first child early if they were living in regions with high levels of under-five compared to women living in areas with lower child mortality in the post-genocide period. Another example is the post-war fertility rise in Bangladesh as a result of a replacement effect of children who had died during the civil war in 1971 (Curlin et al. 1976).

Sexual exposure is directly linked to the probability of conception and the conditions and frequency of sexual intercourse may vary between periods of peace and periods of war. Marital fertility is reduced through the separation of couples due to the conscription of married men (or females), migration, temporary displacement or death. War may also lead to delay in marriage during war, particularly when young men are drawn into war by the mobilization of both the military and militias. De Walque (2006) found that women who were at the age of getting married during the Khmer Rouge genocide in Cambodia (1975-1979) delayed their marriages contributing to fertility decline. Marriage may also be delayed in the aftermath of war through a disruption of the marriage market. The genocide in Cambodia contributed to an estimate of 2.2 to 2.8 million excess deaths, where adult males were the most likely to die. However, the marriage market adapted to the shortage of men by reducing the difference in age between couples in the aftermath period, contributing to a baby boom effect (Ibid). Similar findings were found in Rwanda where the genocide in 1994 led to a skewed gender ratio in the aftermath period. Jayaraman et al. (2009) used the Rwandan Demographic Health Survey (2005) and sibling linked mortality data as a measure of conflict effect, i.e., having siblings who died in 1994 would indicate exposure to conflict. They concluded women living in clusters with a large proportion of sibling deaths in 1994 were more likely to marry later compared to women living in clusters with a lower proportion of sibling deaths.

Psychological stress and traumatic experience such as the loss of loved ones or rape may reduce fecundity and frequency of sexual intercourse as it is associated with declines in reproductive health status (World Report, 2008). A study of Cambodian women in a refugee camp in eastern Thailand reported high proportions of amenorrhea on arrival at camp indicating lower fecundity, which is most likely the main contributor to the low fertility among these women (Holck et al. 1982). Amenorrhea is associated with high levels of malnutrition and emotional stress (Stein & Susser, 1978).

However, facing high mortality risks during periods of violent conflict may produce feelings of hopelessness, which may relax institutional and social restraints on sexual behavior thus increasing the risk of conception (Raschky & Wang, 2012). Cohan & Cole (2002) found that during natural disasters the physical need to be close to a loved one increases when facing high levels of danger as affiliation is comforting. The same mechanism could very well be true for couples during war-like conditions. Furthermore, the social disruption during war may weaken the parental and community monitoring and protection over young people questioning social norms, which may increase the exposure to premarital sex (Muhwezi et al. 2011). Lindskog (2014) found that violent conflict in Rwanda increased the risk for premarital first sexual intercourse, using direct measures of violent conflict linked to the sexual histories of young women across time and place. An increase in premarital sex would in turn increase the risk of first birth in a context of low use of contraception.

The risk of non-consensual sexual intercourse may also increase during wartime through war rape. Sexual violence during war is well documented and war rape has been used systematically to stigmatize women, separating them from their husbands through shame (Farwell, 2004; Milillo, 2006), but again the association of sexual violence during war and fertility is less known. Sexual violence increases the risk of adverse reproductive health effects as rape is associated with post-traumatic stress and sexually transmitted infections (Bartels et al, 2010), but also to an increase in fertility through unwanted and unplanned pregnancies. Women are furthermore placed in a more vulnerable position during war, which may force women to provide sexual services in exchange for protection (Milillo, 2006; Muhwezi et al. 2011). Human Rights Watch (2004) has documented stories of how women provided sex in return for protection during the genocide in Rwanda.

The destruction of the health care system may affect fertility in both directions, fertility increase and fertility decline. The disruption of the health care system has a positive influence on fertility through limited access to modern contraceptives and a loss of family planning services (Mock et al. 2004), increasing the risk of conception. However, limited access to health care during pregnancy and at delivery increases the risk of adverse health outcomes for the infant as well as the mother (Kusiako et al. 2000). Complications during delivery may increase the risk of stillbirths and neonatal mortality (Ibid).

The relative strength of each of these potential pathways from war to fertility will depend on the societal context in which war develops and the nature of the conflict across time and place. Urdal and Che's (2013) cross-national time-series models of developing countries found that higher over-all fertility is associated with violent conflicts, but only in low-income countries. Low-income countries are generally characterized by poverty, high fertility and high infant and maternal mortality. It is therefore likely that where infant and maternal mortality are already high, and where fertility is high and characterized by short birth spacing and low use of modern contraceptives, some of the pathways described above are not likely to change much under conditions of war. For example, the destruction of the health sector and limited access to modern contraceptives will not have the same impact where contraceptive use is already low than where it is relatively high or increasing. The effects of war on reproductive health may make less marginal difference when fecundity, miscarriage, stillbirth and sterility are already high.

Fertility and Conflict in the DRC

The total fertility rate rose in the DRC during the second half of the twentieth century from 5.9 in 1955/1957 to 7.1 in 2001 and then began to decline in 2007 to 6.3 (Romaniuk, 2011). Shapiro and Tambashe (2001) argue that the DRC may have embarked on the fertility transition. Even so, the fertility rates are still high compared to other sub-Saharan African countries. The 1955/1957 survey indicates that urban areas had higher fertility compared to rural areas, which probably reflects the improving living conditions and access to health care during the late colonial period (Romaniuk, 2011). This trend was reversed in the 2001 and 2007 survey where rural areas have higher fertility compared to urban areas; urban fertility has fallen, especially in Kinshasa.

The increase in fertility since the 1950s was partly due to the reduction in sterility that was widespread in central and northern DRC (Ibid). The decline in sterility is believed to be associated with large-scale anti-venereal disease campaigns during the latter part of the colonial period. Furthermore, the view of children as economic resources in old age and the rigid kinship system create a culture supporting high fertility. Couples are pressured to have many children in order to empower the kin network and to strengthen lineage (Romaniuk, 2011). Polygyny is an important factor in marital and reproductive behavior as it strengthens the capacity of the lineage. According to the DRC DHS (2007), 21% of women within reproductive age reported to be living as co-spouses and polygyny is more common in rural areas (24%) than in urban areas (16%). As a result of its sustained high fertility, the DRC has a young population structure with 48% of the population under age 15 and 49% of working age, only 3% elderly in 2007 (DHS, 2007).

The forces supporting high fertility have been countered to some extent by breastfeeding and relatively long periods of postpartum abstinence. Postnatal abstinence is losing ground, especially in urban areas, producing increasing pregnancy rates, but breastfeeding practices remain steady (Romaniuk, 2011). Modern contraception is limited, due in part to the lack of a population policy in the DRC. Only 6.7% of women aged 15-49 use modern contraceptives (DHS 2007). A study on the disparities in modern contraceptive use among women in the DRC concludes that the use of contraceptives relates to the level of education and age as well as the province and location of residence, and the economic status of the household (Kandala, 2014). The use of modern contraceptives provides evidence of geographical patterns, suggesting that beyond individual-level risk factors there are socio-economic factors at the province level that determine the level of accessibility and affordability (Ibid). There was a clear East-West gradient except for North Kivu that had the highest prevalence of contraceptive use, which is possibly associated with the strong presence of NGOs devoted to promoting reproductive health. Urban and better educated women are more likely to use modern contraception than rural and less well educated women. In rural areas, women are especially disadvantaged by the scarcity and the remoteness of health services and family planning (Ibid). Modern contraceptives are also relatively costly in the DRC (Ibid). Contraceptive use increases with age and peaks for women age 20-29 and again at age 45-49, motivated by the need to stop further childbearing (Ibid).

Romaniuk (2011) argues that the most important factor for a real change in reproductive behavior in the DRC is a “strong economic engine of social and cultural change” (p. 20). Urbanization has been progressive since independence in 1960. The primary city, Kinshasa, has grown from 400,000 inhabitants in 1960 to 10 million inhabitants today, one of the largest cities in Africa (Sanguma, 2015). Urbanization exposes women to modern roles and behaviors, which may have an impact on the desired family size, especially in a context where infant mortality decreases. However, war is a powerful hurdle for economic development and may limit modernization processes working for fertility decline such as educational attainment and access to family planning and health service.

The DRC experienced one of the most horrendous wars in Africa with an estimated death toll of 3.9 million people between 1998-2004 (Coghlan et al. 2006). A major stimulus for the war was the huge migration flow of mostly Hutu Rwandese into East DRC as a consequence of the Rwandan genocide in 1994. Among the refugees were the ex-FAR (Hutu government military) and the former Interahamwe (militia active in the killings of Tutsi during the genocide) who, under the protection of President Mobutu in the DRC, reorganized and continued to attack Rwanda from bases in the East DRC refugee camps. 1996 and 1997 were marked by escalating violence; in 1997 President Mobutu was overthrown and Kabila became the new president with support from Rwanda and

Uganda. Shortly thereafter, President Kabila feared a military coup and alienated his former allies by dismissing the Rwandan military officer as chief of staff for the Congolese armed forces (Olsson and Fors 2004). Rwanda and Uganda answered by entering the DRC in August 1998 for what they claimed ‘security reasons’ as the attacks on Rwanda continued from inside East DRC. This action generated a chain reaction pulling six nations into the Second Congolese War. The DRC’s natural resources were plundered and the society disrupted, especially in the border regions between Rwanda and the DRC, and between Uganda and the DRC, as well as in the principal city, Kinshasa. Violent conflict destroyed and disrupted infrastructure including health services, agricultural systems and communication lines causing malnutrition and starvation (Kandala et al. 2011).

The war seemed to end in 2003 with the signing of the peace accords and the departure of Rwandan and Ugandan forces. The eastern part of the DRC remained, however, unstable. In especially north and south Kivu, violent conflicts continued with a myriad of militia and rebel groups playing an active part in the insurgencies and the brutality of sexual violence against civilians, including gang rape and forced marriages (Human Rights Watch, 2002:2009). Human Rights Watch (2009) reports that during the last 15 years tens of thousands of women and girls were victims of sexual violence in the DRC.

Corrupt leadership has marked the DRC since independence in 1960, creating a high base line for both maternal mortality and infant mortality through lack of health care and family planning (van Herp et al. 2003). The DRC did experience great economic growth since 2002 due to foreign aid, but the massive influx of foreign aid has produced opportunities for corruption instead of promoting democracy (Sanguma, 2015). The DRC has poor reproductive health indicators, such as high levels of maternal mortality and infant mortality as well as short birth spacing and low use of modern contraceptives (Kandala, 2014). These are all factors that could be argued to have pushed for an increase in fertility and hence a delayed fertility transition in the DRC.

Romaniuk (2011) argues that the DRC has not yet met the conditions for sustained fertility transition. Future changes in the DRC fertility will depend on both ‘exogenous and endogenous’ forces (Ibid). The former relates to socio-economic factors associated with economic development and modernization expressed through changing norms regarding sexual behavior and family planning. The latter relates to customs associated with traditional childbearing and biological factors such as sterility (Ibid). An improvement in reproductive health and an erosion of traditional customs may increase fecundity and fertility, unless countered by an increase in contraceptive use. However, increased contraceptive use for spacing makes little difference as it merely compensates for the shortening of postnatal abstinence (Ibid). Delays in marriage and first birth may also work to maintain high fertility because they reduce maternal mortality and stillbirths, which is associated with young age at birth. According to the above mentioned scenario, the future course of the fertility transition will be slow. However, Shapiro and Tambashe have a more optimistic view on the future course of fertility based on their previous research on fertility decline in Kinshasa (Shaprio & Tambashe, 2002), where they found that fertility trends begin in the capital city and spread to rural areas. The fertility differences by education indicate that an increase in educational attainment will have a down-ward effect on fertility and they argue that the educational level is increasing in the DRC, especially in urban areas.

No previous research has explored the long term trend in parity-specific fertility before, during and after the Congolese war or possible differences between East and West DRC. No studies have applied direct observations of conflict intensity to study the relationship between conflict and fertility. I use nationally representative data encompassing the birth histories of Congolese women, combined with measures of conflict across time and place to test if the existence and intensity of violent conflicts are associated with higher birth risks, both first and higher-order births.

Data and method

The DRC Demographic Health Survey (DHS), conducted in 2013/2014, are matched with conflict data from the Uppsala Conflict Data Program-Georeferenced Event Dataset (UCDP GED 2013). The DHS survey is nationally representative of women between ages 15-49. The response rate was 98.6%, producing a sample of 18,827 women. The survey provides information on the year and month of each woman's births and whether the child had died, as well as the woman's age, education, province, and urban/rural residence. The UCDP GED 2013 collects data from the BBC Monitoring Service, Reuters, the Red Cross, Amnesty International, etc. Conflict is defined as: "The incidence of the use of armed force by an organized actor against another organized actor or against civilians, resulting in at least 1 direct death in either the best, low or high estimated categories at a specific location for a specific temporal duration" (UCDP GED codebook 2013:4). Indicators are constructed for the intensity and frequency of violent conflicts in each province and year. In a given province and year the number of conflict events ranges from none to 103. In 53.5% of the observations there were no recorded conflict events, covering the time period before and after the Congolese war as well as observations of women living outside provinces of conflict in any given year during the war period. The remaining 46,5% observations were divided evenly into three categories (low, medium, and high). For each province and year the estimated number of conflict deaths is linked to the conflict data, ranging from no deaths to 16,897 deaths. The observations of conflict deaths were divided the same way as conflict events. The conflict indicators are used separately in the models; as the direct conflict indicators have the same zero point, there can be no conflict deaths if there are no conflict events and vice versa.

Conflict indicators were linked to women's birth histories by province and year. The study used piece-wise constant proportional hazard models to estimate effects of war on fertility. Observations before 1989 and after 2010 were excluded to focus attention on the years shortly before and after, as well as during the Congolese Wars. This resulted in the exclusion of 1,497 women whose first birth occurred before 1989. The analytic sample for first births includes 17,330 women.

Separate models are specified for transition to first birth and for transitions to higher-order births because duration dependence differs for first and higher parity births. The models for higher-order births also include controls for the characteristics of previous births.

For first births, the event of interest is conception resulting in a first live birth (birth year and month subtracting 9 months). The women are observed from age 10 or 1989 (whichever came second) until the time of first conception or until 2010 (whichever came first). The unit of analysis is women years at risk of conception.

In analyses of higher-order births, the events are live births. The reason for observing the interval between birth to subsequent birth and not to conception is to reduce the number of women having two events during the same year. The interval from first birth to second birth is referred to as one spell, and the transition from second birth to third birth is another spell and so forth. Women who had two births within the same year (n=56) were recoded as having a full year interval instead of the same year, creating separate rows for each interval. For women who gave birth to twins or triplets the subsequent observations were dropped out of the analyses (n= 3,096 births), because determinants of births after a multiple birth differ from those after a singleton birth. Women who did not have a child at the time of the interview (n=4,645) or whose first birth occurred in 2010 or later (n=1,430) were excluded from analysis, leaving 11,255 mothers observed after a first or higher-order birth.

Fixed covariates included in both sets of analyses are education, place of residence (rural and urban) and province at the time of interview. Although education is observed at the interview, for almost all women it is the education they received before a first birth. In the DRC, educational attainment is one of the lowest in the world, completed at a very early age, well under the mean age at first birth of 19.2 years (DHS 2007). Most of the population lives in rural areas. There are 11 provinces in the DRC. Province or residence controls for such regional differences as socio-economic conditions and cultural norms that could influence reproductive behavior. The 2013/14 DHS does not provide information on women's previous migration, so we cannot be sure that the woman lived in the province or in a rural/urban area throughout the periods we observe. If a woman moved between provinces during her childbearing career, the measure of province – and therefore of conflict events and deaths to which she was exposed– will include a certain amount of error. This issue and its potential influence on the results are discussed at the end of the paper.

Time-varying covariates include the indicators of conflict events and conflict deaths, as well as calendar year categorized as: pre-war (1989-1995), war (1996-2003), lingering war (2004-2007), and post-war (2008-2010). Mother's age, classified as 10-15, 16-20, 21-25, and 26-35, is also a time-varying covariate. Using the calendar year indicator, I tested the interaction with East/West DRC to obtain a more precise specification of ongoing conflict after 2004 in East DRC. The events and deaths will also pick up any ongoing conflicts in East DRC.

For higher-order births, parity at the start of the spell is also fixed at single parities up to seven, 8-10 and 10-14 children. Time-varying covariates within each spell include not only the woman's age (10-15, 16-20, 21-25, 26-30, and 31-47) and measures of conflict as for first births, but also a prior child's death during infancy, and duration since previous birth: less than two years, 3-5 years, 6-10 years, 11-20 years, and 21-38 years. I also tested the interaction between calendar year and East/West DRC as for the first birth as well as an interaction between calendar year and time since previous birth. I present only those interactions that improved model fit using log likelihood ratio test.

Results

Table 1 presents descriptive statistics for the main explanatory and control variables for the transition to first birth for Congolese women. The first column presents the distribution of exposure time and the second column the distribution of events (conception of first live birth) across the person years observed for all women from 1989 to 2010 or first conception, whichever came first. The last column presents the distribution of women across categories of the fixed covariates. Most women live in rural areas. Modal education is primary or secondary. Fixed covariates are distributed roughly similarly across exposure time and events as they are for individual women. Differences reflect differences in the risk of first conception (fewer exposure years or more conceptions). For the conflict indicators, distributions are roughly the same for exposures and events; a greater proportion of exposures and lower proportion of events. The difference is most marked for age. Most of the exposures to risk of first birth are observed at ages 10-15 while most of the events are observed at ages 16-20; this reflects a concentration of first births in the older age range.

Table 1. Descriptive statistics for first conception risk.

	Women-years		Events (first conception)		N= of women	% of women
TIME-VARYING VARIABLES						
Calendar year						
1989-1995	29334	22,9	2281	20,6	-	-
1996-2003	47650	37,2	4124	37,3	-	-
2004-2007	28769	22,5	2585	23,4	-	-
2008-2010	22329	17,4	2063	18,7	-	-
Conflict events						
No conflict events	68524	53,5	5925	53,6	-	-
Low nr of events	16088	12,6	1242	11,2	-	-
Medium nr of events	22012	17,2	1942	17,6	-	-
High nr of events	21458	16,8	1944	17,6	-	-
Conflict deaths						
No conflict deaths	68524	53,5	5925	53,6	-	-
Low nr of deaths	22702	17,7	1858	16,8	-	-
Medium nr of deaths	16884	13,2	1473	13,3	-	-
High nr of deaths	19972	15,6	1797	16,3	-	-
Age						
10-15	80312	62,7	2743	24,8	-	-
16-20	33732	26,3	5909	53,5	-	-
21-25	9781	7,6	1848	16,7	-	-
26-35	4257	3,3	553	5,0	-	-

(Continued)

Table 1 (Continued) TIME-FIXED VARIABLES:						
Place of residence						
Urban	48477	37,8	3529	31,9	6,318	36,5
Rural	79605	62,2	7524	68,1	11,012	63,5
Province						
Kinshasa	14861	11,6	818	7,4	1,681	9.7
Bas-congo	6286	4,9	577	5,2	852	4,9
Bandundu	17329	13,5	1488	13,5	2,276	13.1
Equateur	17958	14,0	1683	15,2	2,470	14,3
Orientale	14805	11,6	1313	11,9	1,980	11,4
North-kivu	7645	6,0	645	5,8	1,080	6,2
Maniema	5585	4,4	536	4,8	798	4,6
South-kivu	6593	5,1	575	5,2	946	5,5
Katanga	14171	11,1	1297	11,7	2,011	11,6
Kasaï Oriental	13784	10,8	1220	11,0	1,903	10,9
Kasaï Occidental	9065	7,1	901	8,2	1,333	7,7
Education						
No education	23231	18,1	2404	21,7	2,965	17,1
Primary	46581	36,4	4761	43,1	6,660	38,4
Secondary	51825	40,5	3712	33,6	7,155	41,3
Higher	6445	5,0	176	1,6	550	3,2
Total	128082		11053		17,330	

Table 2 shows the results from the piece-wise hazard regression models. The first column shows results from a set of bivariate models including only the variable in question and time under risk. The coefficients are the relative risks of a first birth in comparison to the reference category. For example, the risk of first birth was higher during than before the Congolese war and even higher in the years that followed. The direct conflict indicators were not, however, associated with increased first-birth risk; the relative risks were very close to 1, the value for times and places with no conflict events or no conflict deaths. As expected the risk was higher for women in rural areas and those with no education. Women between ages 16-25 had a higher risk of first conception compared to younger women.

Model 1 includes all control variables and conflict year. A steady increase in risk of first birth is observed from the prewar period. There is no indication that the East provinces, marked by intense conflict, have a higher risk compared to provinces with lower intensity of conflict. The risk is rather similarly distributed across the provinces. Furthermore, the interaction between calendar year and East vs. West DRC did not improve model fit; no statistically significant differences were observed between East and West during the post-conflict period (2004-2007 or 2008-2010). Model 1 (as well as models 2 and 3) also shows that no differences were found in the risk between urban and rural areas when province is controlled.

Model 2 shows that when controlling for fixed and time-varying covariates, the number of conflict events is also associated with higher fertility, but the differences are not very large (about 10% higher than with no conflict). The same is shown in Model 3 for conflict deaths.

Table 2. The risk of first birth in the DRC

	Bivariate models	Model 1	Model 2	Model 3
Calendar year				
1989-1995, pre-war	1	1		
1996-2003, Congolese war	1.11***	1.13***		
2004-2007, insurgency in East DRC	1.16***	1.21***		
2008-2010, post-war with lingering conflict in East DRC	1.19***	1.27***		
Conflict events				
No conflict events	1		1	
Low nr of events	0.89***		0.98	
Medium nr of events	1.02		1.10***	
High nr of events	1.05(*)		1.08**	
Conflict deaths				
No conflict deaths	1			1
Low nr of deaths	0.95*			1.04
Medium nr of deaths	1.01			1.09**
High nr of deaths	1.04			1.06(*)
Table 2 continue.				
Place of residence				
Urban	1	1	1	1
Rural	1.30***	0.98	0.98	0.98
Province				
Kinshasa	1	1	1	1
Bas-congo	1.67***	1.42***	1.43***	1.45***
Bandundu	1.56***	1.29***	1.30***	1.31***
Equateur	1.70***	1.42***	1.42***	1.44***
Orientale	1.61***	1.30***	1.27***	1.30***
North-kivu	1.53***	1.35***	1.30***	1.33***
Maniema	1.74***	1.50***	1.49***	1.51***
South-kivu	1.58***	1.40***	1.37***	1.40***
Katanga	1.66***	1.51***	1.49***	1.52***
Kasaï Oriental	1.61***	1.43***	1.45***	1.45***
Kasaï Occidental	1.81***	1.60***	1.61***	1.63***

(Continued)

Table 2. (Continued)				
Age				
10-15	1	1	1	1
16-20	5.13***	5.26***	5.27***	5.27***
21-25	5.53***	5.99***	6.00***	5.99***
26-35	3.80***	4.05***	4.16***	4.16***
Education				
No education	1	1	1	1
Primary	0.99	1.12***	1.13***	1.13***
Secondary	0.69***	0.81***	0.83***	0.83***
Higher	0.26***	0.25***	0.27***	0.27***
Constant		0.02***	0.03***	0.03***
chi2		7713.19	7659.88	7651.19

Table 3 presents descriptive statistics for the explanatory and control variables for the higher birth parities. The first column presents the distribution of exposure time and the second column the distribution of events (births) across the person years observed for women from 1989 to 2010. The last column presents the distribution of women across categories of the fixed covariates. Fixed covariates are distributed roughly similar across exposure time and events as they are for individual women. Again, the differences reflect differences in the risk of birth (fewer exposure years and more births). The conflict indicators follow a similar pattern as for first births in table 1, where the distributions are roughly the same for exposures and events; a greater proportion of exposures and lower proportion of events means that that birth risk is lower for that category. The same is true for parity. The difference is most marked for years since last birth. Most of the events are observed for the period of 0-2 and 3-5 years since last birth. However, the exposure and the events are similar for the period of 0-2 years since last birth.

Table 3. Descriptive statistics of higher parities

	Years since last birth		Events (births)		N= of women	% of women
TIME-VARYING VARIABLES						
Calendar year						
1989-1995, prewar	15061	12,5	4083	12,7	-	-
1996-2003, Congolese war	40551	33,6	11095	34,4	-	-
2004-2007, insurgency in East DRC	33354	27,6	9104	28,2	-	-
2008-2010, post-war with lingering conflict in East DRC	31867	26,4	7952	24,7	-	-
Nr of conflict event						
no conflict event	63612	52,6	16601	51,5	-	-
Low	14693	12,2	3802	11,8	-	-
Medium	22662	18,8	6255	19,4	-	-
High	19866	16,4	5576	17,3	-	-
Nr of conflict death						
no conflict deaths	63612	52,6	16601	51,5	-	-
Low	23609	19,5	6256	19,4	-	-
Medium	15958	13,2	4459	13,8	-	-
High	17654	14,6	4918	15,3	-	-
Years since last birth						
0-2	73493	60,8	18445	57,2	-	-
3-5	31260	25,9	12091	37,5	-	-
6-10	10772	8,9	1523	4,7	-	-
11-20	4710	3,9	172	0,5	-	-
21-34	598	0,5	3	0,0	-	-
Parity						
1	32880	27,2	8871	27,5	-	-
2	25870	21,4	7116	22,1	-	-
3	19634	16,2	5464	17,0	-	-
4	14686	12,2	4010	12,4	-	-
5	10559	8,7	2854	8,9	-	-
6	7184	5,9	1828	5,7	-	-
7	4662	3,9	1064	3,3	-	-
8-10	4974	4,1	981	3,0	-	-
11-14	384	0,3	43	0,1	-	-
Age						
10-15	793	0,7	169	0,5	-	-
16-20	14302	11,8	3672	11,4	-	-
21-25	34532	28,6	10563	32,8	-	-
26-30	34532	28,6	9145	28,4	-	-
31-49	40001	33,1	8685	26,9	-	-
Child death during infancy						
No child death	96734	80,1	25528	79.2	-	-
Child death	24099	19.9	6706	20,8	-	-

(Continued)

Table 3 (Continued) TIME-FIXED VARIABLES:						
Place of residence						
Urban	39426	32,6	9431	29,3	3636	32.3
Rural	81407	67,4	22803	70,7	7619	67.7
Province						
Kinshasa	9522	7,9	1799	5,6	838	7.5
Bas-congo	6726	5,6	1632	5,1	600	5.3
Bandundu	16431	13,6	4061	12,6	1539	13.7
Equateur	18264	15,1	4920	15,3	1702	15.1
Orientale	13851	11,5	3403	10,6	1317	11.7
North-kivu	6914	5,7	1997	6,2	650	5.8
Maniema	5464	4,5	1542	4,8	519	4.6
South-kivu	6411	5,3	1963	6,1	591	5.3
Katanga	14305	11,8	4173	12,9	1339	11.9
Kasaï Oriental	12785	10,6	3763	11,7	1227	10.9
Kasaï Occidental	10160	8,4	2981	9,2	933	8.3
Education						
No education	29011	24,0	7985	24,8	2603	23.1
Primary	52948	43,8	14970	46,4	4926	43.8
Secondary	37427	31,0	9030	28,0	3572	31.7
Higher	1447	1,2	249	0,8	154	1.4
Total	**120833**		**32234**		**11255**	

Table 4 shows the results from the piece-wise constant hazard regression models. The first column shows results from a set of bivariate models including only the variable in question and time under risk. There was no difference in the risk of births during the Congolese war or in the years that followed than during pre-war; the relative risks were the same as prewar. The direct conflict indicators indicate a higher risk for the medium and high number of conflict events and deaths than no conflict events and deaths. The risk is higher for rural residence compared to urban residence. The conflict provinces (North and South Kivu, Maniema, and Katanga) and the mining provinces (Kasaï Oriental and Kasaï Occidental) had a higher risk compared to Kinshasa. As expected, women age 21-25 had the highest birth risk and the risk of birth was slightly higher if the woman has lost a child during infancy. Women with no education or primary education had the highest birth risk. Birth risks were higher 3-5 years since last birth than during the first two years since last birth. Similar risks were found for women with up to five children, and the risk was than reduced at higher parities.

Model 1 indicates a slight increase in the birth risk during the Congolese war and an even higher risk in the years that followed (2004-2007) and then a slight decrease in the post-war period (2008-2010) compared to prewar. The direct effect estimated in model 1 results from the control for age at birth. The decrease in 2008-2010 might suggest the onset of a fertility decline. This finding is consistent with previous research done on estimation of the total fertility rates (TFR) in the DRC (Romaniuk, 2011; Shapiro & Tambashe, 2001). Model 2 shows that the number of conflict events is associated with higher fertility, but the difference is very small (about 5% higher than with no conflict). The same is shown in Model 3 for conflict deaths.

Table 4 also indicates that the risk is reduced for rural areas once the models control for provinces and the risk is highest in the East provinces, south and north Kivu, Maniema and Katanga compared to Kinshasa. The risk is also high in the mining provinces Kasaï Oriental and Kasaï Occidental, a region marked by high fertility and low access to health care, compared to Kinshasa. The interaction between calendar year and East/West DRC did not improve model fit and is therefore not presented. The risk of birth is highest for women age 21-30 and for women with no education or primary education, with the largest difference between the most highly educated women and other women. There was no distinct difference between the bivariate model and the full models for the years since last birth. Differences by parity were slightly lower in the full models compared to the bivariate model.

Table 4. Higher parity main model.

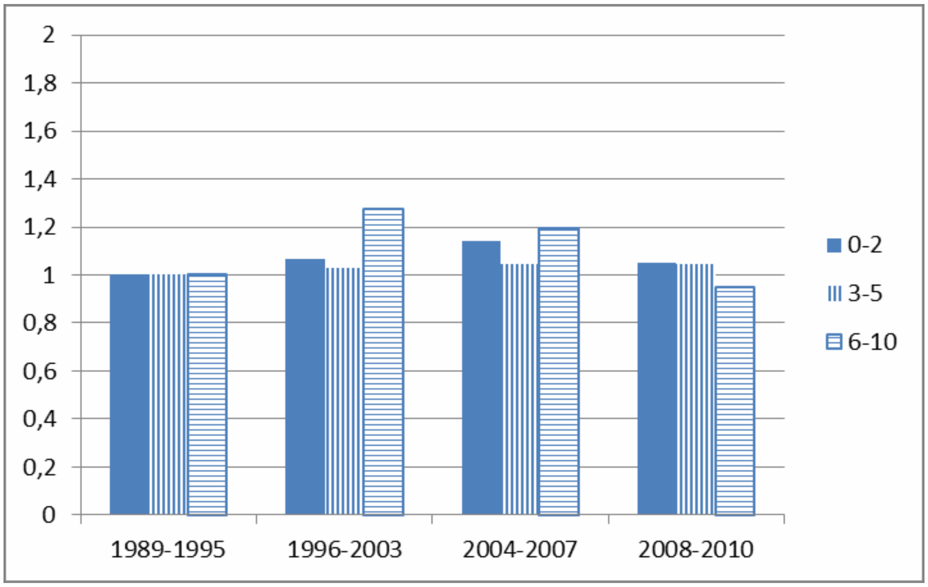
	Bivariate models	Model 1	Model 2	Model 3
Calendar year				
1989-1995, prewar	1	1		
1996-2003, Congolese war	1.01	1.06**		
2004-2007, insurgency period	1.01	1.10***		
2008-2010, post-war with lingering conflicts in East DRC	0.92***	1.03*		
Conflict events				
No conflict events	1		1	
Low nr of events	0.99		1.01	
Medium nr of events	1.06***		1.05**	
High nr of events	1.08***		1.04*	
Conflict deaths				
No conflict deaths	1			1
Low nr of deaths	1.02			1.04**
Medium nr of deaths	1.07***			1.04(*)
High nr of deaths	1.07***			1.03
Place of residence				
Urban	1	1	1	1
Rural	1.17***	1.06***	1.06***	1.06***
Province				
Kinshasa	1	1	1	1
Bas-congo	1.28***	1.10**	1.10**	1.11**
Bandundu	1.31***	1.13***	1.14***	1.15***
Equateur	1.43***	1.26***	1.26***	1.27***
Orientale	1.30***	1.17***	1.15***	1.17***
North-kivu	1.53***	1.35***	1.32***	1.34***
Maniema	1.49***	1.31***	1.32***	1.33***
South-kivu	1.62***	1.46***	1.443***	1.45***
Katanga	1.54***	1.38***	1.36***	1.37***
Kasaï Oriental	1.56***	1.40***	1.40***	1.40***
Kasaï Occidental	1.55***	1.35***	1.36***	1.36***
Age				
10-15	1	1	1	1
16-20	1.20*	1.15(*)	1.16(*)	1.16(*)
21-25	1.44***	1.38***	1.38***	1.39***
26-30	1.38***	1.40***	1.41***	1.41***
31-38	1.02	1.23*	1.25**	1.25**

(Continued)

Table 4 (Continued)				
Child death during infancy				
No child death	1	1	1	1
Child death	1.05***	1.10***	1.11***	1.11***
Continue, table 4.				
Education				
No education	1	1	1	1
Primary	1.03(*)	1.03*	1.03*	1.03*
Secondary	0.88***	0.93***	0.93***	0.93***
Higher	0.63***	0.73***	0.73***	0.73***
Years since last birth				
0-2	1	1	1	1
3-5	1.54***	1.57***	1.57***	1.57***
6-10	0.56***	0.59***	0.59***	0.59***
11-20	0.15***	0.15***	0.15***	0.15***
21-34	0.02***	0.02***	0.02***	0.02***
Parity				
1	1	1	1	1
2	1.02	0.96*	0.96*	0.96*
3	1.03(*)	0.94**	0.94***	0.94***
4	1.01	0.92***	0.92***	0.92***
5	1.00	0.91***	0.91***	0.91***
6	0.94*	0.86***	0.86***	0.86***
7	0.85***	0.78***	0.78***	0.78***
8-10	0.73***	0.66***	0.65***	0.65***
11-14	0.42***	0.36***	0.35***	0.35***
Constant		0.15***	0.15***	0.15***
Lr				
chi2		5152.90	5134.85	5131.71

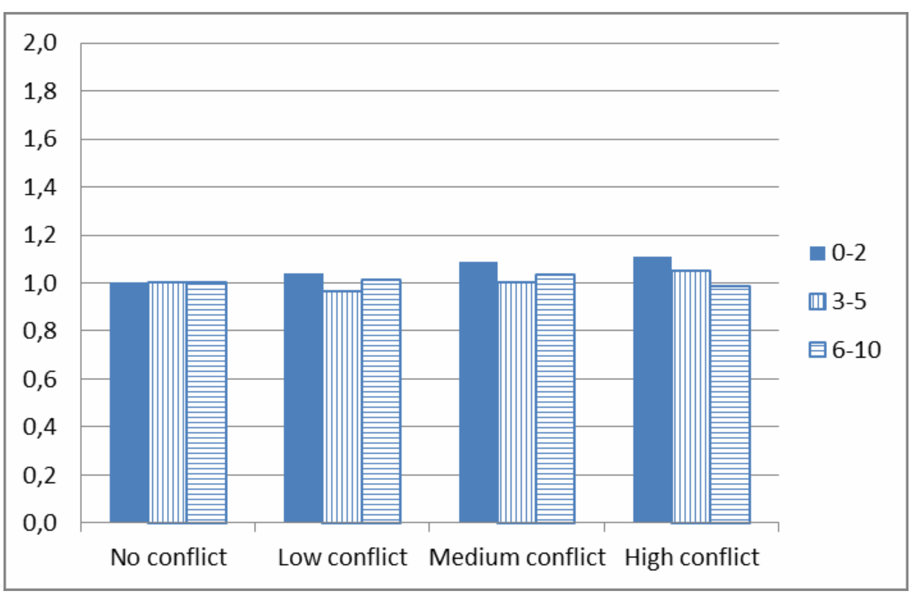
To test the interaction between calendar year and the length of the birth interval, it was necessary to limit the duration to a maximum of ten years after the last birth to avoid empty combinations. The interaction significantly improved the fit over the full model using the limited duration. Figure 2 shows the interaction rescaled so that prewar (1989-1995) is the reference group for all the interval lengths. First, we see a slight increase during wartime and the immediate aftermath in the birth risk at very short intervals, returning to pre-war risk levels in 2008-2010. Second, the birth risk at intervals of 6 to 10 years increased even more. The first result is consistent with increased sexual exposure and lack of contraception, while the second is consistent with a temporary abstinence as war may separate couples and thus lengthen the birth interval.

Figure 2. Interaction between calendar year and years since last birth.



Interactions between each indicator of conflict intensity and birth interval also improved the fit of Models 3 and 4, respectively. As shown in Figures 3 and 4, conflict intensity increased the birth risk primarily for short intervals.

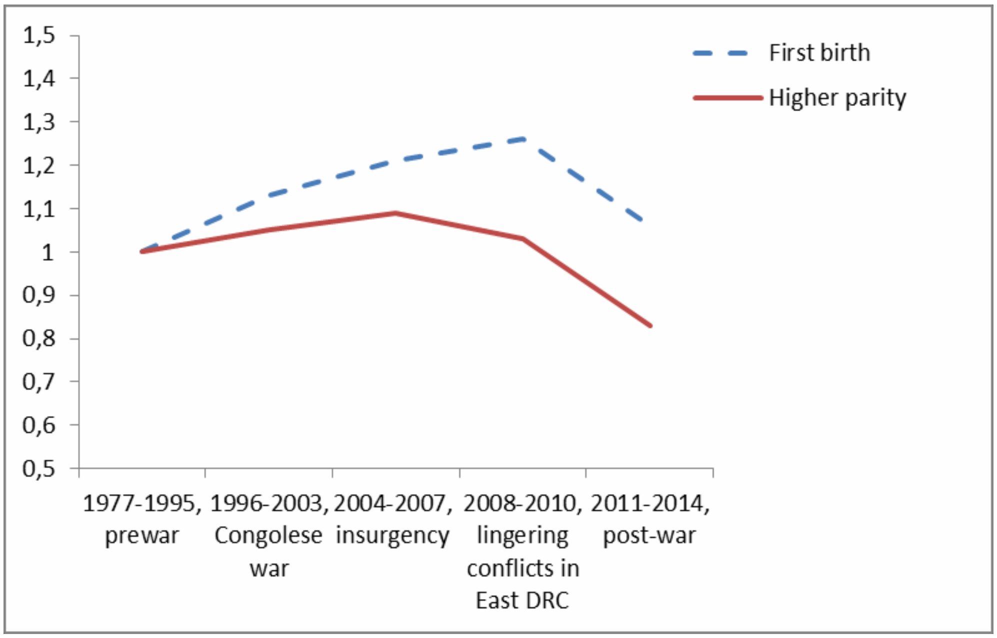
Figure 3. Interaction between conflict events and years since last birth.



Robustness check

To control for secular trends in first births and higher parity births, I include robustness checks by including calendar years after 2010. Figure 5 shows that there is a reduction in the risk of first birth in 2011-2014, suggesting an onset of the fertility transition. Second- and higher-order birth risks continue to decline, following the trend begun in the war's aftermath.

Figure 3. Robustness check of calendar year including year 2011-2014.



Discussion and conclusion

The main finding is that war seems to have delayed fertility transition in the DRC to the post-war period. Increases in higher-order fertility in the years immediately post-war (2004-2007) can possibly be explained by the reunion of temporarily separated couples during war. The conflict effects were not reduced when controlling for previous child death during infancy. Despite the high rates of infant mortality during the Congolese war (Lindskog, 2015), the study finds no support for a replacement mechanism through which conflict might increase fertility. The subsequent decline in first birth and higher-order birth risks indicates an onset of a fertility transition, consistent with Urdal and Chen's (2013) finding that in the cross-section, violent conflicts appear to delay the fertility transition in the poor countries.

The study uses direct measures of conflict intensity across time and place. However, the DHS 2013/2014 does not include information on migration. The limitation of the data related to migration histories may therefore result in measurement error. Some women may have been in different regions at periods earlier in their reproductive lives and experienced different levels of conflict than assigned to them in the analysis. Agadjanian and Prata (2002) studied effects of war in Angola on fertility and found that the probability of a birth declined as the war intensified, followed by a rebound in the after-math. However, using survey data from two peri-urban municipalities of the capital city in Angola including complete birth and migration histories show that short-term war migrants had a higher probability of birth than non-migrants (Avogo & Agadjanian, 2008). Migrating from a region with high intensity of war was associated with increased risk of higher-order births, as was the migration itself.

The DRC experienced extensive migration flows mostly to urban areas (as well as across national borders) and if women did not return by the interview this would mean that some women were coded as being in urban areas when they were actually in rural areas when they were exposed to the risk of a birth. Thus, estimates of rural/urban difference will be biased downward. Errors in measuring conflict could explain why the birth risks were not especially higher during the most frequent and intense levels of conflict.

Although conflict is associated with higher fertility, we cannot determine which of the pathways may underlie the association. The DHS has no information on sexual violence in relation to conception and information regarding breastfeeding practice, postpartum abstinence and abortion was provided only for the five years prior to the survey. It is also possible that the most vulnerable women died during the conflict or resided in refugee camps at the time of the interview and are therefore not included in the DHS. Such possibilities would also serve to generate underestimates of the association between conflict and birth risks.

Nonetheless, this study makes an important contribution to the literature as it deepens the understanding of how war affects parity-specific fertility in a high fertility context. Additional research including refined measures of migration and behavioral factors associated with fertility across time would allow for more nuanced assessments of demographic consequences and implications of war.

Acknowledgments

I would like to thank especially Elizabeth Thomson, Sunnee Billingsley and Sven Drefahl for your much valuable comments and suggestions.

Reference

Abbasi-Shavazi MJ. 2002. Recent changes and the future of fertility in Iran. Department of Demography, Faculty of Social Sciences, University of Tehran, Tehran, IRAN

Agadjanian V, Prata N. 2002. War, peace, and fertility in Angola. *Demography* **39**(2): 215-231. doi.10.1353/dem.2002.0013.

Avogo W. Agadjanian V. 2008. Childbearing in crisis: War, migration and fertility in Angola. *Journal of Biosocial Science* **40**(5): 725-742

Bartels S, Scott J, Leaning J, Mukwege D, Lipton R. 2010. Surviving Sexual Violence in Eastern Democratic Republic of Congo. *Journal of International Women's Studies.* **11**(4): 37-49 http://vc.bridgew.edu/jiws/vol11/iss4/3

Bongaarts J. Frank O. Lesthaeghe R. 1984. The proximate Determinants of Fertility in Sub-Saharan Africa. *Population and Development Review* **10**(3): 511-537

Caldwell JC. 2004. Social Upheaval and Fertility Decline. *Journal of Family History*. **29**(4): 382-406.

Carballo M, Simic S, Zeric D. 1996. Health in Countries Torn by Conflict: Lessons from Sarajevo. *Lancet*. 348(28): 872-875

Coghlan B. Brennan R J. Ngoy P. Dofara D. Otto B. Clements M. 2006. Mortality in the Democratic Republic of Congo: A Nationwide Survey. *Lancet*, 367, 44-51.

Cohan LC, Cole SW. 2002. Life Course Transitions and Natural Disaster: Marriage, Birth, and Divorce Following Hurricane Hugo. *Journal of Family Psychology* **16**(1): 14-25

Curlin GT, Chen LC, Hussain SB. 1976. Demographic crisis: The impact of the Bangladesh civil war (1971) on births in a rural of Bangladesh. *Population Studies: A Journal of Demography*. **30**(1): 87-105

De Bruijn BJ. 1999. Foundation of demographic theory: choice, process, context. Amsterdam, Thesis publishers, 298 p.

de Walque D. 2006. The socio-demographic legacy of the Khmer Rouge period in Cambodia. *Populations Studies*. **60**(2): 223-231
Democratic Republic of Congo the Congo. Demographic and Health Survey 2007. Key Findings. https://www.dhsprogram.com/pubs/pdf/SR141/SR141.pdf Accessed 1 June 2015.

Democratic Republic of Congo the Congo. Demographic and Health Survey 2013/2014. Key Findings. http://dhsprogram.com/pubs/pdf/SR218/SR218.e.pdf. Accessed 1 June 2015.

Fargues P. 2000. Protracted National Conflict and Fertility Change: Palestinians and Israelis in the Twentieth Century. *Population and Development Review*. **26**(3): 441-482

Farwell N. 2004. War Rape: New Conceptualizations and Responses *AFFILIA* **19**(4): 389-403

Garenne J, Joseph V. 2002. The Timing of the Fertility Transition in Sub-Saharan Africa. *World Development* **30**(10): 1835-1843

Holck, S.E. and Cates W. 1982. Fertility and Population Dynamics in two Kampuchean Refugee Camps. *Studies in Family Planning*, **13**(4): 118-124

Human Rights Watch. 2002. The War within the War. Sexual Violence Against Women and Girls in Eastern Congo. www.hrw.org/reports/**2002**/**drc**/Congo0602.pdf

Human Rights Watch. 2004. Struggling to survive: barriers to justice for rape victims in Rwanda. September. ***16****(10)A. http://www.hrw.org/reports/2004/09/29/struggling-survive*

Human Rights Watch. 2009. Soldiers Who Rape, Commanders Who Condone. Sexual Violence and Military Reform in the Democratic Republic of Congo. https://www.hrw.org/report/2009/07/16/soldiers-who-rape-commanders-who-condone/sexual-violence-and-military-reform

Jayaraman A, Gebreselassie T, Chandrasekhar S. 2009. Effect of Conflict on Age at Marriage and Age at First Birth in Rwanda. *Population Research Policy Review* **28**: 551–567

Kandala N-B, Mandundu TP, Mbelas K, Nzita KPD, Kalambayi BB, Kayembe KP, Emina JBO. 2014. Child mortality in the Democratic Republic of Congo: cross-sectional evidence of the effect of geographic location and prolonged conflict from a national household survey**.** *BMC Public Health*. **14**:266 http://www.biomedcentral.com/1471-2458/14/266

Kandala N-B, Madungu TP, Emina JBO, Nzita KPD, Cappuccio FP. 2011. Malnutrition among children under the age of five in the Democratic Republic of Congo (DRC): does geographic location matter? *BMC Public Health* **11**:261. http://www.biomedcentral.com/1471-2458/11/261

Ladier-Fouladi M. 1997. The Fertility Transition in Iran. *Institut National d'Etudes Démographiques*. **9**: 191-213

Lindskog EE. 2014. Violent Conflict and Sexual Behavior in Rwanda. *Population Space and Place*. DOI: 10.1002/psp.1881

Lindskog E Elina. 2015. War effect on infant mortality in the Democratic Republic of Congo. Working paper.

Lindstrom DP, Berhanu B. 1999. The impact of war, famine, and economic decline on marital fertility in Ethiopia. *Demography* **36**(2): 247-261. doi:10.2307/2648112.

Milillo D. 2006. Rape as a Tactic of War Social and Psychological Perspectives. *Journal of Women and Social Work* **21**(2) Sage Publications.

Mock N, Duale S, Brown LF, Mathys E, O'Maonaigh HCO, Abul-Husn NKL, Elliott S. 2004. Conflict and HIV: A framework for risk assessment to prevent HIV in conflict-affected settings in Africa. *Emerging Themes in Epidemiology* **1**(1): 6

Muhwezi W, Kinyanda E, Mungherera M, Onyango P, Ngabirano E, Muron J, Kagugube J, Kajungu R. 2011. Vulnerability to high risk sexual behavior (HRSB) following exposure to war trauma as seen in post-conflict communities in eastern Uganda: a qualitative study. *Conflict and Health* **5**(22).

Olsson O, Fors HC. 2004. Congo: The prize of Predation. *Journal of Peach Research* **41**(3): 321-336

Raschky PA, Wang LC. 2012. Reproductive Behaviour at the End of the World: The Effect of the Cuban Missile Crisis on U.S. Fertility. (November 13, 2012). Available at SSRN: http://ssrn.com/abstract=2175387 or http://dx.doi.org/10.2139/ssrn.2175387.e

Romaniuk A. 2011. Persistence of High Fertility in Tropical Africa: The Case of Democratic Republic of Congo. *Population and Development Review*. **37**(1): 1-28

Schindler K. Brück T. 2011. The Effect of Conflict on Fertility in Rwanda. *Discussion Papers* 1143. IMPRESSUM, DIW Berlin.

Shapiro and Tambashe 2001. Fertility in the Democratic Republic of the Congo. Working paper presented at a United Nations workshop on "Prospects for Fertility Decline in High Fertility Countries," held at the United Nations 9-11 July, 2001.

Stein Z. Susser M. 1978. "Famine and fertility" in Nutritional and Human Reproduction ed. W.H. Mosley (New York: Plenum Press): 123-145

The UCDP GED Point Dataset Codebook: Sundberg R, Melander E. 2013. Introducing the UCDP Georeferenced Event Dataset. *Journal of Peace Research*. **50**(4): 523-532

Urdal H, Che C P. 2013. War and Gender Inequalities in Health: The Impact of Armed Conflict on Fertility and Maternal Mortality. *International Interactions: Empirical and Theoretical Research in International Relations.* **39**(4): 489-510

Van Herp M, Parqué V, Rackly E, Ford N. 2003. Mortality, Violence and Lack of Access to Health-care in the Democratic Republic of Congo. *Disasters* **27**(2): 141-153

Verwimp P, Van Bavel J. 2005. Child Survival and Fertility of Refugees in Rwanda. *European Journal of Population* **21**: 271-29

Winter, J. M. 1992. War, family, and fertility in twentieth-century Europe. In Gillis, J. R. & Levine, T. D. (eds) *The European Experience of Declining Fertility 1850–1970: The Quite Revolution.* Blackwell, Cambridge, MA.

Woldemicael G. 2008 Recent fertility decline in Eritrea: Is it a conflict-led transition? *Demographic Research* **18**(2): 27-58