

# Prevalence of HIV infection in conflict-affected and displaced people in seven sub-Saharan African countries: a systematic review



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## Summary

**Background** Violence and rape are believed to fuel the HIV epidemic in countries affected by conflict. We compared HIV prevalence in populations directly affected by conflict with that in those not directly affected and in refugees versus the nearest surrounding host communities in sub-Saharan African countries.

**Methods** Seven countries affected by conflict (Democratic Republic of Congo, southern Sudan, Rwanda, Uganda, Sierra Leone, Somalia, and Burundi) were chosen since HIV prevalence surveys within the past 5 years had been done and data, including original antenatal-care sentinel surveillance data, were available. We did a systematic and comprehensive literature search using Medline and Embase. Only articles and reports that contained original data for prevalence of HIV infection were included. All survey reports were independently evaluated by two epidemiologists to assess internationally accepted guidelines for HIV sentinel surveillance and population-based surveys. Whenever possible, data from the nearest antenatal care and host country sentinel site of the neighbouring countries were presented. 95% CIs were provided when available.

**Findings** Of the 295 articles that met our search criteria, 88 had original prevalence data and 65 had data from the seven selected countries. Data from these countries did not show an increase in prevalence of HIV infection during periods of conflict, irrespective of prevalence when conflict began. Prevalence in urban areas affected by conflict decreased in Burundi, Rwanda, and Uganda at similar rates to urban areas unaffected by conflict in their respective countries. Prevalence in conflict-affected rural areas remained low and fairly stable in these countries. Of the 12 sets of refugee camps, nine had a lower prevalence of HIV infection, two a similar prevalence, and one a higher prevalence than their respective host communities. Despite wide-scale rape in many countries, there are no data to show that rape increased prevalence of HIV infection at the population level.

**Interpretation** We have shown that there is a need for mechanisms to provide time-sensitive information on the effect of conflict on incidence of HIV infection, since we found insufficient data to support the assertions that conflict, forced displacement, and wide-scale rape increase prevalence or that refugees spread HIV infection in host communities.

## Introduction

There is a common belief that conflict fuels the HIV/AIDS epidemic, and consequently, refugees and internally displaced people fleeing humanitarian emergencies have a high prevalence of HIV infection.<sup>1-6</sup> However, this assumption has been questioned.<sup>7-9</sup> Much of the research behind these claims has not been rigorously assessed and seems to have ignored elements during conflict that might reduce transmission. A notion is emerging about how the HIV epidemic is affected by conflict and forced displacement that depends on the interaction of several complex and commonly countervailing factors.

Sub-Saharan Africa is disproportionately affected by both conflict and the HIV pandemic. Only during the past few years have reports with sufficient data for prevalence of HIV infection become available to make comparisons within and between populations affected by conflict and displacement. These new data allow for a more thorough and scientific assessment of the subject. We asked whether there is evidence to show that conflict increases HIV transmission and whether refugees

fleeing conflict have a higher prevalence of infection than do surrounding host populations. We compared prevalence of HIV infection in populations directly affected by conflict with that in populations not directly affected by conflict but located nearest to the conflict, and compared prevalence in refugees and in the nearest surrounding host communities.

## Methods

### Search strategy and selection criteria

From May, 2005, to September, 2006, we searched PubMed, Medline, and Embase from January, 1981, onwards without language restrictions, using Medical Subject Heading terms to identify papers that dealt with the topic of HIV and armed conflict or HIV epidemic. Database searches were done with one or more combinations of the following terms: "HIV", "AIDS", "conflict", "war", "insurgency", and "refugee". Once countries were selected, searches were then done by combination of country names and one or more of the search terms.

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See [Comment](#) page 2140

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For refugees, we used original data from UN High Commissioner for refugees (UNHCR) antenatal-care sentinel surveillance (antenatal-care clinics provide the most accessible cross-section of healthy, sexually active women in the general population, and are the most common sites for sentinel surveillance in most developing countries) in collaboration with national governments or the Centers for Disease Control and Prevention (CDC) in the USA, following national government protocols including quality-assurance methods. All final reports were reviewed and approved by UNHCR and national governments.

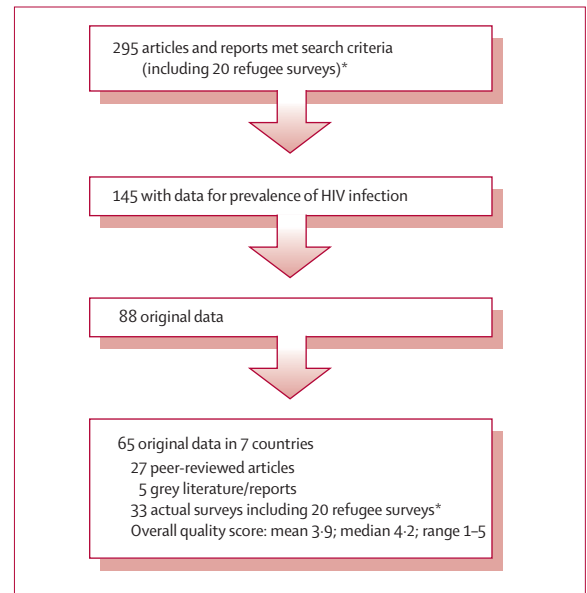
We identified published country and antenatal-care sentinel-site surveillance data for HIV from the UNAIDS and WHO global HIV/AIDS online database.<sup>10</sup> Web-based searches of governmental and non-governmental organisations were done to obtain both published and unpublished articles. Complete articles and documents were analysed except in two instances, which are discussed in the text.

We then searched the references of these publications to identify further relevant research and approached the authors of studies whose publications suggested that data for prevalence of HIV infection existed but were not included in their articles or reports (three of five authors were contacted and produced data; two did not respond despite repeated attempts). Some articles and reports were written in French or Spanish; at least one of the authors is fluent in each of these languages.

All original surveys presented were approved by ethics committees in the countries where the research was done; in some instances, universities and the CDC also approved the research through their ethics review boards.

#### Country and comparison site selection

From the global literature search, we identified seven countries with a history of widespread conflict that had original data for prevalence of HIV infection within the past 5 years. These data allowed for a comprehensive interpretation of the HIV epidemic in these countries, and included original antenatal-care sentinel surveillance data for refugees in six countries. Dates for the conflicts were obtained from the Uppsala database—a comprehensive database assessing armed conflicts.<sup>11</sup> The countries were: The Democratic Republic of Congo (DRC), southern Sudan, Rwanda, Uganda, Sierra Leone, Somalia, and Burundi. The DRC has not been at peace since independence from Belgium in 1960. The conflict intensified with large-scale killing and rape in 1997 and, despite a 2003 peace accord, violence continues in eastern areas. The civil war in southern Sudan began in 1983 and there has been tenuous peace after the peace agreement was signed in January, 2005. In Rwanda, there was political instability from 1990 to 2002, with genocide in 1994. Uganda underwent conflict in 1978–79 when the Tanzanian People's Defence Force invaded and ended



**Figure: Selection of studies meeting inclusion criteria**

\*Antenatal-care sentinel surveys in refugees undertaken by UNHCR and its partners.

the rule of Idi Amin, in a civil war that ousted Milton Obote in the early 1980s, and the present conflict in northern Uganda that began in 1988. The civil war in Sierra Leone between 1991 and 2000 was characterised by widespread violence and rape. In Somalia, the civil war officially lasted from 1989 to 2002, when a cease-fire agreement was signed by the warring parties. However, political discord and conflict continue. Burundi has had low-intensity conflict with intermittent high-intensity episodes since 1991.

Antenatal-care sentinel sites not directly affected by conflict, which were nearest to areas affected by conflict, were chosen. The nearest surrounding host community with data for prevalence of HIV infection was selected to compare with prevalence in refugee sites. In most circumstances, antenatal-care sentinel data were used. In Tanzania, where there were no sentinel-site data in the regions in which the refugee camps were located, population-based data by region were used as a comparison. Such comparisons were not definitive because of differences in population sizes, urban-rural and socioeconomic disparities, and the varying proximity of the different sites to one another.

#### Review process

We included only articles and reports that contained original data for prevalence of HIV infection. Two trained epidemiologists (PBS, AR) independently reviewed these publications and examined the sample size and power, sampling method, testing algorithm, results, and interpretation of the data. A quality score between 1 and 5 (the highest score was 5) was calculated for every paper on the basis of these criteria (figure). UNHCR original data

were examined by a UNHCR epidemiologist and host national government professionals, and CDC personnel when applicable. We used host government protocols and quality procedures following internationally accepted guidelines. UNAIDS and WHO reports on prevalence of HIV infection<sup>10</sup> have a rigorous group assessment procedure before publication.<sup>12,13</sup> Individual countrywide HIV sentinel surveillance and population-based reports that were not yet on the UNAIDS or WHO website<sup>10</sup> followed international guidelines and were released jointly by host governments, UNAIDS, and WHO. All other survey reports were independently assessed by two epidemiologists (PBS and AR) to see whether they met internationally accepted guidelines for HIV sentinel surveillance<sup>14</sup> and population-based surveys.<sup>15</sup> When both epidemiologists agreed that the sampling method or testing algorithm in any of these studies did not meet guidelines, the publication was excluded. Furthermore, when results and interpretation of the data were regarded as biased by both evaluators, the publication was included but we discussed the biases. All articles with original data from the seven countries were abstracted by one epidemiologist and then confirmed by another (PBS and AR).

### Statistical methods

The data for prevalence of HIV infection presented here are from antenatal-care sentinel surveillance unless otherwise specified. Population-based survey data were also reported; such data generally indicate lower rates than antenatal-care sentinel data, and comparisons between the two should be interpreted with caution.<sup>16,17</sup> When available, the corresponding 95% CIs for the HIV prevalence estimates are provided. Statistical significance refers to a statistical test ( $\chi^2$ ) with  $\alpha=0.05$ . No pooled analysis was done.

### Role of the funding source

The sponsor of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

### Results

The figure shows the selection of studies meeting inclusion criteria. Nine articles and reports included original data from at least one of the authors. The findings are summarised by country. Although some data for prevalence of HIV infection are available in the DRC since the late 1980s,<sup>10,16,18,19</sup> until recently there have been no reliable data from the east, which has been affected by conflict. A 1997 study<sup>20</sup> in western DRC (Kinshasa, Mbuji-Mayi, and Bwamanda) showed prevalence to have changed little despite political instability and a poor environment since 1991; HIV-2 infection was rare. However, the sample size of pregnant women in Bwamanda was insufficient.<sup>20</sup> In 2002,

	Prevalence (95% CI)	Neighbouring country* and nearest sentinel site (2002)	Prevalence
Bukavu (urban)	3.1% (1.9–5.1)	Burundi, Kayanza (semiurban) Muramvya (rural)	10.2% 14.7%
Bunia (urban)	3.2% (2.0–5.1)	Uganda, Arua (rural)	5.2%
Goma (urban)	5.4% (3.8–7.6)	Rwanda, Gisenyi (rural)	7.1%
Kindu (urban)†	3.7% (2.4–5.8)	..	..
Kisangani (urban)†	6.3% (4.4–8.8)	..	..
Lodja (rural)†	6.6% (4.8–9.1)	..	..
Neisu (rural)	6.7% (4.7–9.2)	No site near border in Sudan	
Karawa (rural)	4.5% (2.9–6.6)	Central African Republic, Bangassou (rural)	9.0%

\*Tanzania and Zambia do not have any sentinel sites close to the above-listed sentinel sites for eastern DRC. †These sentinel sites are not near the border.

**Table 1: Prevalence of HIV infection in eastern DRC (2004) and in nearest neighbouring-country sentinel sites**

	Prevalence (95% CI)	Year	Host population	Prevalence (95% CI)	Year
<b>Burundian refugees in Tanzania</b>					
Mtabila and Muyovosi camps	1.7%	2001	Kigoma region*	2.0%	2003
	4.5%	2003			
Nduta and Mtendeli camps	1.3%	2001			
	1.6%	2002			
	1.7%	2003			
Lukole Camp	4.8%	2001	Kagera region*	3.7%	2003
	3.1%	2002			
	1.6%	2003			
<b>DRC refugees in Tanzania</b>					
Lugufu and Nyaragusu camps	1.0%	2001	Kagera region*	3.7%	2003
	2.5%	2002			
	1.8%	2003			
<b>DRC refugees in Rwanda</b>					
Gihembe camp	1.5% (0.4–3.8)	2002	Byumba site	6.7% (4.7–9.4)	2002
<b>DRC refugees in Zambia</b>					
Mwange camp	1.2%	2005	Nchelenge site	18.9%	2002
Kala camp	3.4%	2005			
<b>Eritrean refugees in Sudan</b>					
Several camps in eastern Sudan	4.1%	2002	El Gadarif site	4.0%	1998
<b>Sudanese refugees in Uganda</b>					
Palorinya settlement	1.0% (0.3–1.8)	2004	Immediate surrounding population	5.9% (1.7–10.1)	2004
			Moyo site	4.3%	2002
Kyangwali settlement	2.7% (1.3–4.0)	2004	Immediate surrounding population	2.8% (1.0–6.6)	2004
			Hoima site	4.6%	2002
<b>Sudanese refugees in Kenya</b>					
Kakuma camp	5.0% (3.5–7.0)	2002	Lodwar site	18.0%	2002
<b>Somali refugees in Kenya</b>					
Dadaab camps	0.6% (0.01–1.1)	2003	Garissa site	26.0%	2002
	1.4% (0.5–2.2)	2005		11.0%	2004

\*Population-based data.

**Table 2: Prevalence of HIV infection in refugees and host communities in selected sites, 1998–2005**

convenience sampling with a selection bias excluding rural populations was again used in four areas of DRC (Kinshasa and Mbuji-Mayi in the west and Kisangani and Lubumbasha in the east).<sup>21</sup> No clear trend emerged from the previous study in Kinshasa and Mbuji-Mayi. However, despite the reported rape of women and girls in Kisangani,<sup>21</sup> the rate of HIV infection in pregnant women was similar to or lower than that in 1999 (3.4% [95%CI 2.5–7.4] vs 9.0%). Although the authors claimed that prevalence of HIV infection was higher for internally displaced people in Lubumbasha than for non-internally displaced people in this region (7.1% [3.1–13.6] vs 3.4% [2.5–7.4]), the CIs overlap and the method used to estimate prevalence was not stated.<sup>21</sup> A prevalence of 24.1% was estimated in Kalemie health zone, North Katanga, in 2001.<sup>22</sup> However, concerns about the validity of that study were justified, because HIV-1 prevalence was 5.9%, HIV-2 13.8%, and mixed infection 4.5%. HIV-2 is not common in DRC, and the 2003–04 countrywide study reported negligible rates of HIV-2 infection throughout the country.

The first countrywide antenatal-care seroprevalence study since the war began was undertaken in 2003–04, and estimated an overall prevalence of HIV infection of 4.9% (4.3–5.6), with no apparent difference between western and eastern DRC (4.1% [3.6–4.7] vs 4.9% [4.3–5.6]).<sup>23</sup> Although western regions showed a typical pattern<sup>16,19</sup> of higher urban than rural prevalence (5.2% [4.4–6.3] vs 2.1% [1.4–3.3]), the contrary was noted for eastern regions (4.4% [3.6–5.2] vs 5.9% [4.8–7.2]).<sup>23</sup> Prevalence in eastern DRC sites seemed to be lower than in the nearest sentinel sites in neighbouring countries, except for Rwanda where it was much the same (table 1).

Data are available for Congolese refugees in three countries (table 2). In Rwanda, refugees primarily came from rural areas of north and south Kivu provinces (eastern DRC) in 1995–96. In 2002, refugees had a lower prevalence of HIV infection than did surrounding host populations.<sup>24</sup> In Tanzania, refugees came from rural areas of south Kivu province in 1996 and 1998. Antenatal-care sentinel surveillance for refugees took place yearly from 2001 to 2003.<sup>25–27</sup> Although there are no Tanzanian sentinel sites near the camps, a 2003 population-based survey in Kigoma, Tanzania, where camps are located, had a higher prevalence than in the camps.<sup>28</sup> In Zambia, refugees came from rural areas of Katanga province in 1997–98. In 2005, prevalence of HIV infection was lower in Mwange and Kala camps<sup>29</sup> than in the nearest Zambian sentinel site.<sup>10</sup> No data are available for rural south and north Kivus, from where refugees in Rwanda and Tanzania originate. However, the urban site in Bukavu, south Kivu, had a 2004 prevalence of 3.1%.<sup>23</sup> We identified no data for rural Katanga province, from where refugees in Zambia originate.

We found few data for HIV infection from southern Sudan. A 2002–03 population-based survey and sequential

sampling in antenatal-care clinics in Yei, Western Equatoria, and Rumbek (Bar-el-Ghazal) reported a prevalence in people aged 15–49 years of 0.4% in Rumbek town and 4.4% in Yei town, and 0.8 and 3.0% in pregnant women from antenatal-care clinics, respectively. The prevalence in rural Yei was 0.7% (0–1.6) for people aged 15–49 years.<sup>30</sup> Although the methods were sound, 26% of individuals refused to have their blood drawn and tested for HIV. In Juba, the largest town in southern Sudan, prevalence of HIV infection was 3.0% in outpatients (n=309)<sup>31</sup> in 1995 and 4.0% in 1998.<sup>10,32</sup> The prevalence of the nearest sentinel sites of southern Sudan's neighbouring countries at peace was 18% in Lodwar, Kenya (in 2002),<sup>33</sup> 11% in Mboki, Central African Republic (2002),<sup>10</sup> and 14.6% in Gambella, Ethiopia (2001),<sup>10</sup> whereas prevalence in settings affected by conflict was 4.3% in Moyo, Uganda (2002)<sup>34</sup> and 3.2% and 6.7% in Bunia and Neisu, DRC, respectively (2004).<sup>23</sup> There were no reliable data with which to compare prevalence of HIV infection in northern Sudan with that in southern Sudan.<sup>35,36</sup> However, several studies suggest that the HIV epidemic in this country seems to be dominated by east African viruses, and that soldiers and internally displaced people might have introduced the virus into the north from the south.<sup>31,37,38</sup>

Information about prevalence of HIV infection was available for Sudanese refugees in Kenya and Uganda (table 2). Kakuma refugee camp in Kenya was established in 1992, and the prevalence was 5.0% in 2002.<sup>39</sup> No data exist for the immediate surrounding host population; the nearest sentinel site of Lodwar had a prevalence of 18.0% in 2002.<sup>33</sup> Sudanese refugees arrived in Uganda between 1995 and 1998. HIV data are available for Kali health centre (Palorinya settlement in Moyo district) and Rwenyawawa health centre (Kyangwali settlement in Hoima district) for 2004.<sup>40</sup> In Palorinya, prevalence was lower for refugees than for the immediate surrounding population.<sup>34,40</sup> In Kyangwali, the prevalence in refugees was similar to that of the immediate surrounding population; the nearest sentinel site of Hoima had a prevalence of 4.6% in 2002.<sup>34,40</sup> No data exist for Sudanese refugees in Central African Republic or DRC. Sudanese refugees in Ethiopia were estimated to have a prevalence of HIV infection of 2% (0.0–8.0; n=94); however, this sample, besides being small, seemed to include both refugees and local people.<sup>41</sup> No data exist from the mostly rural areas of southern Sudan when the refugees fled. Furthermore, other than for Juba, time-trend data are not available.

Prevalence of HIV infection in Rwanda has been well documented (see webfigure 1).<sup>10,24,42–46</sup> Antenatal-care sentinel data show a consistent decrease in prevalence in Kigali during the years of instability (1990–2002) and after the 1994 genocide, with a rising prevalence outside of Kigali beginning in the early 1990s, peaking in 1996, and then falling.

Many articles reported that the 1994 genocide caused a substantial increase in HIV infection in the rural

See Online for webfigure 1

population because of massive displacement, population mixing, and wide-scale rape.<sup>47–52</sup> The most common claim of reduction in the urban-rural prevalence gap is based on two studies—a peer-reviewed population-based national survey in 1986 that estimated rates of 17·8% and 1·3% in the urban and rural populations, respectively,<sup>42</sup> and an unpublished population-based survey with purposive sampling in 1997 that estimated rates of 11·6% and 10·8%, respectively.<sup>44</sup> Another examination of the urban-rural divide was a small 1995 study of antenatal-care data in Kigali, which reported that women who lived in Kigali before 1994 (n=291) had a prevalence of HIV infection of 26·1% (20·9–31·3) compared with 24·4% (18·5–30·3) in women who had lived outside of Kigali (n=113).<sup>50</sup> The estimates of the number of women raped during the genocide varies from thousands to hundreds of thousands.<sup>53</sup> The most common claim that large-scale rape during the genocide greatly increased prevalence is based on an unpublished report of 1125 female survivors, of whom about 70% were positive for HIV.<sup>54,55</sup> We could not examine the full report despite repeated attempts to contact the authors. In comparison, the 1997 study reported that of the 4800 surveyed women, only 2·2% had ever been raped; most rapes took place during the conflict. Of the rape survivors, 15·2% were positive for HIV compared with 11·0% in women not raped (p=0·16).<sup>44</sup>

Huge numbers of Rwandans from all over the country were displaced, during the 1994 genocide, to Tanzania, DRC, and Burundi. Data for the prevalence of HIV infection in refugees are scarce. One study of Rwandan refugees in Goma had a small sample size (n=96) and was not representative of the population.<sup>56</sup> Prevalence of HIV infection was not measured for Rwandan refugees in Tanzania, although some data from the 1997 survey in Rwanda are available for displaced people (returned refugees and internally displaced people) from 1994 to 1997.<sup>44</sup> Of the 4793 people in the study, 73·7% had been displaced. The overall prevalence of HIV infection in displaced people did not seem to differ from that in the overall population of the survey (10·5% [9·5–11·5] vs 11·1% [10·2–12·0]).<sup>44</sup> Unfortunately, prevalence in displaced and non-displaced people were not compared.

Some available data support the claim that armed conflict in Uganda in 1978–79 might have disseminated or seeded HIV infection throughout the country. A positive correlation was recorded between ethnic patterns of recruitment into the Uganda National Liberation Army in 1979 and clinically reported AIDS cases in 1990.<sup>57</sup> A similar claim, of seeding by troop movements of the Tanzania People's Defence Force during the liberation war, was also made.<sup>58</sup> However, the very short incubation period, of 3 years from the initial HIV infection to death from AIDS, makes this assertion suspect. There are no data to show how the civil war in the early 1980s that ultimately ousted Milton Obote affected prevalence of HIV infection in Uganda.

The prevalence of HIV infection in northern Uganda, as in the rest of the country, fell during the 1990s and early 2000s. However, there is concern that the prevalence in some parts of the country might now be rising.<sup>59</sup> HIV prevalence in the Acholi district, specifically Gulu, fell from 27·0% in 1993 to 12·8% in 1998, and 11·3% in 2003 (see webfigure 2).<sup>34,60</sup> Although the intensity of the conflict increased from 1996 onwards, trends from 1998 to 2003 showed a larger decrease in Gulu than in peaceful western and eastern Uganda, represented by the sentinel sites of Mbarara and Mbale regional hospitals, respectively. However, prevalence remains high in Northern Uganda; in 2002, Gulu had the highest prevalence (11·9%) of all sentinel sites in Uganda, followed by Mbarara (10·8%), and Kampala (8·3%)—these three sites are urban areas. The HIV prevalences in the more rural sites in Northern Uganda are much lower than in Gulu. For example, data from prevention of mother-to-child transmission programmes (>97% uptake by pregnant women) were 4·9% in Pader in 2003 and 7·4% in Kitgum.<sup>61</sup> The prevalence of HIV infection at the nearest sentinel sites of Uganda's neighbouring countries was 3·2% in Bunia, DRC (which was affected by conflict; data from 2004),<sup>23</sup> 3·0% and 0·8% in Yei and Rumbek, southern Sudan, respectively (affected by conflict; data from 2002 and 2003),<sup>30</sup> and 18·0% in Lodwar, Kenya (peaceful, data from 2002).<sup>33</sup>

Estimates of prevalence of HIV infection during the war in Sierra Leone fluctuate widely. National prevalence was estimated at 4·0% in 1995, 7·0% in 1997, and 3·0%, in 2000.<sup>10,32,62</sup> Countrywide population-based surveys after conflict were done in 2002 (overall prevalence 0·9% [0·4–1·3]; Freetown 2·1% [1·2–2·9]; outside of Freetown 0·7% [0·2–1·2])<sup>63</sup> and in 2004 (overall 1·5%; urban 2·1%; rural 1·3%).<sup>64</sup> Sierra Leone has a lower prevalence of HIV infection than does neighbouring peaceful Guinea. Lower Guinea has a prevalence of 2·7%, middle Guinea 3·9%, and upper Guinea 2·1% for pregnant women living in urban areas in 2001.<sup>65</sup> The neighbouring country of Liberia, which had been in conflict for 13 years until 2002, does not yet have reliable HIV data. Refugees from Sierra Leone sought refuge in the rural areas of the Guinean Forest region, but no prevalence studies were undertaken in this group.

In Somalia, few HIV data were available before the 2004 countrywide antenatal-care sentinel surveillance survey was undertaken.<sup>66</sup> No antibodies to HIV were detected in blood screening of urban and rural populations before and during the conflict from 1978 to 1995.<sup>67–70</sup> The 2004 survey showed a national prevalence of HIV infection of 0·9%, with the central-south area at 0·6%, northeast at 1·0%, and northwest at 1·7%. The prevalence at the nearest sentinel sites of Somalia's neighbouring countries was 19% in Jijiga, Ethiopia (2001),<sup>10</sup> 11% in Garissa, Kenya (2004),<sup>10</sup> and 2·9% in Djibouti (only 2003 national data are available).<sup>10</sup> Somali refugees went to Dadaab refugee camps, Kenya, in 1991–92. Sentinel surveillance was

See Online for webfigure 2

undertaken in 2003 (0.6% [0.01–1.1]) and 2005 (1.4% [0.5–2.2]), and showed that HIV infection did not differ between these years ( $p=0.2$ ).<sup>71,72</sup> There are no HIV data for the immediate surrounding populations. Garissa town, the nearest sentinel site, had a prevalence of 4% in 2002 and 1% in 2004.<sup>33</sup> Refugees primarily came from the central-south zone in Somalia.<sup>66</sup>

In Burundi, conflict began when the country had fairly high rates of HIV infection that were higher in the capital cities than outside; prevalence was similar to that in Uganda and Rwanda. The prevalence in Bujumbura, the capital city, fell over time, whereas the rural prevalence lagged behind, with an increase in the mid 1990s followed by a decrease. A national antenatal-care survey in 2003 showed an overall prevalence of 3.9%, with 6.2% and 2.1% in the urban and rural areas, respectively.<sup>18</sup> Burundian refugees were displaced to Kigoma and Kagera regions in northwest Tanzania in the early 1990s. Prevalence of HIV infection was documented in these camps between 2001 and 2003 (table 2).<sup>25–27</sup> There are no data for the immediate surrounding host populations, although population-based data exist for each of the regions.<sup>28</sup> We found no suitable data for the rural areas in which Burundi refugees originate, since most sentinel sites in these areas are semiurban.<sup>10</sup>

Of the 12 sets of refugee camps, nine (75%) had a lower prevalence of HIV infection, two (17%) a similar prevalence, and one (8%) a higher prevalence than their respective host communities.

## Discussion

From original data combined with a systematic review of published work, we conclude that there is insufficient evidence that HIV transmission increases in populations affected by conflict. Furthermore, there are insufficient data to conclude that refugees fleeing conflict have a higher prevalence of HIV infection than do their surrounding host communities. In many circumstances, comparisons of HIV prevalence in both situations show the opposite result.

Data collection during conflict, although possible, is fraught with difficulties and interpretation should be cautious.<sup>7</sup> Such estimates need to be supplemented with reliable data from after conflict. Many of the estimated rates of HIV infection during conflict were shown to be high compared with nationwide surveys undertaken immediately after conflict, as was the case for Sierra Leone and eastern DRC. Poor survey methods, restricted accessibility favouring urban areas with high prevalence, and biased interpretation of data might have led to the high rates often reported during conflict. Such results are consistent with preconceived notions that the military and wide-scale rape increase HIV transmission at a population level. This study shows the need for mechanisms to provide time-sensitive information on the effect of conflict on disease incidence.

Some evidence supports the claim that armed conflict could disseminate or seed HIV throughout a country when the epidemic is in its early stages. This dissemination might have allowed the virus to spread rapidly in areas where it might not have appeared as quickly if conflict and subsequent demobilisation had not taken place. Uganda seems to have experienced this effect in 1978–79, as did Guinea Bissau, where an armed struggle for independence from Portuguese rule occurred from 1963 to 1974.<sup>73,74</sup> There is evidence that war in southern Sudan introduced the virus from the south to the north.<sup>31,37,38</sup> However, despite claims to the contrary, there are no data to show that conflict increased the prevalence of HIV infection in the seven African countries studied irrespective of the magnitude of prevalence at the start of the conflicts.

A plausible explanation for results from DRC, south Sudan, Sierra Leone, and Somalia is that conflict began when the prevalence of HIV infection in those countries was low and remained fairly low throughout the conflict compared with their peaceful neighbouring countries. Mass killings, forced displacement, and hiding can lower the incidence of infections and consensual exposures, and reduce social networks in which individuals might be exposed to HIV. Refugees who fled from these countries could have had a similar level of prevalence of HIV infection to their surrounding host communities. However, since there are no data from the areas of origin and asylum at the time the refugees fled for these countries, this notion is not certain. This contention is reinforced by data showing that prevalence of HIV infection is lower in rural areas, from where most of the refugees in these countries came, than in urban areas. However, eastern DRC had a similar prevalence for both rural and urban areas, perhaps because of factors related to mining sites in rural areas. Further studies are needed to explain these data, including the addition of more rural sites in future surveys. The scarce trend data for refugees suggest that their prevalence of HIV infection increases over time towards that of the host communities. There is no evidence that refugees exacerbate the HIV epidemic in host communities.

Despite the high prevalence of HIV infection at the time of conflict in northern Uganda, Rwanda, and Burundi, prevalence decreased over time in a manner similar to areas in the country that were not affected by conflict (ie, Uganda). Apart from eastern DRC, prevalence was higher in urban than in rural areas, as is common in many parts of sub-Saharan Africa.<sup>16,19</sup> This difference could be a major determinant of prevalence of HIV infection, irrespective of a country's state of conflict. Refugees generally come from rural areas affected by conflict, which might explain why they seem to have a lower or similar rate of HIV infection to that of host communities, even if they fled from high-prevalence countries, as was the case for Burundi.

The 1994 genocide in Rwanda resulted in enormous death and suffering. The available evidence does not suggest that population incidence of HIV infection

increased as a result of the genocide, as has been previously claimed. Articles showing that the prevalence in rural populations increased after the genocide because of widespread mixing of urban and rural populations outside of Rwanda are based on biased surveys with restricted geographical coverage that over-represent periurban and semiurban areas and under-represent rural areas.<sup>44,50</sup> In Kigali, prevalence of HIV infection has fallen since the late 1980s, whereas in areas outside Kigali it increased until the mid 1990s and then decreased. This trend is similar to that in Burundi and might represent the natural course of the epidemic in this region. The large number of deaths in Rwanda during the short time when the genocide occurred makes assessment of the incidence of HIV exposure during the genocide impossible.

Rape is often used as a weapon of war, as has been well documented in DRC,<sup>75</sup> Rwanda,<sup>53</sup> Sierra Leone,<sup>76</sup> and Liberia.<sup>77</sup> Owing to the complexity of such settings and the large number of deaths and displacements, assessment of the effect of rape on incidence of HIV infection is especially difficult, and numbers of rapes are often underestimated because of a reluctance to discuss such painful experiences.<sup>78</sup> Although every occurrence of rape is abhorrent and could increase an individual's risk of contracting HIV infection, there are no data to show that wide-scale rape raised the overall prevalence of infection in the populations of these seven countries. Many interacting factors should be considered, including the rates of HIV infection of the rapists and rape survivors, the probability of transmission from rape, and the eventual number of survivors who become HIV-infected. Survivor infection rates should be compared with the overall population size and prevalence of infection of the country. Although estimation of the probability of HIV transmission from rape is difficult, it is probably higher than from consensual sex because of genital or rectal trauma and several assailants.<sup>79</sup> For consensual sex, transmission risk in discordant couples varies from one in 330 to one in 3300 exposures.<sup>80</sup> Prevalence of HIV infection in Sierra Leone remained fairly low even though rape occurred on a wide scale. Despite assertions that extensive rape in eastern DRC fuelled the HIV epidemic,<sup>1,81</sup> we found no significant difference between the prevalence in western and eastern regions of the country.<sup>23</sup> Although the scale of rape and its effect on incidence of HIV infection during the Rwandan genocide are unclear, the actual transmission of HIV during rape at the time of the event is only one element that should be considered. War and rape might cause the survivor to be shunned from his or her community and thus engage in high-risk sex to survive. In communities, war and rape can change societies' culture, which unless challenged directly, could be passed on to future generations (Garrett L, personal communication).

Reconstruction periods after conflict might be a more vulnerable time for HIV transmission than during conflict. As countries recover from the physical and psychological

trauma of conflict, transport increases, building takes place, and people migrate to urban areas in search of work.<sup>7,82</sup> However, data from these seven countries to accord with this assertion are scarce. Although the two population-based surveys in Sierra Leone after conflict suggest a rise in prevalence, the studies are different and cannot be directly compared. The 2002 HIV study surveyed people aged 12–49 years in 79% of the country, whereas that in 2004 surveyed those aged 15–49 years throughout the whole country. Further comparable studies over time are needed to examine this hypothesis.

Our study has several strengths and limitations. We searched extensively, contacted authors and policymakers to assess the quality of published and unpublished data, and visited all the countries discussed. We have extensive experience working on HIV infection in conflict areas. However, the study is restricted by the nature and quality of the work in displaced populations and countries affected by conflict. The nature of displacement suggests that proportions of populations who were once directly affected by conflict might not be identified by surveys. Similarly, populations that have been affected by violence might be unwilling to undergo voluntary testing, which could contribute to biased assessments. Furthermore, although abstraction of data was undertaken by one epidemiologist then confirmed by another, it was not done in duplicate by two independent reviewers with agreement expressed by  $\kappa$  statistics.

Reliable time-trend data for prevalence of HIV infection for DRC, South Sudan, Sierra Leone, and Somalia were scarce. Although prevalence in these countries was unlikely to fall substantially during the conflict to low levels relative to that of its peaceful neighbours, this possibility cannot be ruled out. Consequently, we cannot definitively conclude that the prevalence in these countries was low when conflict began, although this was likely. Comparisons of neighbouring countries' nearest sentinel sites and the nearest surrounding host community sites with refugee sites are subject to biases from geographical considerations, urban versus rural factors, and year of measurement. Thus, comparisons should be made cautiously. Comparable HIV data are needed for refugees and their immediate surrounding populations. Furthermore, these data need to be adjusted for age to improve comparability. Finally, comparisons between prevalence of HIV infection established by antenatal-care sentinel surveillance and population-based survey data should be made carefully because, for the most part, rates are higher with antenatal-care sentinel surveillance than with population-based surveys.<sup>16,17</sup>

Past assumptions that conflict and displacement increase prevalence of HIV infection were made from a few surveys, some of questionable quality and others with biased interpretation of results. Displaced populations and those affected by conflict are clearly at risk of HIV transmission. Furthermore, to expect that incidence of HIV infection will be high in survivors of

conflict and rape is understandable. However, these assumptions were not rigorously scrutinised, and there were insufficient data available to examine the wider connection between conflict and displacement in several countries—only recently have sufficient studies become available to do so. Although some conclusions from the seven African countries studied here might apply to other countries affected by conflict, every situation is unique and should be examined according to context. Generalisations should be avoided, since they probably led to the original unsubstantiated assumptions that we investigated. Furthermore, the many factors and their interplay that affect prevalence of HIV infection in refugees could be different for internally displaced people. There are insufficient data to make any conclusions about prevalence in people who are internally displaced.<sup>83</sup> Although challenging, prospective HIV studies in displaced communities and in those affected by conflict compared with nearby host communities unaffected by conflict are needed to further elucidate the complex factors that affect HIV transmission in these populations.

#### Contributors

PBS conceived the idea for the study and undertook original research in Sierra Leone and South Sudan. PBS, LB, NP, DY, and MS undertook sentinel surveillance in refugee camps. PBS, AR, and JC reviewed the literature. All authors analysed data. PBS, ARB, and JC wrote the paper, and LB, NP, DY, and MS reviewed the final draft.

#### Conflict of interest statement

We declare that we have no conflict of interest.

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