Epidemiology of chronic hepatitis C virus infection in sub-Saharan Africa

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Hepatitis C virus (HCV) is a major cause of chronic liver disease in the world. The WHO estimates that 3% (170 million) of the world's population are chronically infected with HCV. Sub-Saharan Africa is of great interest because it is reported to have the highest HCV prevalence rate (5·3%), and a concurrent HIV epidemic. In our review of the published literature we found consistent evidence of high HCV prevalence in many countries of Africa. We estimate the overall prevalence of HCV in Sub-Saharan Africa is 3·0%. The central African region has the highest estimated prevalence of 6%, west Africa has an estimated prevalence of 2.4%, and southern and east Africa with the lowest estimated prevalence of 1·6%. Given low sexual transmission of HCV and infrequency of intravenous drug use in Sub-Saharan Africa, iatrogenic causes of HCV transmission need to be further evaluated.

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Of all acute hepatitis C virus (HCV) infections 70–80% become chronic liver infections, of which 10–25% progress to cirrhosis and/or hepatocellular cancer over the course of several decades. Most acute and chronic HCV infections remain asymptomatic for years and, except with expensive screening tests, carriers are usually not identified. Treatment is limited, very costly, and only partly effective. No vaccine is available or expected in the near future. Accordingly, the epidemiology of HCV is the primary tool available to health professionals for preventing infection and evaluating efforts at intervention.[1]

The major channels for HCV transmission are all related to exposure to infected blood and blood products: intravenous drug use (IDU), transfusion of untested blood, unsterile medical and dental procedures, and traditional medical and cosmetic procedures (eg, scarification, tattoos) involving blood exposure.[1] Controversy continues about whether to attribute more than a small fraction of HCV infections to sexual contact or mother-to-child transmission (MTCT) (both of which can involve blood exposure). Transmission is estimated to be less than 5% for both.[1,2] Other risk factors involving household exposures—eg, eating utensils, shaving razors, and toothbrushes—are felt to be minimum risk factors for HCV acquisition.[1]

The WHO estimates that 170 million people worldwide—roughly 3% of the world population—are chronically infected with HCV and that three to four million new infections occur each year.[1] The prevalence of HCV in economically developed countries is less than 1–2%. The general population HCV prevalence in these countries is much lower since most of the individuals with HCV have a history of blood transfusion before 1990 or have used contaminated needles while injecting illicit drugs. By contrast, in the developing world, the prevalence of HCV is thought to be both higher and distributed more generally throughout the adult population (table 1).

Table 1. Hepatitis C estimated prevalence rate, and number infected, by WHO regions

WHO region	Total population (millions)	HCV rate (%)	Infected population (millions)
Africa	602	5·3	31·9
Americas	785	1·7	13·1
Eastern Mediterranean	466	4·6	21·3
Europe	858	1·0	8·9
Southeast Asia	1500	2·0	32·3
Western Pacific	1600	3·9	62·2
Total	5811	3·1	169·7

Source: WHO Weekly Epidemiological Record, No. 49, December 1999

It is only recently with the advent of modern testing methods in the 1990s, that the epidemiology of HCV could be studied. As a result, high rates of HCV in many areas of the world are just being recognised as a significant public health problem.[1] Sub-Saharan Africa has the highest WHO estimated regional HCV prevalence (5·3%) and a concurrent HIV epidemic. In this article, we present a review of published literature on HCV prevalence for the countries of sub-Saharan Africa. We will examine regional differences in prevalence and identify risk factors associated with the observed patterns of the current HCV epidemic in Africa.

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Figure 1. Regional base-map. This map divides the 43 countries of sub-Saharan Africa into three regions. (Not all countries are named on the map.)

Methods

Overview

We searched for articles published after 1990 on Medline using the terms "hepatitis C", "prevalence", "epidemiology", "Africa", and names of each of the sub-Saharan countries. The bibliographies of the articles on hand were used to find other references, and we searched through indexes of major journals that publish on HCV.

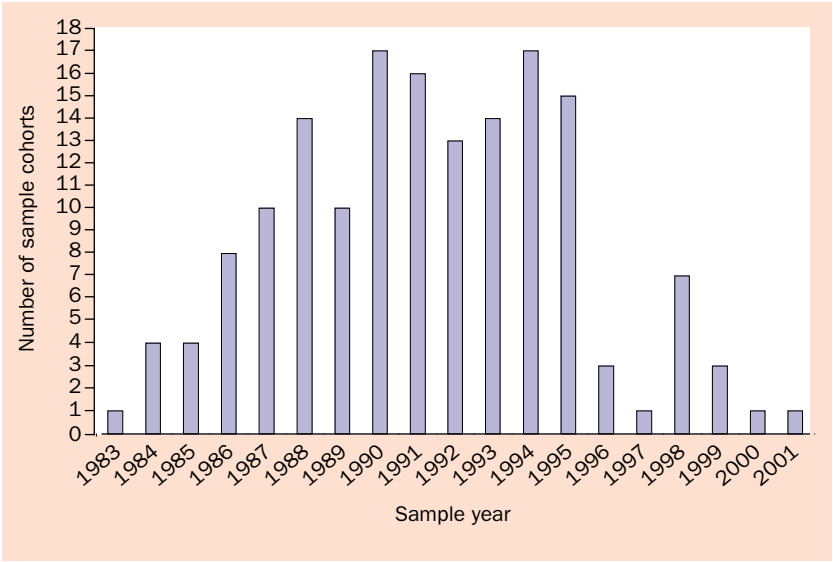


Figure 2. Frequency distribution of sample year for published studies determining HCV prevalence.

We limited our study to mainland countries in sub-Saharan Africa and Madagascar that correspond to WHO's Africa region. In addition, we included Sudan but excluded Algeria and the small island states for a total of 43 countries in Sub-Saharan Africa.

Studies with no data on HCV diagnostic assays or HCV prevalence were excluded.

Classification of data

We gathered detailed data for each article and organised these into a database (see master table on the *TLID* website, http://image.thelancet.com/extras/02ID2004webonly.pdf). All studies were categorised by country and the population cohort sampled. The other documented variables are the year of blood collection, type of HCV diagnostic assay used, age of the sample population, the sample size of the cohort, and the HCV prevalence.

Population sub-groups

We grouped the sample population for each study into two categories: general population and high-risk population.

The general population includes all samples selected among healthy groups, such as women seeking antenatal care and blood donors, as well as samples selected from inpatients or outpatients for reasons other than those with known or suspected liver disease, and illnesses involving multiple blood exposures or blood transfusions.

The high-risk population is limited to those with acute or chronic liver disease, those whose medical conditions have led to multiple transfusions of blood or blood products (eg, haemophiliacs, some sickle-cell patients) or other high-risk blood exposures (eg, dialysis and renal transplant patients).

Diagnostic assays for detecting HCV

In classifying our data we found three main groups of assays for the detection of markers for HCV. Enzyme immunoassays were predominantly used as the screening assay for the detection of antibody to HCV. Confirmatory assays in which reactivity to individual antigens could be measured, such as line immunoassays and immunoblots, were also employed in many cases. The PCR assay, which detects the HCV genome, was increasingly used as a means of showing current HCV infection. It is the most specific of the

Table 2. Estimated HCV prevalence of general population cohorts for 34 sub-Saharan countries categorised by regions

Country	Population (1000)	Number of cohorts	Sample size	HCV prevalence (%)	
				Range	Average
Central Africa					
Burundi	6356	3	1184	4·9–33·3	11·3
Cameroon	14 876	32	6015	0·0–40·0	13·8
CAR	3717	3	709	0·0–6·1	2·4
Chad	7885	2	290	2·4–5·8	4·8
Congo	3018	2	0	2·5–9·2	
DR Congo	50 948	3	2572	4·3–6·6	5·5
Equatorial Guinea	457	1	2042	1·7–1·7	1·7
Gabon	1230	2	1597	6·5–16·5	9·2
Rwanda	7609	3	610	0·9–17·0	4·1
Sudan	31 095	2	865	1·5–3·2	2·8
Uganda	23 300	3	881	0·0–14·2	6·6
Central Africa total	147 474	56	16 765	0·0–40·0	6·0
West Africa					
Benin	6272	6	1110	0·0–4·0	1·6
Burkina Faso	11 535	3	965	2·2–8·3	4·9
Cote d'Ivoire	16 013	3	429	3·3–8·2	3·3
Gambia	1303	1	212	2·4–2·4	2·4
Ghana	19 306	4	5033	0·1–5·4	1·7
Guinea	8154	6	2050	0·8–8·7	5·5
Mauritania	2665	1	349	1·1–1·1	1·1
Niger	10 832	6	2327	0·0–7·6	1·8
Nigeria	113 862	5	669	0·0–5·8	2·1
Senegal	9421	7	352	0·0–7·3	2·2
Togo	4405	5	478	1·3–6·1	3·9
West Africa total	203 766	47	13 974	0·0–8·7	2·4
South and east Africa					
Eritrea	3659	5	323	0·0–6·0	1·9
Ethiopia	62 908	5	2080	0·6–3·4	1·9
Kenya	30 669	3	1567	0·0–1·0	0·9
Madagascar	15 970	2	1564	1·2–3·3	2·1
Malawi	11 308	1	140	0·7–0·7	0·7
Mozambique	18 292	2	536	2·1–3·2	2·8
Somalia	8778	12	2203	0·0–7·0	1·5
South Africa	43 309	15	68 931	0·0–3·5	0·1
Swaziland	925	1	194	1·5–1·5	1·5
Tanzania	35 119	7	2188	0·5–8·6	3·2
Zambia	10 421	2	583	0·0–0·3	0·2
Zimbabwe	12 627	2	579	0·2–7·7	2·0
S E Africa total	253 986	57	80 888	0·0–8·6	1·6
Africa total	605 225	160	111 627	0·0–40·0	3·0

Population data from UN, 2000

assays and it has been found that approximately 75–80% of those with a positive confirmatory test will have virus detected by PCR.[3] This test is, however, the most technically demanding and the most expensive. Since confirmatory assays are normally recommended for low-risk general populations due to lack of specificity of the screening assays, particularly with earlier assays, we used only data from studies that employed confirmatory assays, including PCR.

Age groups

The published studies do not adhere to uniform age categories in their presentation of results and therefore do not support the calculation of age-specific HCV prevalence rates (nor a statistical meta-analysis). Therefore, in order to comparatively examine the age variable in sub-Saharan Africa, we categorised studies by three broad age groups: less than 20, 20–40, and older than 40 years of age.

Regions

We divided sub-Saharan Africa into three regions by their proximity and geopolitical associations (figure 1). The central African region includes 12 countries, the west Africa region comprises 15, and the southern and east Africa region includes 16 countries.

Calculations of national and regional prevalence

Since data on HCV prevalence in Africa are limited, results of national and regional prevalence are only indicative of possible trends and primarily intended for future examination of specific areas of concern. For this review, country-specific HCV prevalence rates were obtained by calculating the weighted average of HCV prevalence data for all population cohorts in that country, using the sample size of the cohort as weight. When sample size was not available, the corresponding weight was zero. To obtain regional and overall sub-Saharan Africa prevalence, we

calculated the weighted average of average HCV prevalence for all countries in that region, using the country's population size as weight.

Results

We identified 118 studies from 37 countries in sub-Saharan Africa that met our inclusion criteria. Six countries—Guinea-Bissau, Liberia, Mali, Botswana, Djibouti, and Lesotho—had no HCV prevalence data. These 118 studies provide data on HCV prevalence for 245 population cohorts, with a total of 116 000 individual blood samples collected between 1983 and 2000. 48 (20%) of the 245 cohorts had only HCV screening assays and no confirmatory diagnostic assay, and three did not list the assay used. These studies were not used for further analyses. Among these were single studies for three countries—Angola, Sierra Leone, and Namibia.

The master table presents all the studies organised by country with detailed information on diagnostic assays and HCV prevalence determinations for each population group sampled. The studies not used for analyses are marked with an asterisk under the column HCV assays. Of the remaining 194 population cohorts (from 34 countries), 34 were from high-risk groups and the rest, 160 cohorts, were general population samples.

Sample collection year

Whereas all studies were published after 1990, some of the analyses were done on archived blood after HCV diagnostic testing became available. The collection of the samples spanned the period 1983–2000. 52 cohorts did not indicate the year of blood sampling. We plotted the year of blood sampling, which shows that most of the samples tested were drawn between 1988 and 1994, suggesting that the picture of the HCV epidemic in Africa as seen in the published literature is almost a decade old (figure 2).

Overview

We calculated HCV prevalence by the weighted average method for each of the 33 countries from the 160 general population cohorts for which we had data (table 2). (We could not calculate the HCV prevalence for the Congo because the two cohorts did not indicate a sample size.) The number of blood samples tested with confirmation assays for the countries varied from a low of 140 in Malawi to 68 931 for South Africa, with a median of 881. The overall estimated HCV prevalence for the 33 countries of sub-Saharan Africa Africa is 3·0%. Median prevalence is 2·2%; range from 0·1% to 13.8%. There are large differences in HCV prevalence between the three regions (figure 3). In the general population cohorts, the central African region has more than doubled the population-based prevalence (6%) of either of the other two regions (west Africa is 2·4% and southern and east Africa is 1·6%). We discuss the results from each of the regions in detail below. The weighted average HCV prevalence for five countries is based on a single cohort.

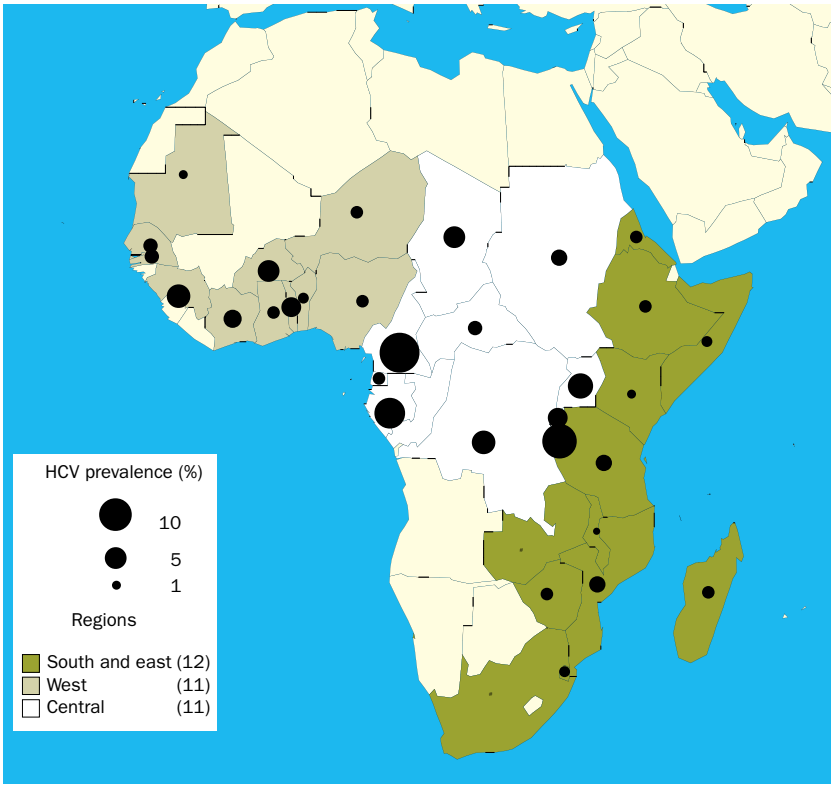


Figure 3. General population HCV prevalence by country and region. The size of the dot indicates the estimated average prevalence for each country. Countries for which we have no data are shown in yellow. (Congo has no dot because no sample size data was available.)

Central Africa region

The overall weighted average prevalence for the central Africa region is 6·0%. This region has nine of the ten countries whose HCV prevalence is greater than the sub-Saharan African median of 2·2% (range 0–40%). Cameroon appears to have the highest prevalence (13·8%) and is the best studied in the region, with 13 studies done over 14 years and confirmed tests on over 6000 individuals from the general population categories. Equatorial Guinea has the lowest prevalence in the region, 1·7%, among 2042 people sampled from one cohort. Two countries that fall into this region—Congo and Angola—did not have data to calculate HCV prevalence.

West Africa region

The overall weighted average prevalence for the west Africa region is 2·4%. This region has six of the 11 countries whose HCV prevalence is at or greater than the sub-Saharan Africa median of 2·2% (range 1·1–5·5%). The highest HCV prevalence for this region is in Guinea, 5·5%, with 2050 samples.

Table 3. Estimated HCV prevalence for high-risk cohorts for 17 sub-Saharan countries categorised by regions

Country	Number of cohorts	Sample size	HCV prevalence (%)	
			Range	Average
Central Africa				
Burundi	1	80	55·0–55·0	55·0
Cameroon	5	354	12·5–46·8	25·2
Rwanda	1	105	45·7–45·7	45·7
Sudan	1	115	11·3–11·3	11·3
Central Africa total	8	654	11·3–55·0	
West Africa				
Benin	2	43	17·0–38·0	23·3
Gambia	1	203	16·7–16·7	16·7
Niger	2	182	5·4–5·6	5·5
Nigeria	1	156	5.1–5·1	5·1
Senegal	4	311	2·1–10·9	4·2
West Africa total	10	895	2·1–38·0	
South and east Africa				
Ethiopia	1	238	38·2–38·2	38·2
Kenya	2	237	1·6–2·0	1·7
Mozambique	1	178	6·2–6·2	6·2
Somalia	2	172	14·5–40·3	23·8
South Africa	7	742	4·3–65·0	23·5
Tanzania	1	92	5·4–5·4	5·4
Zambia	1	152	1·3–1·3	1·3
Zimbabwe	1	57	3·5–3·5	3·5
S E Africa total	16	1868	1·3–65·0	

For Nigeria, the most populous country in sub-Saharan Africa (110 million people), we found only five general population cohorts with a total sample size of 669. Four countries did not have sufficient data to calculate HCV prevalence: Guinea-Bissau, Liberia, Mali, and Sierra Leone.

South and east African region

The south and east Africa region has an overall weighted average prevalence of 1·6%. This region has two of 12 countries with HCV prevalence at or greater than the sub-Saharan Africa median of 2·2% (range 0·1–3.2%). Four of 16 countries in the region (Botswana, Djibouti, Lesotho, Namibia) had no studies with confirmed tests for general population categories. For Ethiopia, with 63 million people, we found five general population cohorts—2080 samples, with HCV prevalence range 0·6–3·4%, and population weighted average 1·9%. South Africa, the next largest country in the region, (43 million people), is well studied; we found 15 general population cohorts (68 931 samples).

High-risk groups

Table 3 shows the HCV prevalence in the 34 high-risk cohorts. This table confirms that the highest prevalence is in the central Africa region with median 35% and range from 11% to 55%, compared with west Africa with median 5·5% and range 2·1% to 38%, and south and east Africa, with median 4·5% and range from 1·3% to 65%.

Blood donors

By contrast with clinical populations (despite differences among blood donors and circumstances around blood donations in different societies), blood donors offer the best comparison between general populations in different countries (table 4). We see the same regional trends in prevalence among blood donors as among general population and high-risk groups (figure 4). The highest HCV prevalence is in the central Africa region. The population weighted average prevalence is 6% (median 4·8%, regional range 0·9 to 17%,) among the eight cohorts. In the west African region the weighted average prevalence is 3·0% (median 1·3%, regional range 0% to 5·8%), and in the south and east Africa region, weighted average prevalence is 1·9% (median 0·6%, regional range 0 to 8%). An outlier among blood donors is in Tanzania, with

Table 4. Estimated HCV prevalence for blood donor cohorts for 22 sub-Saharan countries categorised by regions.

Country	Number of cohorts	Sample size	HCV prevalence (%)	
			Range	Average
Central Africa				
Burundi	1	340	4·9–4·9	4·9
Cameroon	2	117	6·4–14·7	8·7
CAR	1	163	6·1–6·1	6·1
Chad	2	290	2·4–5·8	4·8
Rwanda	2	482	0·9–17·0	2·7
Central Africa total	8	1392	0·9–17·0	6·0
West Africa				
Benin	2	931	1·4–2·3	1·7
Ghana	2	3264	0·1–0·8	0·5
Guinea	1	228	4·4–4·4	4·4
Mauritania	1	349	1·1–1·1	1·1
Niger	3	1695	0·5–3·2	1·3
Nigeria	2	304	2·5–5·8	3·6
Senegal	1	0	0·0–0·0	··
Togo	1	241	3·3–3·3	3·3
West Africa total	13	7012	0·0–5·8	3·0
South and east Africa				
Ethiopia	1	500	1·4–1·4	1·4
Kenya	1	780	0·9–0·9	0·9
Malawi	1	140	0·7–0·7	0·7
Mozambique	1	194	2·1–2·1	2·1
Somalia	1	157	0·6–0·6	0·6
South Africa	3	66 531	0·0–0·9	0·1
Tanzania	1	100	8·0–8·0	8·0
Zambia	1	240	0·0–0·0	0·0
Zimbabwe	1	437	0·2–0·2	0·2
S E Africa total	11	69 079	0·0–8·0	1·9

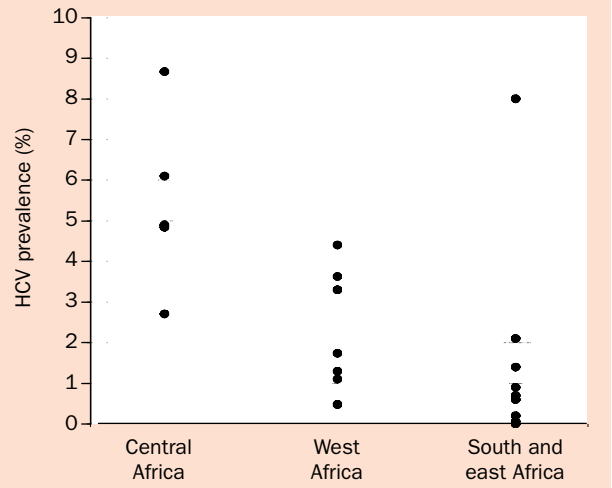


Figure 4. Scatter plot of estimated HCV prevalence for blood donors by region. Each dot represents the estimated HCV prevalence for blood donor cohorts in one country.

a prevalence of 8% among 100 samples tested in 1998.[4] In South Africa, blood donations are well studied and HCV prevalence is less than 0·1% among almost 67 000 samples. Figure 5 compares the prevalence among blood donors and the general population in each country. Figure 6 summarises by each region, general population HCV prevalence for each country and the regional prevalence for general population, blood donor, and high-risk cohorts.

Age variations

We found 29 studies of general population cohorts with HCV prevalence data for at least two of the three age groups: less than 20, 20–40, and more than 40 years. In all cases but two, the higher age group has the highest HCV prevalence rate (table 5). Figure 7 shows HCV prevalence of the 29 studies by age groups. The youngest group (age <20) has the lowest prevalence (median 1·3%, 22 studies, range 0 to 11%), and the oldest group (age>40) has the highest (median 12%, 27 studies, range 0 to 55%). The middle group (age 20–40) has the average prevalence (median 3·0%, 29 studies, range 0 to 28%). While there is substantial overlap in the age group data, the data indicate a positive correlation between age and HCV infection throughout sub-Saharan Africa.

Discussion

This review finds consistent evidence of high HCV prevalence in the general population of many sub-Saharan countries of Africa (an order of magnitude above those seen in general populations in the economically developed world), and substantial variations in the prevalence of HCV between African countries and regions—differences that warrant further research. The Sub-Saharan Africa population weighted average prevalence of 3% may not be a reflection of the true HCV general population prevalence. No cross-sectional population surveys were done (except Madagascar[5]) and the studies were often limited geographically or to very specific population groups (in-patients, out-patients, or certain tribes &c,). We therefore took great care to specify the population cohort (general population versus high-risk groups) for each sample. Two other issues, besides the sampling, may confound the interpretation of data on HCV prevalence from Africa. HCV diagnostic assays were sometimes done long after collection of blood samples[6,7] and this may affect the result of the assays. Second, there are some concerns that antibody tests designed for HCV genotypes and subtypes common in Europe and the USA might not perform as well with African sera.[8] Given limited knowledge about the natural history of HCV, particularly in Africa, it is possible that Africans may clear HCV infections more often and/or retain antibody longer, such that prevalence of HCV infections may be much lower than prevalence of anti-HCV antibody.[9] However, many African studies have found the number of viraemic samples to be over 70% of the number of confirmed antibody positive samples, similar to most

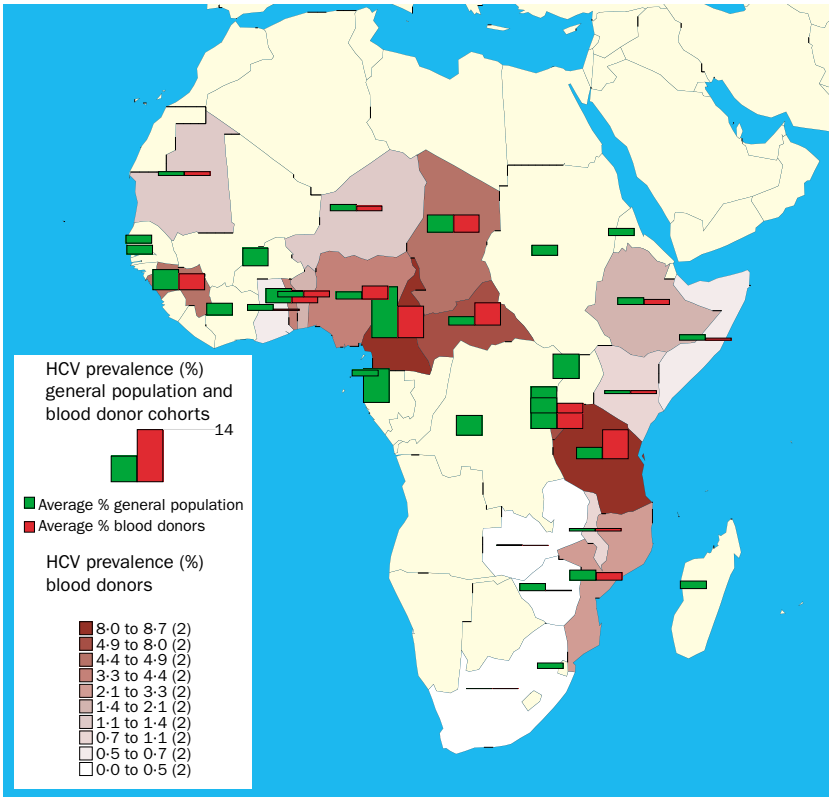


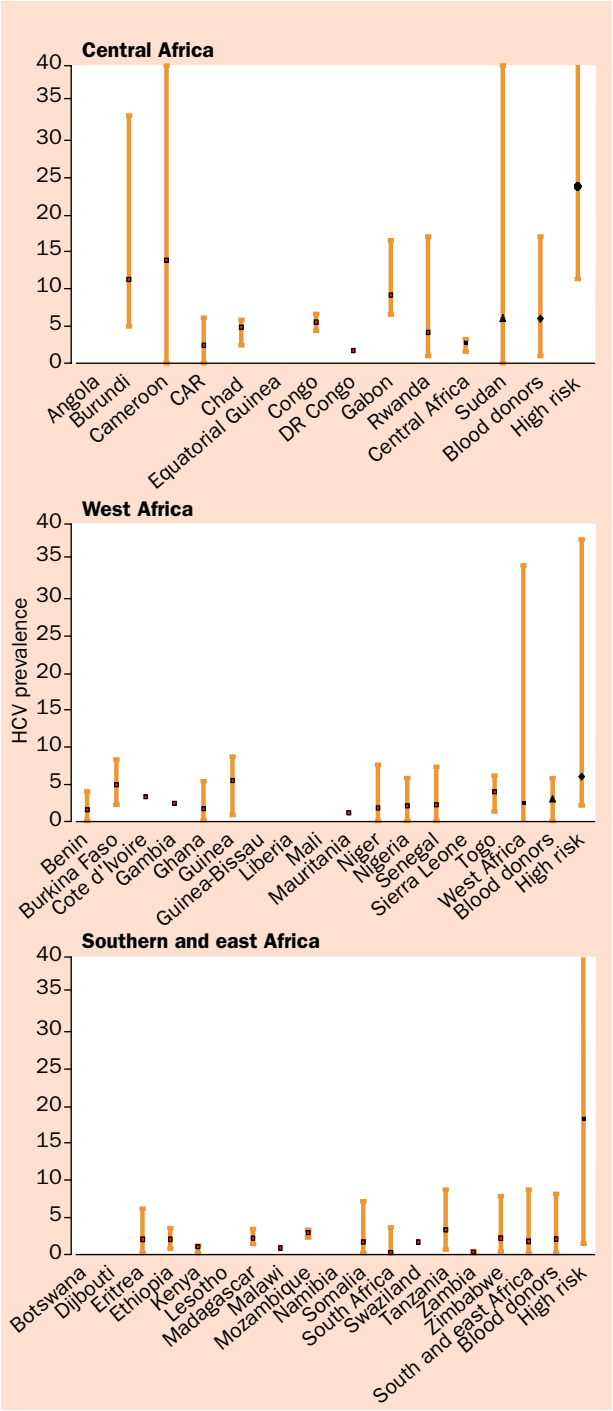
Figure 5. General population versus blood donor estimated HCV prevalence for sub-Saharan countries. The countries for which we have blood-donor-population prevalence data are shaded according to the HCV prevalence. In addition, a bar graph in each country shows the HCV prevalence data calculated with both the general population cohorts and the blood-donor-population cohorts, confirmed assays only.

economically developed countries.[10–12] In spite of these limitations, the prevalence estimates we have summarised are based on the available peer-reviewed literature, using only those studies that have used the more specific HCV diagnostic assays.

Our sub-Saharan Africa weighted average prevalence of 3% is lower than the WHO figure of 5·3% for Africa (which includes most of the countries in this review). This difference could be accounted for by the fact that our prevalence data are based only on confirmed diagnostic HCV assays, the specificities of which have progressively improved over the decade and are therefore less likely to overestimate the prevalence of infection. Additionally, many more studies on HCV prevalence have been published in the few years since the WHO estimate was calculated.

Regional differences

In the absence of random sampling done with the same criteria across different countries and time frames, the data from the various general population samples we analyse within countries and regions are the basis for suggesting that actual differences may exist in the HCV epidemics in the different countries of sub-Saharan Africa. The range of findings of blood donors (with all the limitations noted above) suggests that the differences seen in other convenience samples are a valid measure of (at least) regional differences in HCV. Such substantial differences in the prevalence of HCV in sub-Saharan Africa (a high of 12% in the general population of Cameroon and a low of 0·1% in South Africa, both well studied countries) may suggest that the epidemic may be at a different point of development in different geographic areas. We know from the case of the schistosomiasis campaign in Egypt, where HCV infection affects up to 30% of the general adult population, that a single mass injecting campaign (1960–1980) has the potential to launch a iatrogenic national epidemic of HCV.[1,13] Similarly, studies in Pakistan identified medical injections as the most important channel for HCV transmission.[2] Many parallels may be seen with the diagnosis and treatment for trypanosomiasis between 1920 and 1960, in Central Africa.[14,15] However, further research would be required to show whether these treatments established high rates of HCV prevalence in this region the same way that treatment for schistosomiasis did in Egypt. These cases guide our examination of the variance of HCV prevalence in African countries—drawing our attention to unsterile injecting and contaminated medical procedures and equipment as a potential factor in the epidemiology of HCV in the general populations of sub-Saharan Africa.



Figures 6. Estimated HCV prevalence by country for general population cohorts. The maximum and minimum cohort prevalence used in the calculation of the estimated prevalence are shown for each country. Also shown is the regional prevalence for general population, blood donor, and high-risk cohorts.

Blood supply

Given the absence of consistent screening of donors and the background prevalence of HCV in many areas, blood transfusions are a major risk factor for acquisition of HCV in Sub-Saharan Africa. Among all countries in Africa, we know only of South Africa and Zimbabwe that consistently test blood for HCV antibodies. Other countries test some donors, but the percentage of blood tested is unknown. Risks of transmitting HCV through blood transfusions can be demonstrated from HCV infections in those who are transfused. In Benin, Jeannel reports 17% HCV antibody prevalence in sickle-cell patients with at least three lifetime transfusions versus 0% in those with no transfusions.[16]

Table 5. HCV prevalence by age groups for general population cohorts

Country	Reference*	Prevalence %		
		< 20 yr	20–40 yr	> 40 yr
Central Africa				
Burundi	Ntakarutimana, 1995	0·0	6·5	27·1
Burundi	Aubry, 1995, 1997	0·0	26·0	44·0
Cameroon	Delaporte, 1994	1·5	17·9	18·7
Cameroon	Mencarini, 1991	4·0	8·0	17·0
Cameroon	Louis, 1994a	0·6	0·6	32·9
Cameroon	Ndumbe, 1993b	1·7	8·0	..
Cameroon	Ndumbe, 1994	4·4	8·1	2·5
Cameroon	Kowo, 1995	0·0	6·0	29·0
Cameroon	Ndjomou, 2002	..	7·0	55·0
Cameroon	DuCorps, 1994	..	0·0	48·2
Cameroon	Nkengasong, 1995	6·1	27·7	35·5
CAR	Fretz, 1995	0·0	0·0	7·0
Chad	Massenet, 1993	..	1·6	12·5
DR Congo	Laurent, 2001	2·8	7·0	21·3
DR Congo	Laurent, 2001	4·0	5·6	..
Equatorial Guinea	Basaras, 1999	0·1	1·9	5·6
Gabon	Delaporte, 1993	1·0	8·0	23·0
Sudan	Omer, 2001	..	1·0	1·7
West Africa				
Ghana	Wansbrough-Jones, 1998	1·3	2·4	5·6
Mauritania	Lo, 1999	11·0	0·7	0·0
Togo	Agbodjan, 1995	3·3	3·0	7·8
South and east Africa				
Ethiopia	Frommel, 1993	2·2	3·4	3·6
Ethiopia	Frommel, 1993	1·3	1·9	7·8
Ethiopia	Frommel, 1993	0·4	1·7	1·5
Ethiopia	Frommel, 1993	0·4	0·0	3·2
Madagascar	Morvan, 1994	1·6	2·2	8·8
Mozambique	Bos, 1995	1·4	0·6	7·2
Tanzania	Stark, 2000	..	4·0	12·0
Zimbabwe	Gangaidzo, 1997	..	1·6	12·8

*See table on http://image.thelancet.com/02ID2004webonly.pdf for details

Unsterile injections

There are as yet few intravenous drug users in sub-Saharan Africa. Therefore the high rate of unsterile medical injections, both within or outside the formal health care system, may account for significant HCV transmission and serve as the bridge to the general population.[17] From studies of injection practices, Simonsen and colleagues estimated that Africans get an average of 1·5 medical injections per year of which 50% are unsafe.[17] Kane and colleagues have estimated the risk of HCV transmission through an unsafe injection at 6%.[18] Many studies have found a link with injection use, for example, a group of rural women from Tanzania with a history of hormone injections for contraception had a HCV prevalence rate of 19% compared with 5% for women who used no or other family planning methods.[19,20]

Scarification and tattoos

Two studies show only a weak association between scarification and HCV.[21,22] Scarification is on the decline in many parts of sub-Saharan Africa and it may be difficult to identify these risks without studies that measure and control for other risk factors.

Heterosexual transmission

Some authors propose that high prevalence of sexually transmitted diseases in Africa with or without greater promiscuity could allow heterosexual transmission of HCV to be higher than in developed countries.[23,24] Others state that epidemiological evidence does not support an important role for sexual transmission.[19]

Mother-to-child transmission

Some of these studies report zero to low HCV prevalence in young children, as evidence that MTCT is negligible.[11,25,26] Studies elsewhere have shown that vertical transmission is proportional to the HCV RNA level in the mother.[27,28] High viral loads are seen in women with acute HCV infection, (compared with those with chronic HCV) and women with concurrent HIV infection. In one study of 441 mother-child pairs, the rate of vertical transmission was 3·8 times higher in those mothers co-infected with HIV.[29]

No transmission of HCV by breastfeeding has been noted.[27,29]

Age variations

The consistent increase in HCV prevalence with age of the general population is evident across all regions and in all countries with multiple samples that allow comparison.

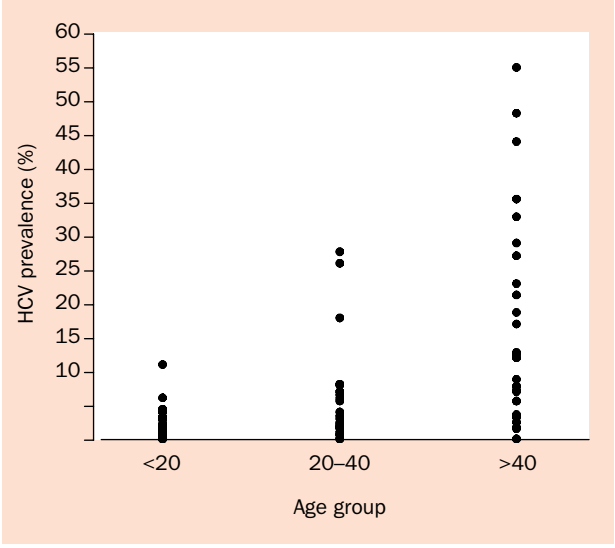


Figure 7. Scatter plot of HCV prevalence for general population cohorts by age group.

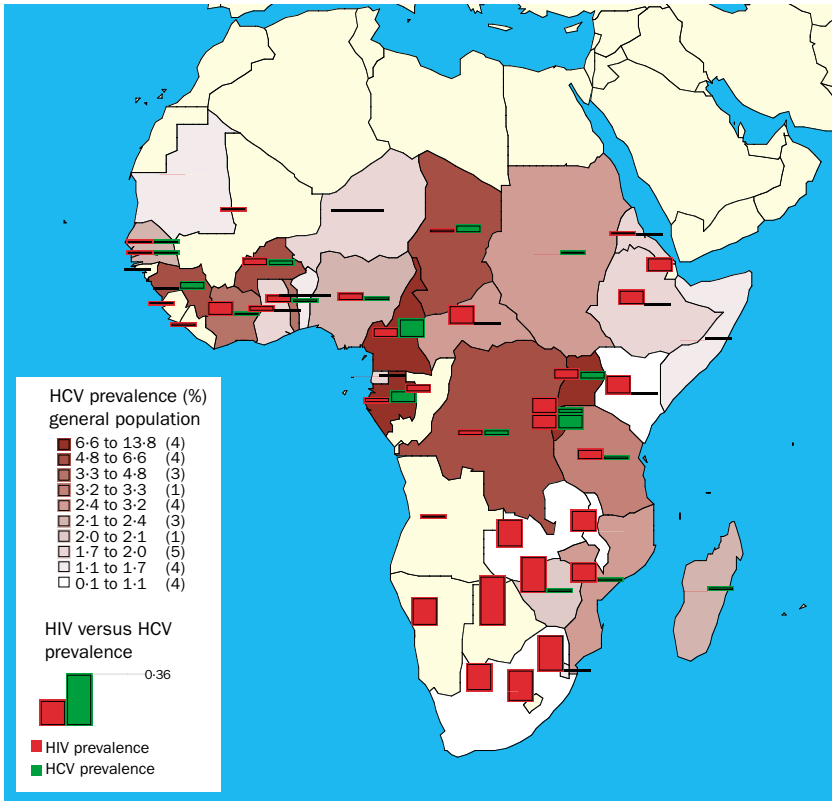


Figure 8. HIV versus HCV prevalence for sub-Saharan countries. The countries for which we have general population prevalence data are shaded according to the HCV prevalence. In addition, a bar graph shows side by side for each country the 1999 HIV prevalence data, (UNAIDS, 2000) and the estimated average HCV prevalence for the general population.

The low sexual transmission efficiency of HCV, and the elevated HCV prevalence rates in high-risk populations that are more heavily exposed to blood products, suggests that this effect may be due to ongoing and repeated exposures to HCV infection through the medical care system.

HCV and HIV co-infection

HCV and HIV share a common route of parenteral transmission. Although our study did not focus on this aspect, we found 20 studies that looked for HIV and HCV co-infection. These studies found virtually no association between the prevalence of the two infections.[19,30,31] Only one study showed a significant level of co-infection.[23] Further research is required into this association. It is interesting to note that the countries with the highest HIV infection prevalence have the lowest estimated HCV prevalence (figure 8).

Conclusions

There is no systematic surveillance programme to monitor HCV in sub-Saharan Africa and a comparative study of HCV prevalence remains weak in the absence of well-designed random sample surveys covering major populations in Africa. This review shows significant rates of HCV prevalence in many sub-Saharan African countries, an overall estimated HCV prevalence of 3·0%, with higher prevalence in the central Africa region (6·0%) and lower (2·4% and 1·6%) rates in the other two regions. These levels are an order of magnitude above those of general populations of Europe and North America.

Given the low transmission of HCV through sexual contact, the indication of rising prevalence with age supports the view that unsterile injections and other iatrogenic routes of transmission may be the main risk factor for HCV infection in Africa. While donated blood is tested for HCV in economically developed countries, testing for HCV is routine in very few African countries. Additionally, while injecting drug use is still relatively rare in Africa, there are early indications of its appearance in the large cities of Nigeria, Kenya, and South Africa. Should injecting drug use enter the picture in sub-Saharan Africa, it would amplify the HCV prevalence seen now.

The cases of Egypt and Pakistan indicate the potential of iatrogenic factors to establish HCV reservoirs that can then extend to the general population through the widespread use of unsterile injecting and the ongoing contamination of the stream of medical equipment in common use and reuse. But there has been very little epidemiological research on injections and other medical procedures as risk factors for HCV (or HIV) transmission in sub-Saharan Africa, and it is critical that this become a focus of epidemiological study and prevention efforts. The data reported in this review should serve as a baseline for future assessments of the HCV epidemic's trajectory in sub-Saharan Africa and help to evaluate the effects of relevant interventions.

Search strategy and selection criteria
These are described in detail in the method section.

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Conflicts of interest
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