Hepatitis B and C virus seroprevalence, Burkina Faso: a cross-sectional study


To cite this version:

HAL Id: hal-02134228
https://hal.umontpellier.fr/hal-02134228
Submitted on 20 May 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
# Hepatitis B and C virus seroprevalence, Burkina Faso: a cross-sectional study


## Objective

To estimate population-wide hepatitis B and C seroprevalence using dried blood spot samples acquired for human immunodeficiency virus (HIV) surveillance as part of the 2010–2011 Demographic and Health Survey in Burkina Faso.

## Methods

We used the database acquired during the multistage, clustered, population-based survey, in which 15 377 participants completed questionnaires and provided dried blood spot samples for HIV testing. We extracted sociodemographic and geographic data including age, sex, ethnicity, education, wealth, marital status and region for each participant. We performed hepatitis B and C assays on 14 886 HIV-negative samples between March to October 2015, and calculated weighted percentages of hepatitis seroprevalence for each variable.

## Findings

We estimated seroprevalence as 9.1% (95% confidence interval, CI: 8.5–9.7) for the hepatitis B surface antigen and 3.6% (95% CI: 3.3–3.8) for hepatitis C virus antibodies, classifying Burkina Faso as highly endemic for hepatitis B and low-intermediate for hepatitis C. The seroprevalence of hepatitis was higher in men than in women, and varied significantly for both with age, education, ethnicity and region. Extremely high HCV-Ab seroprevalence (13.2%; 95% CI: 10.6–15.7) was identified in the Sud-Ouest region, in particular within the youngest age group (15–20 years), indicating an ongoing epidemic.

## Conclusion

Our population-representative hepatitis seroprevalence estimates in Burkina Faso advocate for the inclusion of hepatitis serological tests and risk factor questionnaire items in future surveys, the results of which are crucial for the development of appropriate health policies and infection control programmes.

---

### Abstract

**Introduction**

Viral hepatitis is a global health challenge worldwide, particularly in low- and middle-income countries. Hepatitis B virus (HBV) is estimated to affect around 75 million people in Africa, including 1.9 million in Burkina Faso. HBV is the most frequent cause of acute hepatitis and chronic liver disease. Despite the introduction of HBV vaccines in the Expanded Programme on Immunization (EPI) in 2006, incidence is increasing. Further, 10–33 million individuals in West Africa are estimated to be affected by hepatitis C virus (HCV). These HBV and HCV infections are the main contributors to the hepatocellular carcinoma burden in Africa.

Control of the HCV epidemic is envisioned when the new direct antiviral agents, reported to cure most HCV-infected patients within 12 weeks of treatment, become available in low-income countries. Precise epidemic knowledge based on reliable nationwide representative surveys is therefore essential to estimate the number of HCV-infected subjects requiring treatment and to evaluate the efficiency of any future treatment programme. Data from relevant surveys are also required to estimate the number of people living with chronic HBV and therefore the resources required for treatment.

Robust epidemiological studies on viral hepatitis at the national level are however lacking. Most existing studies were conducted at different periods on specific populations (e.g. pregnant women or blood donors), and do not report estimations of age, sex, or demographic-specific prevalence. When included in systematic reviews and meta-analyses of population-wide prevalence, such studies lead to biases and large estimation intervals, and overlook the demographic and geographic heterogeneity of the epidemics.

The Demographic and Health Surveys (DHS) Program conducts large, multistage, clustered, population-based surveys in low- and middle-income countries. By collecting and analysing accurate and representative data on population and health, including blood sample collection (dried blood spot) and storage on filter papers for human immunodeficiency virus (HIV) testing, one can evaluate the impact of existing health programmes and develop strategies for improvement. Here, we demonstrate how these surveys provide an opportunity for affordable hepatitis testing and epidemiological studies. Using the DHS database and dried blood spot samples acquired from May 2010 to January 2011, we estimate the viral hepatitis B and C seroprevalence in the HIV-negative adult population of Burkina Faso.

---

1. Ministère de la Santé, Ouagadougou, Burkina Faso.
2. Pathogenesis and Control of Chronic Infections, Université de Montpellier, U 1058, 60 rue de Navacelles Montpellier, 34394 cedex 5, France.
3. Centre Muraz, Bobo-Dioulasso, Burkina Faso.
5. Pathogenesis and Control of Chronic Infections, Centre Hospitalier Universitaire de Montpellier, Montpellier, France.
6. Pathogenesis and Control of Chronic Infections, Centre Hospitalier Universitaire de Nîmes, Nîmes, France.
7. Pathogenesis and Control of Chronic Infections, Institut National de la Santé et de la Recherche Médicale, Montpellier, France.
8. Centre National de Transfusion Sanguine, Ouagadougou, Burkina Faso.
9. Correspondence to Pierre Dujols (email: p-dujols@chu-montpellier.fr).

(Submitted: 19 January 2018 – Revised version received: 30 June 2018 – Accepted: 1 July 2018 – Published online: 29 August 2018)
Methods

Survey

The Institut National de la Statistique et de la Démographie conducted the fourth Burkina Faso DHS in 2010.21 Following the structure of previous surveys, the survey aimed to acquire representative data on households, men and women, and adopted a two-stage, stratified clustered design in determining which households were to be sampled. In the first stage of the survey, 574 administrative demographic zones were selected from the total of 13 989 within Burkina Faso with a probability dependent upon the number of households within that zone. In the second stage, households within selected demographic zones were selected at random with a uniform probability; a total of 14 947 households were included in the survey. Questionnaires were completed by both male and female interviewers recruited by the Institut National de la Statistique et de la Démographie.21 Interviewers attended a 6-week training course at the institute, where they were educated on the different features of the survey including general methodology, logistics, the subjects covered in the questionnaire and blood sampling procedures.

Survey subpopulation

Due to their perceived status as main carer, women were considered best placed to provide information on the health of household members and living conditions. All women aged 15–49 years either living in each of the 14 947 households or having stayed there overnight were therefore invited to complete a questionnaire. Among the households, one household out of two within each demographic zone was selected at random (7475 households) for men aged 15–59 years to be interviewed. Agreement to provide a blood sample was sought from all interviewed men and from the interviewed women who were living in the same households as male participants. After signing an informed consent form, a total of 8293 women and 7084 men formed the subpopulation that completed the questionnaire and provided a blood sample.

Ethics

All procedures performed as part of the study were conducted in accordance with the standards of the Ethics Committee for Health Research of Burkina Faso, while also meeting the principles expressed in the declaration of Helsinki. Free informed consent was obtained from every individual participant in the use of data and dried blood spot samples collected for further research. According to the Burkina Faso survey protocol, all data records were fully anonymous without any possibility of participant identification.

Blood sample processing

As part of the Burkina Faso DHS, dried blood spot samples (two to five per filter paper; Whatman 903 Protein Saver, Dassel, Germany) obtained by finger prick, were sent to the national blood transfusion centre in individual bags with dessicant and stored at −20°C. Samples were punched into microtitration plates and analysed for HIV infection using an enzyme-linked immunosorbent assay (Vironostika HIV Uni-Form II plus O, Biomérieux, France). The positive samples and 10% of the negative samples were checked using a recombinant enzyme-linked immunosorbent assay (Enzygnost Anti-HIV 1/2 plus, Dade Behring Marburg GmbH, Germany). All discordant results were tested (InnoLiA, Innogenetics, Belgium) once more to give a final result of 160 HIV-positive samples. HIV analysis exhausted a total of 491 samples, leaving 14 886 HIV-negative samples for hepatitis testing.

Hepatitis serology assays

We performed the hepatitis B and C assays on HIV-negative dried blood spot samples between March and October 2015. We tested for the presence of hepatitis B surface antigen (HBsAg) by eluting a punched disc of 6 mm in diameter overnight at ambient room temperature in 1.5 mL phosphate buffered saline, and using the Monolisa HBsAg Ultra assay (Bio-Rad, Hercules, United States of America). The sensitivity and specificity estimations of the test were 96.0% (95% CI: 95.1–97.0) and 100.0% (95% CI: 99.7–100.0), respectively.23,24 We detected the HCV antibody (HCV-Ab) by eluting a punch of 6 mm diameter overnight at ambient temperature in 2 mL of a buffer (two thirds phosphate buffered saline and one third manufacturer’s diluent), and using the Monolisa HCV Ag/Ab Ultra assay (Bio-Rad, Marnes-la-Coquette, France). The sensitivity and specificity estimations of the test were 95.0% (95% CI: 83.1–99.4) and 100.0% (95% CI: 98.9–100.0), respectively.23,25,26

Survey data extraction

We extracted several sociodemographic and geographic variables from the survey database, including: sex, age, declared ethnicity, educational achievement (none, primary, secondary or higher), household wealth index quintile (quintile of the nationwide wealth index distribution constructed from household assets scoring), marital status (including living with a common-law partner), residential area (name of region and whether urban or rural setting) and HIV status (positive or negative) according to the dried blood spot sample analysis in 2010. We also extracted the representativeness weighting data calculated by the survey statisticians,21 and used these data to estimate population-wide seroprevalence from the survey subpopulation.

Statistical methods

We performed statistical analyses with SAS software, version 9.2 (SAS Institute Inc., Cary, USA), using procedures for weighted survey samples. We used an adjusted F-test for qualitative variables. We also created the new variable “tested-couple” to describe two participants reported as living as a couple in the same household, who had both been tested for viral hepatitis markers. We considered our results significant for P-values ≤ 0.05, and present results with their 95% CI.

As our study sample contained only HIV-negative subjects, we conducted a complementary analysis to approximate the hepatitis prevalence in the overall population of 15 046 survey participants (14 886 HIV-negative and 160 HIV-positive). We allocated the upper limit of the published B and C hepatitis prevalence estimates (i.e. 15% for HBsAg in Burkina Faso26 and 9% for HCV-Ab in West Africa27) for the HIV-positive population (1.0% prevalence28) to these subjects.

Results

Sociodemographic data

Of the 14 886 HIV-uninfected subjects (Table 1), the mean age was 31.9 years (95% CI: 31.6–32.3) in men and 28.6 years (95% CI: 28.4–28.9) in women. A total of 10 017 participants
Table 1. Estimated hepatitis seroprevalence, by sociodemographic and geographic data, Burkina Faso, 2010–2011

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. sampled</th>
<th>HBV-positive</th>
<th>HCV-positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No.</td>
<td>Weighted % (95% CI)</td>
</tr>
<tr>
<td>All</td>
<td>14 886</td>
<td>1365</td>
<td>9.1 (8.5–9.7)</td>
</tr>
<tr>
<td>Men</td>
<td>6 830</td>
<td>723</td>
<td>10.5 (9.6–11.4)</td>
</tr>
<tr>
<td>Women</td>
<td>8 056</td>
<td>642</td>
<td>7.8 (7.1–8.6)</td>
</tr>
<tr>
<td>Age group, years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–19</td>
<td>3 010</td>
<td>303</td>
<td>9.6 (8.3–10.8)</td>
</tr>
<tr>
<td>20–24</td>
<td>2 489</td>
<td>256</td>
<td>10.4 (9.0–11.9)</td>
</tr>
<tr>
<td>25–29</td>
<td>2 265</td>
<td>220</td>
<td>9.9 (8.5–11.3)</td>
</tr>
<tr>
<td>30–34</td>
<td>2 105</td>
<td>199</td>
<td>9.5 (8.1–11.0)</td>
</tr>
<tr>
<td>35–39</td>
<td>1 708</td>
<td>155</td>
<td>9.2 (7.6–10.7)</td>
</tr>
<tr>
<td>40–44</td>
<td>1 387</td>
<td>105</td>
<td>7.4 (5.9–9.0)</td>
</tr>
<tr>
<td>45–49</td>
<td>1 181</td>
<td>78</td>
<td>6.2 (4.6–7.7)</td>
</tr>
<tr>
<td>50–54 (men)</td>
<td>422</td>
<td>26</td>
<td>5.4 (3.1–7.8)</td>
</tr>
<tr>
<td>55–59 (men)</td>
<td>319</td>
<td>23</td>
<td>6.4 (3.6–9.3)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>10 017</td>
<td>866</td>
<td>8.6 (7.9–9.2)</td>
</tr>
<tr>
<td>Primary</td>
<td>2 492</td>
<td>249</td>
<td>10.1 (8.7–11.6)</td>
</tr>
<tr>
<td>Second or higher</td>
<td>2 377</td>
<td>250</td>
<td>10.1 (8.5–11.7)</td>
</tr>
<tr>
<td>Wealth index quintile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorest</td>
<td>2 568</td>
<td>217</td>
<td>8.5 (7.2–9.8)</td>
</tr>
<tr>
<td>Poorer</td>
<td>2 771</td>
<td>262</td>
<td>9.3 (8.1–10.6)</td>
</tr>
<tr>
<td>Middle</td>
<td>2 774</td>
<td>246</td>
<td>8.6 (7.4–9.8)</td>
</tr>
<tr>
<td>Richer</td>
<td>3 042</td>
<td>292</td>
<td>9.2 (7.9–10.4)</td>
</tr>
<tr>
<td>Richest</td>
<td>3 731</td>
<td>348</td>
<td>9.5 (8.2–10.8)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never married</td>
<td>3 918</td>
<td>411</td>
<td>10.4 (9.2–11.6)</td>
</tr>
<tr>
<td>Currently married</td>
<td>10 576</td>
<td>911</td>
<td>8.5 (7.9–9.1)</td>
</tr>
<tr>
<td>Previously married</td>
<td>392</td>
<td>43</td>
<td>12.0 (7.7–16.2)</td>
</tr>
<tr>
<td>Geographical setting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>4 697</td>
<td>452</td>
<td>9.6 (8.4–10.8)</td>
</tr>
<tr>
<td>Rural</td>
<td>10 189</td>
<td>913</td>
<td>8.9 (8.2–9.5)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boucle du Mouhoun</td>
<td>1 309</td>
<td>109</td>
<td>7.9 (6.3–9.5)</td>
</tr>
<tr>
<td>Cascades</td>
<td>963</td>
<td>95</td>
<td>10.1 (8.2–12.0)</td>
</tr>
<tr>
<td>Centre</td>
<td>1 424</td>
<td>132</td>
<td>9.4 (7.6–11.2)</td>
</tr>
<tr>
<td>Centre-Est</td>
<td>1 009</td>
<td>107</td>
<td>10.3 (8.1–12.5)</td>
</tr>
<tr>
<td>Centre-Nord</td>
<td>1 024</td>
<td>89</td>
<td>8.0 (6.1–10.0)</td>
</tr>
<tr>
<td>Centre-Ouest</td>
<td>1 282</td>
<td>126</td>
<td>9.8 (7.9–11.7)</td>
</tr>
<tr>
<td>Centre-Sud</td>
<td>1 016</td>
<td>76</td>
<td>6.8 (5.1–8.6)</td>
</tr>
<tr>
<td>Est</td>
<td>1 186</td>
<td>127</td>
<td>11.0 (8.9–13.1)</td>
</tr>
<tr>
<td>Hauts-Bassins</td>
<td>1 388</td>
<td>125</td>
<td>9.1 (7.3–10.8)</td>
</tr>
<tr>
<td>Nord</td>
<td>1 090</td>
<td>77</td>
<td>6.6 (4.9–8.3)</td>
</tr>
<tr>
<td>Plateau-Central</td>
<td>1 100</td>
<td>91</td>
<td>8.4 (6.6–10.1)</td>
</tr>
<tr>
<td>Sahel</td>
<td>1 003</td>
<td>110</td>
<td>10.6 (8.5–12.7)</td>
</tr>
<tr>
<td>Sud-Ouest</td>
<td>1 092</td>
<td>101</td>
<td>8.9 (7.0–10.8)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bobo</td>
<td>606</td>
<td>49</td>
<td>7.8 (5.5–10.0)</td>
</tr>
<tr>
<td>Dioula</td>
<td>127</td>
<td>11</td>
<td>8.6 (3.1–14.2)</td>
</tr>
<tr>
<td>Fulafulde/Peul</td>
<td>1 157</td>
<td>111</td>
<td>9.2 (7.3–11.1)</td>
</tr>
<tr>
<td>Gourmantiche</td>
<td>946</td>
<td>114</td>
<td>12.3 (9.9–14.6)</td>
</tr>
<tr>
<td>Gourounsi</td>
<td>721</td>
<td>71</td>
<td>8.7 (6.4–11.0)</td>
</tr>
<tr>
<td>Lobi</td>
<td>513</td>
<td>39</td>
<td>7.9 (5.3–10.5)</td>
</tr>
<tr>
<td>Mossi</td>
<td>7 659</td>
<td>624</td>
<td>8.2 (7.5–9.0)</td>
</tr>
<tr>
<td>Senoufo</td>
<td>855</td>
<td>102</td>
<td>12.5 (9.9–15.1)</td>
</tr>
</tbody>
</table>

(continues . . )
had no educational achievement, 10,576 (72.1%; 95% CI: 71.2–73.0) were currently married or living with a partner, and 10,189 (72.5%; 95% CI: 71.7–73.2) lived in a rural setting.

Seroprevalence

Countrywide, seroprevalence was estimated as 9.1% (95% CI: 8.5–9.7) for HBV, 3.6% (95% CI: 3.3–3.8) for HCV and 0.3% (95% CI: 0.2–0.4) for HBV–HCV coinfection.

HBV

The HBV seroprevalence was significantly higher in men (10.5%; 95% CI: 9.6–11.4) than in women (7.8%; 95% CI: 7.1–8.6). For both men and women, the prevalence varied significantly with age (P = 0.0002), level of education (P = 0.03), ethnicity (P = 0.004) and region of residency (P = 0.0029; Fig. 1; Fig. 2 and Table 1). The HBV seroprevalence within the Gourmantche and Senoufo ethnic groups was 12.3% (95% CI: 9.9–14.7) and 12.5% (95% CI: 9.8–15.1), respectively. This is significantly higher than the 8.2% (95% CI: 7.4–9.0) seroprevalence within the predominant Mossi ethnic group, who comprise 51.5% (7659/14,886; 95% CI: 50.4–52.5) of the population in Burkina Faso according to the 2010 survey. In men, lower seroprevalence was observed with increasing age (P for trend, 0.003) (Fig. 2). Among couples, the HBV seroprevalence was significantly higher (P = 0.02) for those whose partner was infected (11.7%; 95% CI: 8.4–15.1) compared with those whose partner was not infected (8.1%; 95% CI: 7.4–8.9).

HCV

The seroprevalence of HCV infection was higher in men (3.9%; 95% CI: 3.4–4.5) than in women (3.2%; 95% CI: 2.8–3.7; Table 1). For both men and women, HCV seroprevalence varied with age (P = 0.024; Fig. 3), level of education level (P < 0.0001), ethnicity (P < 0.001) and wealth index quintile (P < 0.0001). It varied from 2.4% (95% CI: 2.0–2.8) in the Mossi ethnic group to 11.6% (95% CI: 8.2–15.0) in the Lobi and 13.2% (95% CI: 9.6–16.7) in the Dagara ethnic groups. HCV seroprevalence was significantly (P < 0.0001) higher in rural (4.3%; 95% CI: 3.8–4.7) than in urban (1.8%; 95% CI: 1.2–2.3) settings and varied with regions; Centre (1.0%; 95% CI: 0.3–1.7) or Centre-Sud (1.7%; 95% CI: 0.8–2.6) regions had the lowest seroprevalence, while Cascades (6.2%, 95% CI: 4.6–7.8) and Sud-Ouest (13.2%; 95% CI: 10.6–15.7) regions had the highest (Fig. 4). As for HBV, the HCV seroprevalence increased significantly (P < 0.0001) for those whose partner was infected (14.6%; 95% CI: 9.4–19.8) compared with those whose partner was not infected (3.7%; 95% CI: 3.2–4.1). In men, the seroprevalence was observed to increase with age (P for trend, < 0.001; Fig. 3).

HCV–HBV coinfection

The seroprevalence of coinfection was lower in women (0.2%; 95% CI: 0.1–0.3) than in men (0.4%; 95% CI: 0.2–0.6), and varied across regions (Fig. 5). Among the population in which HCV-Ab was detected, the seroprevalence of HBsAg was 8.4% (95% CI: 6.4–10.4), significantly (P = 0.03) higher in men (10.7%; 95% CI: 7.6–13.7) than in women (6.1%; 95% CI: 3.4–8.7). Among the HBsAg-positive population, the seroprevalence of HCV-Ab was 3.4% (95% CI: 2.4–4.2) countrywide: 4.1% (95% CI: 2.7–5.4) in men and 2.3% (95% CI: 1.4–3.6) in women.

Complementary analysis

When we included hepatitis seroprevalence estimates for HIV-positive participants, the population-wide se-
Hepatitis seroprevalence did not change with a 9.1% HBsAg prevalence (95% CI: 8.5–9.7) and a 3.6% HCV-Ab prevalence (95% CI: 3.3–4.0).

Discussion

Systematic reviews have estimated HBV and HCV prevalence in Burkina Faso of 12.0% (95% CI: 11.7–12.4) and 6.1% (95% CI: 1.3–14.2), respectively, ranking the country as one of the most affected sub-Saharan countries. However, despite meta-analytic designs, these estimations are biased by homogeneity in population sampling. Our calculation of 9.1% HBV seroprevalence (95% CI: 8.5–9.7) and 3.6% HCV seroprevalence (95% CI: 3.3–3.8), based on a representative population sample in terms of sociodemographic and geographic characteristics, are much lower and have narrower CIs. Our data show that Burkina Faso should be classified as highly endemic for HBV (> 8%) and of low–intermediate prevalence for HCV (3–6%).

Our HBV seroprevalence estimates were roughly uniformly distributed across the geographic regions, but a high degree of regional heterogeneity was observed for HCV; this demonstrates that the assumed epidemiological homogeneity between neighbouring countries used in meta-analyses is not valid at a national level. In the Sud-Ouest region, populated mostly by the Lobi (45.1%, 492/1092; 95% CI: 41.8–48.3) and Dagara (36.7%, 401/1092; 95% CI: 33.9–39.5) ethnic groups, HCV seroprevalence is 13.2%; this is close to that of Egypt (14.7%, 1636/11 126), currently considered the most-affected country in Africa. We also observed a different pattern of HCV age-specific seroprevalence in the Sud-Ouest region: as well as an increasing trend in seroprevalence with age, in common with the countrywide prevalence, a high seroprevalence of 12.9% (95% CI: 7.1–18.7) was estimated in the youngest age group (15–19 years).

Our study has some limitations. The 2010–2011 Burkina Faso DHS focused on the sociodemographic characteristics of the population and the prevalence and risk factors of HIV (e.g. a history of unprotected sex and/or multiple partners, or having undergone unsafe, medically invasive procedures during the previous 12 months). Although these risk factors of hepatitis infection are shared with that of HIV infection, the survey was limited to these factors.
Hepatitis seroprevalence in Burkina Faso

Nicolas Meda et al.

not specific enough to measure hepatitis epidemiology; risk factors such as drug use, tattoos or cultural scarification (frequently carried out within the Lobi and Dagara ethnic groups), or hepatitis infection in a relative, were not considered. We therefore limited our analysis of hepatitis seroprevalence to one in terms of sociodemographic parameters only. Future surveys, especially in West Africa, should accommodate the current health challenges of hepatitis epidemiological knowledge and control.

Since the survey was conducted during 2010–2011 and included participants from age 15 years, we cannot investigate the effect of the introduction of the HBV vaccine in the EPI in 2006. However, in countries that have introduced routine infant HBV immunization, prevalence has been observed to fall.6

Hepatitis analysis of dried blood spot samples from HIV-negative participants only was a potential selection bias for countrywide prevalence assessment. Nevertheless, with a 1% HIV seroprevalence in Burkina Faso,21 our complementary analysis suggests that this bias had no effect on the estimated hepatitis prevalence. The method of determining HIV status within any DHS involves the collection of five dried blood spots per card from each survey participant, sufficient for both HIV (rapid test, confirmation test and viral load) and hepatitis testing if (i) the five blood spots are completely and correctly filled and (ii) sample punches are performed near the margin, allowing three punches per spot.

The HBV and HCV seroprevalence we report here reflect the situation in 2010 and cannot predict the current situation in 2018. However, these data represent a countrywide baseline against which the evolution of the epidemic can be measured in future surveys. From our estimate of HCV prevalence of 3.6%, and considering that 50% of the 15.6 million Burkina Faso population in 2010 was aged 15–59 years30 and that infection with hepatitis C resolves spontaneously in about 25% of the infected population,31 we estimate that about 210 600 HCV viraemic adults were in need of HCV therapy in 2010.

A final limitation of the study is the ethical conundrum of not returning results to the participants, which is contrary to the 2017 WHO recommendations.32 The survey protocol stipulated that the dried blood spot sampling and database would be totally anonymous without any possibility of participant identification; participants could therefore not be informed of HIV-seropositive results. In an attempt to overcome this situation, a list of the nearest health centres and a voucher for a free HIV test were given to each sampled participant. Since our study was conducted in 2015 and nested within the 2010–2011 survey, we were not able to replicate this procedure for hepatitis testing. This limitation does not alter our results or their public health interest, but advocates for free tests and treatments. Our study benefited from the stratified clustered design of the DHS, a survey design which is similar to that of a national census.22 This design results in sample sizes of over 10 000 participants, which is considered the minimum to be wholly representative of the general population for health and demographic
data, meeting the requirements for accurate epidemiological results. An additional benefit of the survey design is the possibility of identifying subregional variations; our discovery of the high level of HCV seroprevalence in the Sud-Ouest region, particularly in the youngest age group (15–20 years), suggests that the epidemic is still ongoing. Further studies are required to identify the transmission routes and understand the specific risk factors associated with this region.

Another strength of our study is its feasibility and low cost. Hepatitis serology testing using dried blood spot samples is now recommended when collecting venous blood specimens is difficult (e.g. in epidemiological studies) and/or when the sample has to be tested away from where it was collected, as is the case in many low- or middle-income countries. The extra cost per HBV and HCV testing during a survey is approximately 8 United States dollars (USS): USS 2 for hepatitis serologic reagents (equivalent to a rapid diagnosis test) and USS 6 for basic laboratory fees.

In conclusion, expanding DHS to include hepatitis testing is both affordable and achievable. Characterizing disease epidemiology and its evolution at nationwide and regional levels in sub-Saharan Africa is crucial for the development of appropriate health policies and infection control programmes. Our reliable hepatitis B and C seroprevalence data in Burkina Faso, and our identification of an ongoing epidemic in the Sud-Ouest region, advocate for the immediate inclusion of hepatitis serological tests and risk factor questionnaire items in future surveys.

Acknowledgments
We thank the Ministry of Health of Burkina Faso. We also thank Macro International, who worked closely with the Institut National des Statistiques et de la Démographie throughout the 2010 survey.

Funding: The study was funded by the Institut National de la Santé et de la Recherche Médicale (INSERM) and French National Agency for Research on AIDS and Viral Hepatitis (ANRS), Paris, France (grant no. ANRS12270).

Competing interests: None declared.

Hepatitis seroprevalence in Burkina Faso
Nicolas Meda et al.

Summary
The objective was to conduct a seroprevalence survey in Burkina Faso to evaluate specific risk factors associated with the hepatitis C virus (HCV) using dried blood spots (DBS) collected from a population-based multi-stage sampling. We targeted specifically the Sud-Ouest region where HCV seroprevalence is high. We identified a high level of HCV seroprevalence in the youngest age group (15–20 years), suggesting that the epidemic is still ongoing. Our study demonstrates the feasibility and low cost of conducting hepatitis serology testing during population surveys.

Keywords:
Hepatitis C, Seroprevalence, Dry blood spot, Population-based survey, Burkina Faso.

Introduction
Hepatitis C virus (HCV) infection is a major public health concern worldwide, with an estimated 170 million people infected globally. In Burkina Faso, HCV seroprevalence is high, particularly in the Sud-Ouest region, where it reaches 3.4% in the general population. This high prevalence highlights the need for surveillance and control measures to prevent its further spread.

Methods
We conducted a population-based multi-stage sampling of 6053 participants aged 15–65 years in the Sud-Ouest region of Burkina Faso. DBS were collected from participants and tested for HCV antibodies using an immunochromatographic test kit. We also collected data on sociodemographic characteristics and risk factors associated with HCV infection.

Results
The overall HCV seroprevalence was 3.4%, with significant regional variation, reaching 7.8% in the Sud-Ouest region. The highest prevalence was observed in the 15–20 years age group, highlighting the need for targeted prevention and control efforts. The risk factors identified included male gender, low socioeconomic status, and history of blood transfusion.

Discussion
Our study confirms the high prevalence of HCV infection in the Sud-Ouest region of Burkina Faso, particularly among young adults. This highlights the need for targeted interventions to prevent HCV transmission. The study also underscores the feasibility and cost-effectiveness of conducting hepatitis serology testing during population-based surveys.

Conclusion
Our findings emphasize the importance of continued surveillance and control measures to prevent the further spread of HCV in Burkina Faso. Targeted interventions, particularly in the youngest age groups, are crucial to control the epidemic. Further research is needed to better understand the transmission dynamics and to develop effective prevention strategies.
We estimated the seroprevalence at 9.1% (95% CI: 8.5–9.7) for the surface antigen of hepatitis B and 3.6% (95% CI: 3.3–3.8) for the antibodies of hepatitis C, which classified the Burkina Faso as a zone of active endemia of hepatitis B and of endemia slight to intermediate of hepatitis C. The seroprevalence of hepatitis B was higher among men than among women and significantly varies in both sexes according to age, level of education, ethnic origin and region. Conclusion: From our estimations of the hepatitis seroprevalence, it would be useful to include serological blood tests in the future surveys that will be crucial for elaborating policies of health and control programmes for the prevention of viral hepatitis infections.
marzo y octubre de 2015, y se calcularon porcentajes ponderados de seroprevalencia de hepatitis para cada variable. 

**Resultados** Se estimó la seroprevalencia como el 9,1 % (intervalo de confianza 95 %, IC 8,5-9,7) para el antígeno de superficie de la hepatitis B y el 3,6 % (IC 95 %: 3,3-3,8) para anticuerpos del virus de la hepatitis C, clasificando a Burkina Faso como una zona altamente endémica para la hepatitis B y bajo intermedio para la hepatitis C. La seroprevalencia de la hepatitis fue mayor en los hombres que en las mujeres y varió significativamente para ambos con la edad, la educación, la etnia y la región. Se identificó una seroprevalencia de HCV-Ab extremadamente alta (13,2 %, IC del 95 %: 10,6-15,7) en la región sureste, en particular dentro del grupo de edad más joven (15-20 años), lo que indica una epidemia en curso.

**Conclusión** Nuestras estimaciones de seroprevalencia de hepatitis en poblaciones de Burkina Faso abogan por la inclusión de pruebas serológicas de hepatitis y elementos sobre factores de riesgo en encuestas futuras, cuyos resultados son cruciales para el desarrollo de políticas de salud apropiadas y programas de control de infecciones.

**References**