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Seroprevalence of hepatitis C virus infection in Cameroon: a systematic review and meta-analysis

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ABSTRACT

Objective Better knowledge of hepatitis C virus (HCV) seroprevalence at the national level can help to implement pertinent strategies to address the HCV-related burden. The aim of this paper was to estimate the seroprevalence of HCV infection in Cameroon.

Design Systematic review and meta-analysis.

Participants People residing in Cameroon.

Data sources Electronic databases including PubMed/MEDLINE, AJOL, WHO-Afro Library, Africa Index Medicus, National Institute of Statistics and National AIDS Control Committee, Cameroon from 1 January 2000 to 15 December 2016 were searched. English and French languages papers were considered. Two independent investigators selected studies. The methodological quality of the studies was assessed using the Newcastle–Ottawa scale.

Results 31 studies including 36 407 individuals were finally considered. There was no national representative study. The overall pooled prevalence was 6.5% (95% CI 4.5% to 8.8%; I²=98.3%). A sensitivity analysis of individuals at low risk of HCV infection showed a pooled prevalence of 3.6% (95% CI 2.3% to 5.2%, I²=97.7%, 18 studies) among 22 860 individuals (general population, blood donors and pregnant women), which was higher than for a high-risk population (healthcare workers and people with other identified comorbidities), 12.2% (95% CI 4.9% to 22.2%; I²=98.3%, 13 studies); p=0.018. The prevalence was higher in the East region, in rural settings, and when using an enzyme immunoassay technique for detecting HCV antibodies. Sex, sites, study period, sample size, timing of data collection and methodological quality of studies were not sources of heterogeneity.

Limitation One-third of studies (29.0%) had a low risk bias in their methodology and most were facility-based (87.1%).

Conclusion The seroprevalence of HCV infection in Cameroon indicates the need for comprehensive and effective strategies to interrupt HCV transmission in the Cameroonian population. Specific attention is needed for the East region of the country, rural settings and high-risk populations. A national representative study is needed to provide better estimates.

Strengths and limitations of this study

► This is the first review to investigate the prevalence of HCV infection in Cameroon including specific populations.
► Strong and reliable methodological and statistical procedures were used.
► Common to most meta-analyses, the results may yield significant heterogeneity that cannot be explained.
► The sensitivity and specificity of HCV screening tools would be a source of heterogeneity; however, due to the lack of data in primary studies, it was not possible to investigate that.
► Not all regions in Cameroon were represented and most of the included studies were hospital-based, making it difficult to generalise the findings of this review.

and chronic hepatitis infection. Most routes of transmission of this blood-borne virus infection include unsafe injection practices, inadequate sterilisation of medical equipment and the transfusion of unscreened blood and blood products.[1] Less common routes include sexual transmission and mother-to-child transmission.[1] The global estimation of people living with HCV is between 130 and 150 million, with most of them developing HCV-related cirrhosis or liver cancer.[2] Viral treatment for HCV can cure 90% of persons with HCV infection, but access to diagnosis and treatment is low, especially in African countries which are the most affected part of the world.[1]

To date there is no vaccine for hepatitis C, making its control difficult. In May 2016 the World Health Assembly adopted the first global strategy for reducing the burden of HCV infection.[3] The goal was to eliminate HCV infection as a public health concern by reducing by 90% incident viral hepatitis infections and reducing by 65% deaths due to viral hepatitis by 2030.[3] Strategies should be implemented by each country with the

INTRODUCTION

Hepatitis C virus (HCV) infection is a liver centripetal disease than can cause acute

support of the World Health Organization.[3] In order to achieve these goals it is necessary for each country, before considering strategies to be implemented, to have detailed epidemiological data of good quality.

Published systematic reviews and meta-analyses provide the seroprevalence of HCV in Africa, with one of them not reporting estimates by country.[4 5] These two reviews inform on the overall seroprevalence without emphasis on specific populations, especially high-risk groups to which interventions should be mostly directed. In addition, there is a lack of the source of data for each country in these reviews. Better knowledge of HCV seroprevalence at the national level can help to implement pertinent and effective strategies to address the HCV-related burden at country level. The goal of the present review is to provide a detailed summary of the data on the seroprevalence of HCV in the general Cameroonian population, and specific populations such as blood donors, pregnant women, healthcare workers and HIV-infected people in particular. We strongly believe that interventions to reduce the HCV-related burden in Cameroon should be better if more detailed data at the country level are available. The present systematic review and meta-analysis aims to determine the seroprevalence of HCV infection in populations residing in Cameroon.

METHODS
Design
This review was reported following the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines.[6] The PRISMA checklist can be found in Supplementary file 1. This review was registered in the PROSPERO International Prospective Register of systematic reviews, registration number CRD42016053713. The Centre for Reviews and Dissemination guidelines were used as reference for the methodology of this review.[7]

Setting
Cameroon is a Central African country. It covers a surface area of $472\,650\,km^2$ divided into 10 administrative regions: Adamawa, East, Far-North, Littoral, North, North-West, South, South-West, West and Centre where the capital city Yaoundé is located. Cameroon counted 22.25 million inhabitants in 2013.[8]

Criteria for considering studies for the review
Inclusion criteria
► Study design: cross-sectional, case-control or cohort studies.
► Participants: people residing in Cameroon.
► Studies of interest: studies reporting the seroprevalence of HCV infection or enough data to compute this estimate.
► Outcome measurement: diagnosis of HCV infection should be based on the presence of antibodies anti-HCV.
► Types of publication: published and unpublished data.

Exclusion criteria
► Studies conducted among Cameroonian populations residing outside Cameroon.
► Studies in subgroups of participants selected on the basis of the presence of any other viral hepatitis.
► Case series, reviews, commentaries and editorials.
► Studies lacking primary data and/or explicit method description.
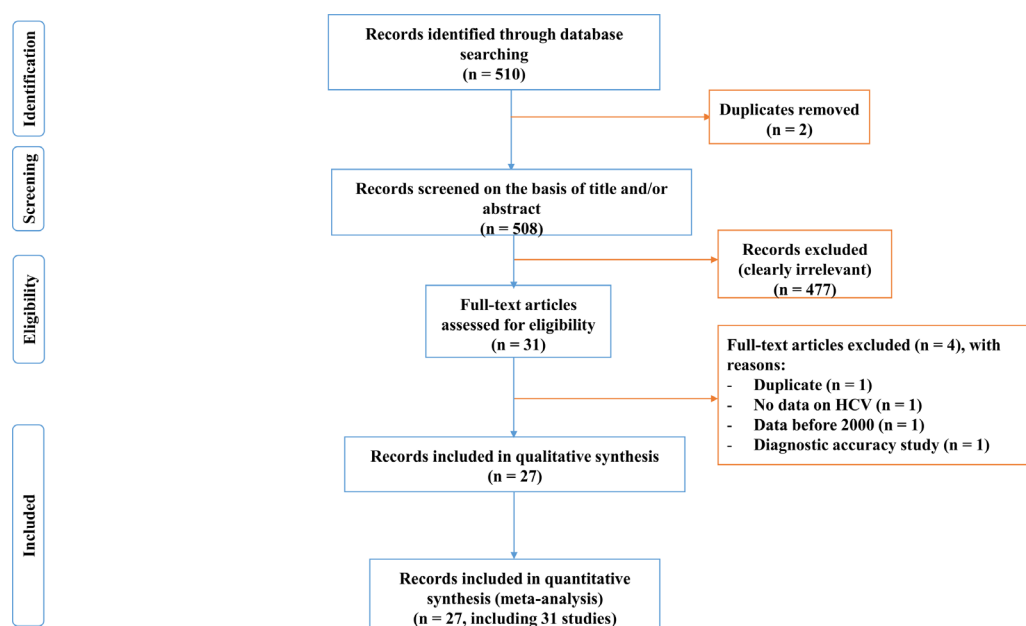
Figure 1 Process of identification and selection of studies for inclusion in the review.

► Duplicates (for studies published in more than one report, the most comprehensive and up-to-date version was used).

Search strategy used to identify relevant studies
Database searching

A comprehensive search of databases was performed to identify all relevant articles published on HCV infection in Cameroon from 1 January 2000 to 15 December 2016 in English and French. The following databases were screened: MEDLINE through PubMed, African

Figure 2 Forest plot of the prevalence of hepatitis C virus infection in all subpopulations in Cameroon.

Journals Online, Africa Index Medicus, National Institute of Statistics, Cameroon (http://www.statistics-cameroon.org/), National AIDS Cont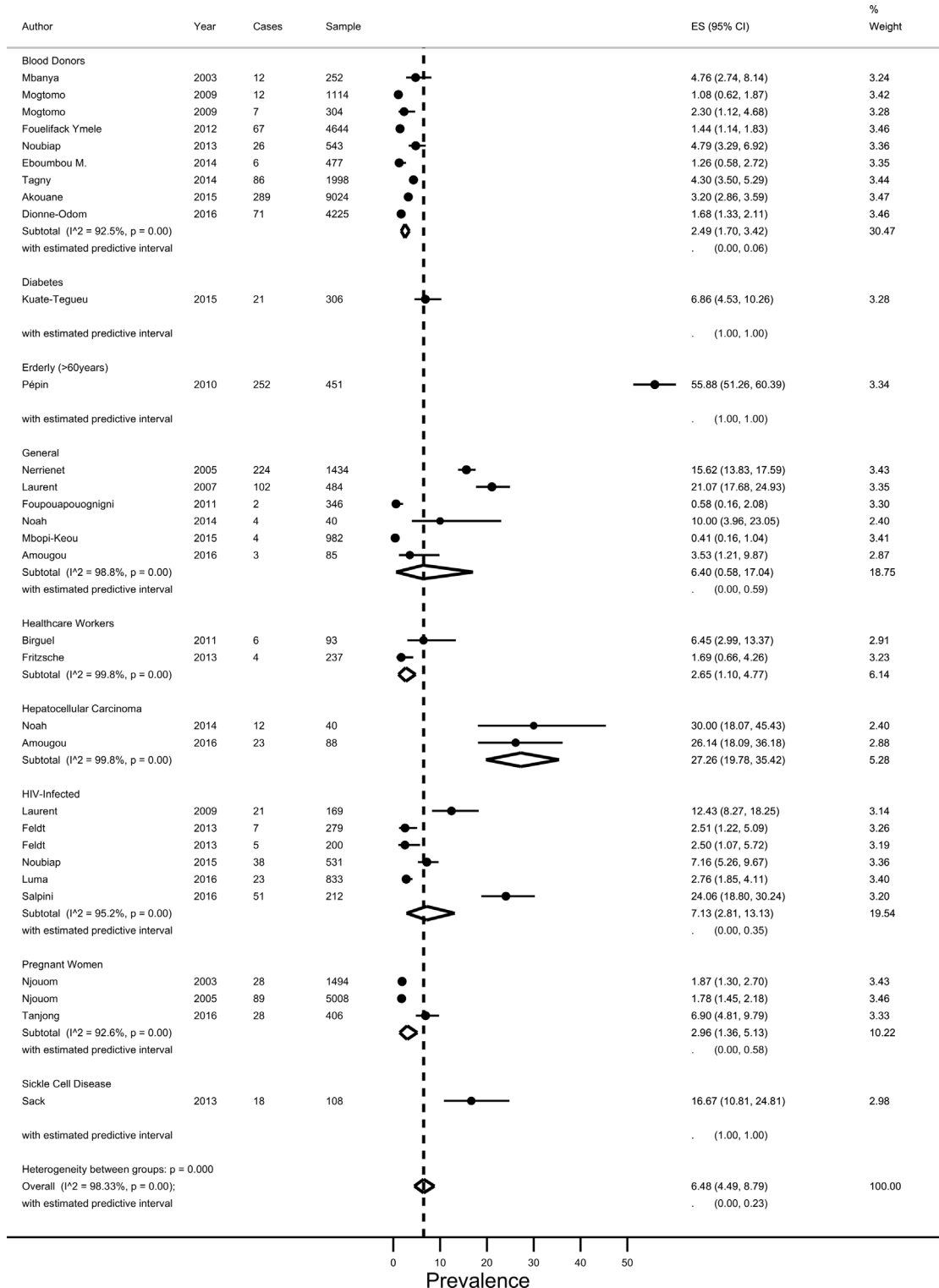rol Committee, Cameroon (http://www.cnls.cm/), Health Sciences and Diseases (the biomedical journal of the Faculty of Medicine and Biomedical Sciences, University of Yaoundé 1, Cameroon) and WHO Afro Library. A predefined strategy using a combination of relevant terms was used. Both text words and medical subject heading (MeSH) terms were used; for example, 'viral hepatitis C', 'hepatitis virus C', 'HCV' and 'Cameroon'. These terms and their variants were used in varying combinations. The literature search strategy was adapted to suit each database. The main search strategy conducted in PubMed is shown in Supplementary file 2. The last search was performed on 15 December 2016.

Searching for other sources

Reference lists of eligible articles and relevant reviews were manually searched to identify other sources.

Selection of included studies

Records were independently identified and their titles and abstracts were screened by two investigators to assess their eligibility. Full texts of articles deemed potentially eligible were acquired. The full text of each study was then assessed for eligibility by two investigators. Studies were consensually retained to be included by two investigators. Disagreement was solved by a third investigator.

Appraisal of the quality of included studies

An adapted version of the Newcastle–Ottawa Scale (NOS) was used to assess the methodological quality of studies included in this review (Supplementary file 3).[9] This scale was also used to assess the risk of bias affecting study findings. There is no validation study that provides a cut-off score for rating low-quality studies; a priori, we arbitrary established that 0–3, 4–6 and 7–9 stars would be considered as high, moderate and low risk of bias, respectively.
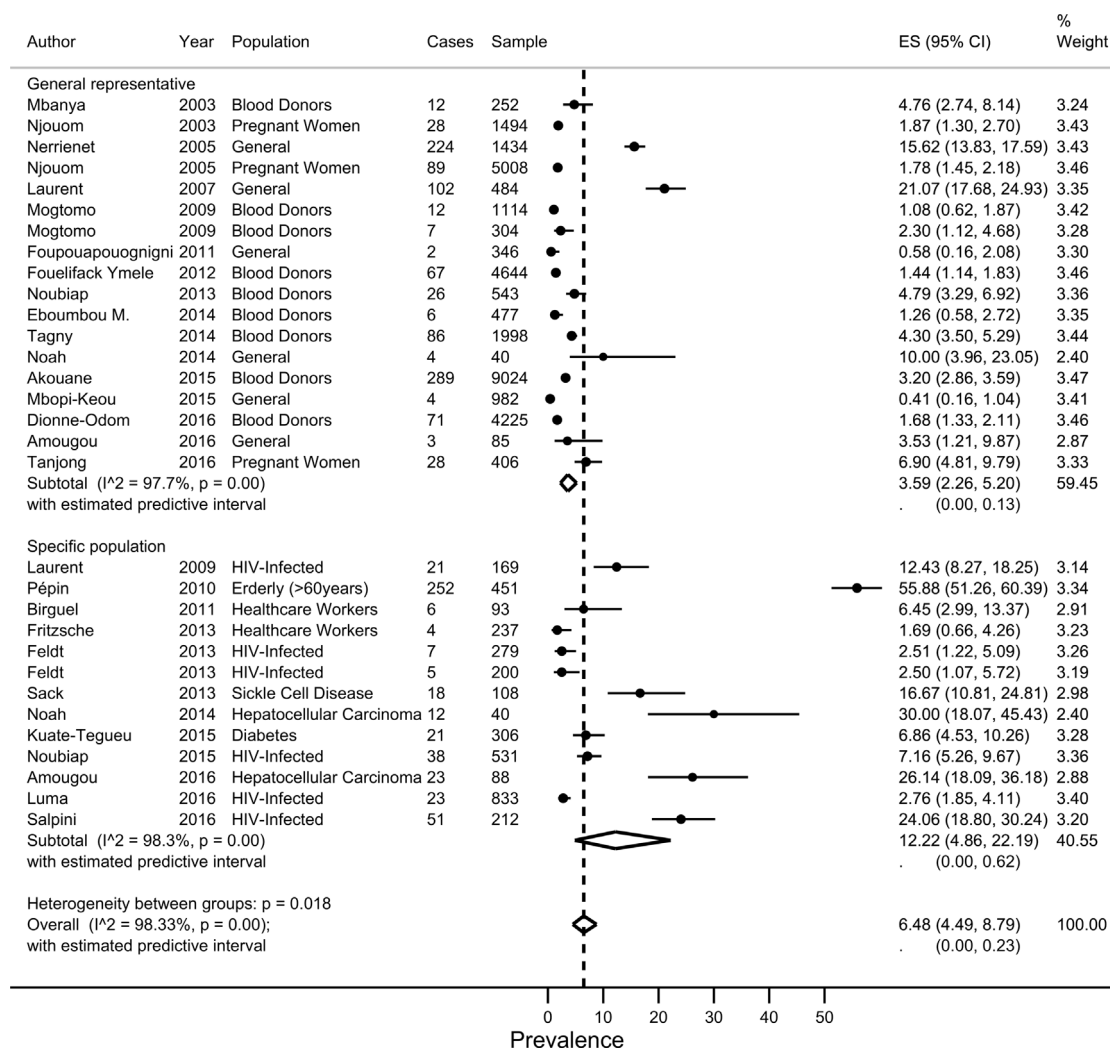
Author	Year	Population	Cases	Sample	ES (95% CI)	% Weight
General representative						
Mbanya	2003	Blood Donors	12	252	4.76 (2.74, 8.14)	3.24
Njouom	2003	Pregnant Women	28	1494	1.87 (1.30, 2.70)	3.43
Nerrienet	2005	General	224	1434	15.62 (13.83, 17.59)	3.43
Njouom	2005	Pregnant Women	89	5008	1.78 (1.45, 2.18)	3.46
Laurent	2007	General	102	484	21.07 (17.68, 24.93)	3.35
Mogtomo	2009	Blood Donors	12	1114	1.08 (0.62, 1.87)	3.42
Mogtomo	2009	Blood Donors	7	304	2.30 (1.12, 4.68)	3.28
Foupouapouognigni	2011	General	2	346	0.58 (0.16, 2.08)	3.30
Fouelifack Ymele	2012	Blood Donors	67	4644	1.44 (1.14, 1.83)	3.46
Noubiap	2013	Blood Donors	26	543	4.79 (3.29, 6.92)	3.36
Eboumbou M.	2014	Blood Donors	6	477	1.26 (0.58, 2.72)	3.35
Tagny	2014	Blood Donors	86	1998	4.30 (3.50, 5.29)	3.44
Noah	2014	General	4	40	10.00 (3.96, 23.05)	2.40
Akouane	2015	Blood Donors	289	9024	3.20 (2.86, 3.59)	3.47
Mbopi-Keou	2015	General	4	982	0.41 (0.16, 1.04)	3.41
Dionne-Odom	2016	Blood Donors	71	4225	1.68 (1.33, 2.11)	3.46
Amougou	2016	General	3	85	3.53 (1.21, 9.87)	2.87
Tanjong	2016	Pregnant Women	28	406	6.90 (4.81, 9.79)	3.33
Subtotal (I^2 = 97.7%, p = 0.00)					3.59 (2.26, 5.20)	59.45
with estimated predictive interval					. (0.00, 0.13)	
Specific population						
Laurent	2009	HIV-Infected	21	169	12.43 (8.27, 18.25)	3.14
Pépin	2010	Erderly (>60years)	252	451	55.88 (51.26, 60.39)	3.34
Birguel	2011	Healthcare Workers	6	93	6.45 (2.99, 13.37)	2.91
Fritzsche	2013	Healthcare Workers	4	237	1.69 (0.66, 4.26)	3.23
Feldt	2013	HIV-Infected	7	279	2.51 (1.22, 5.09)	3.26
Feldt	2013	HIV-Infected	5	200	2.50 (1.07, 5.72)	3.19
Sack	2013	Sickle Cell Disease	18	108	16.67 (10.81, 24.81)	2.98
Noah	2014	Hepatocellular Carcinoma	12	40	30.00 (18.07, 45.43)	2.40
Kuate-Tegueu	2015	Diabetes	21	306	6.86 (4.53, 10.26)	3.28
Noubiap	2015	HIV-Infected	38	531	7.16 (5.26, 9.67)	3.36
Amougou	2016	Hepatocellular Carcinoma	23	88	26.14 (18.09, 36.18)	2.88
Luma	2016	HIV-Infected	23	833	2.76 (1.85, 4.11)	3.40
Salpini	2016	HIV-Infected	51	212	24.06 (18.80, 30.24)	3.20
Subtotal (I^2 = 98.3%, p = 0.00)					12.22 (4.86, 22.19)	40.55
with estimated predictive interval					. (0.00, 0.62)	
Heterogeneity between groups: p = 0.018						
Overall (I^2 = 98.33%, p = 0.00);					6.48 (4.49, 8.79)	100.00
with estimated predictive interval					. (0.00, 0.23)	

0   10   20   30   40   50
Prevalence

Figure 3 Forest plot of the prevalence of hepatitis C virus infection in subpopulations by infection risk status in Cameroon.

Data extraction and management

One investigator extracted data regarding general information (authors, year of publication, regions in Cameroon and included populations), study characteristics (study design, setting, sample size, mean or median age, age range, proportions of male participants, diagnosis criteria for HCV infection, timing of data collection) and the seroprevalence of HCV infection. Two main groups were defined regarding their a priori risk of acquiring HCV infection: low-risk population (general population, blood donors and pregnant women) and high-risk population (healthcare workers, HIV-infected people, patients on haemodialysis and patients with sickle cell disease, diabetes or hepatocellular carcinoma). Where only primary data (sample size and number of cases) were available, these were used to calculate the seroprevalence estimate. Where prevalence rates or relevant data for estimating them were not available, the corresponding authors were contacted to request the missing information. In the absence of a response or unavailability of full data, the study was excluded. A second investigator double-checked extracted data for accuracy.

Data synthesis including assessment of heterogeneity

Data were analysed and synthetised using the statistical software STATA Version 13.0 for Windows (Stata Corp, 2013. Stata Statistical Software: Release 13, College Station, Texas, USA). Standard errors for the study-specific estimates were determined from the point estimate and the appropriate denominators, assuming a binominal distribution. We pooled the study-specific estimates using a random-effects meta-analysis model to obtain an overall summary estimate of the prevalence across studies, after stabilising the variance of individual studies with the use of the Freeman–Tukey double arcsine transformation.[10] All forest plots from meta-analyses were reported with the double arcsine-transformed pooled proportions. All pooled estimates were reported with their 95% confidence intervals (CI) and 95% prediction intervals (PI). Heterogeneity was assessed using the χ^2 test on Cochrane's Q statistic[11] and quantified by calculating the I^2 value.[12] Values of 25%, 50% and 75% for I^2 represent low, medium and high heterogeneity, respectively. Where substantial heterogeneity was detected, when possible we performed subgroup analysis to investigate the possible sources of heterogeneity using the following grouping variables: populations, timing of data collection, sex, study setting, study site, geographical regions in Cameroon, HCV infection screening tools, study period, sample size and study methodological quality. Only populations at low risk of HCV infection were considered for these subgroup analyses. We compared subgroups using the Q-test based on analysis of variance. We assessed the presence of publication bias using funnel plots and the formal Egger's test.[13] A p value <0.10 was

considered indicative of statistically significant publication bias. In addition, we conducted a trim-and-fill adjusted analysis to take into account asymmetry in the published articles, re-computing the effect size at each iteration until the funnel plot was symmetrical about the (new) effect size.[14] We assessed inter-rater agreement for study inclusion using Cohen's kappa (κ) coefficient.[15]

RESULTS
Study selection

Initially, a total of 510 articles were identified. Two duplicates were removed. After screening titles and abstracts, 477 records were found to be irrelevant and were excluded. Agreement between investigators on abstract selection was high (κ=0.91, p<0.001). Full texts of the remaining 31 records were scrutinised for eligibility, four of which were excluded (figure 1).[16–19] In all, 27 papers including 31 studies were retained for review and then for meta-analysis.

Characteristics of included studies

Supplementary file 4 presents the characteristics of the studies included in the meta-analysis. The 27 included papers included studies conducted in eight of the 10 regions of Cameroon.[20–46] The North and Adamawa regions were not represented. There was no national representative study. Concerning distribution of the studies among groups, nine studies were conducted among blood donors, six in the general population, six in HIV-infected people, three in pregnant women, two in healthcare workers, two in patients with hepatocellular carcinoma, one in diabetic patients, one in patients with sickle cell disease and one in elderly people. Eighteen studies were conducted in people at low risk of HCV infection and 13 in high-risk populations. Nineteen studies were conducted in urban settings only, three in rural settings only and nine in both settings. Four studies were population-based and 27 were hospital-based. Mean/median ages reported in 23 studies varied from 8 to 70 years. Age ranged from 0 to 102 years. Three studies included only women (pregnant women) and 28 included both women and men. The proportion of men in 19 studies including both sexes varied from 27% to 94%. Concerning the diagnostic tests used in the studies, 15 used an enzyme-linked immunoassay test, 11 used enzyme immunoassay tests and five used rapid diagnostic tests.

Methodological quality of studies

Nine studies (29.0%) had a low risk of bias, 18 (58.1%) had a moderate risk of bias and 4 (12.9%) had a high risk of bias in their methodological quality. Two papers were case–control studies and 27 were cross-sectional studies. Twenty-six studies included prospectively collected data and five retrospectively collected data (Supplementary file 4).

Overall pooled prevalence of HCV infection

Table 1 presents a summary of the statistical analyses. The seroprevalence of HCV infection varied widely (figure 2). The crude overall seroprevalence of HCV infection in the pooled sample of 36 407 individuals was 6.5% (95% CI 4.5% to 8.8%, I²=98.3%). For the overall crude seroprevalence, the funnel plot suggested publication bias (Supplementary file 5) which was confirmed by the results of Egger's test (p<0.001). There was a difference in the prevalence between populations at high risk of HCV infection (12.2%; 95% CI 4.9% to 22.2%, I²=98.3%) and populations at low risk (3.6%; 95% CI 2.3% to 5.2%, I²=97.7%) with p for difference=0.018 (figure 3). For the sensitive overall seroprevalence in the low-risk group, the funnel plot suggested no publication bias (Supplementary file 6) which was confirmed by the results of Egger's test (p=0.255). In the sensitivity analysis, the trim-and-fill analysis adjusted four studies and calculated a new seroprevalence of HCV infection at 4.1% (95% CI 2.0% to 6.2%) in the population at low risk of HCV infection. I² measure was high in all meta-analyses (>90%), indicating that most of the variation was attributed to variation in effect size across studies rather than chance. The estimated PI for the pooled prevalence was wide, suggesting heterogeneity with substantial variation in effect size across individual studies.

Source of heterogeneity and subgroup analysis

Table 1 presents the HCV seroprevalence of all subgroups including assessment of heterogeneity, assessment of publication bias and assessment of difference between subgroups. The prevalence was higher in the East region compared with others, higher when using the enzyme immunoassay method compared with the enzyme-linked immunoassay and rapid diagnostic test, and higher in rural sites than in urban sites. There was no difference in the seroprevalence of HCV infection when comparing subgroup populations (figure 4), risk of bias in the methodological quality of studies, timing of data collection, study period, sample size and sex (table 1).

DISCUSSION

This systematic review investigated the seroprevalence of HCV infection in different populations in Cameroon. The information provided in this review may contribute to improve public health interventions in the country and therefore contribute to reducing the burden of HCV infection. We found a pooled seroprevalence of 6.5% (95% CI 4.5% to 8.8%), which is slightly higher than that found in the sensitivity analysis excluding high-risk individuals (3.6%; 95% CI 2.3% to 5.1%) and the adjusted trim-and-fill analysis (4.1%; 95% CI 2.0% to 6.2%). Our pooled estimate is close to the findings of a systematic review of HCV focusing on Africa which reported a seroprevalence of 4.9% (95% CI 0.9% to 11.9%) from 16 studies in Cameroon with age range 25–70 years.[5] Our review included 31 studies with participants aged 0–102

years. The reported seroprevalence in low-risk participants (3.6%) in our review is close to that reported in other reviews in Africa (2.5–3.0%).[4 5] The seroprevalence reported in this study suggests that, in a population of 22.25 million inhabitants such as in Cameroon,[8] there are about 511 750–1 146 250 inhabitants infected by HCV. Therefore, access to screening for HCV and treatment should be urgently scaled up nationwide. Between-study heterogeneity was significant, suggesting that about 97% of the variability in the measure of the HCV prevalence is due to heterogeneity between studies rather than chance. This heterogeneity was partly explained by differences in the distribution of HCV prevalence among regions, settings and screening tools. However, we were not able to measure the impact of the sensitivity and specificity of HCV screening tools.

The seroprevalence of HCV in the general population, blood donors and pregnant women was not different. This, however, is different from the results of a meta-analysis in Africa which reported a higher seroprevalence of HCV infection in the general population than in blood donors and pregnant women.[5] In our review, the seroprevalence was slightly higher in the general population than in blood donors and pregnant women, but the difference was not statistically significant. Not surprisingly, the seroprevalence of HCV infection was higher in high-risk groups than in low-risk groups, as in other reviews in Africa.[4] With regard to HCV seroprevalence in specific populations, the rates in blood donors, pregnant women and HIV-infected people were close to those reported in other reviews in Africa and Cameroon.[4] The seroprevalence in patients with hepatocellular carcinoma in our review is higher than that reported in patients with liver disease in sub-Saharan Africa.[4] This could be explained by the fact that the current review included only patients with liver cancer and no other liver diseases. The absence of difference between low-risk infection groups (general representative populations) calls for close strategies for all groups when implementing preventive strategies focusing on the reduction of this seroprevalence. Specific strategies are needed for high-risk groups in Cameroon.

Analyses suggest that the seroprevalence of HCV infection did not differ with regard to study settings, sex and study period, pointing out the need for close strategies in these groups. There was a difference in seroprevalence across regions. The East region had the highest seroprevalence while the lowest rates were recorded in the West region. This result should be interpreted carefully since there was only one study from the East region and one from the West region. It is also important to note that the Adamawa and North regions were not represented in this comparison. The prevalence was higher when using enzyme immunoassay. However, due to lack of reporting of sensitivity and specificity in primary studies, it is not possible to discuss accurately this finding. We found a higher prevalence of HCV infection in rural setting than in urban settings.

Table 1 Summary statistics from meta-analyses of seroprevalence studies on hepatitis C virus (HCV) infection among populations in Cameroon using random effects model and arcsine transformations

Group	No of studies	No of participants	No of cases	Prevalence, % (95% CI)	I², %	p_heterogeneity	95% prediction intervals	p_Egger test	p_difference subgroups
Crude analysis									
Risk of HCV infection									
Low risk*	18	32860	1056	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.9	0.255	
High risk†	13	3587	485	12.2 (4.9 to 22.2)	98.3	<0.001	0.0–62.2	0.770	
Overall	31	36407	1541	6.5 (4.5 to 8.8)	98.3	<0.001	0.0–23.3	0.111	0.018
Sensitivity analysis (low risk only)									
Population									
General	6	3371	339	6.4 (0.6 to 17.0)	98.8	<0.001	0.0–59.1	0.768	
Blood donors	9	22581	576	2.5 (1.7 to 3.4)	92.5	<0.001	0.4–6.4	0.890	
Pregnant women	3	6908	145	3.0 (1.4 to 5.1)	92.6	<0.001	0.0–57.7	NE	
Overall	18	32860	1060	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.8	NE	0.471
HCV screening tools									
Enzyme immunoassay	6	7390	276	4.7 (1.4 to 9.5)	97.9	<0.001	0.0–28.7	0.416	
Enzyme-linked immunoassay	10	23945	754	3.4 (1.8 to 5.5)	98.0	<0.001	0.0–13.4	0.557	
Rapid diagnostic test	2	1525	30	1.4 (0.9 to 2.1)	99.6	<0.001	NE	0.498	
Overall	18	32860	1060	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.8	0.079	0.015
Risk of bias									
High	1	40	4	10.0 (4.0 to 23.1)	–	–	NE	–	
Moderate	12	28912	808	2.5 (1.3 to 4.0)	97.5	<0.001	0.0–10.1	NE	
Low	5	3908	248	6.5 (2.3 to 12.5)	97.3	<0.001	0.0–38.1	NE	
Overall	18	32860	1060	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.8	NE	0.204
Timing of data collection									
Retrospective	3	17893	427	2.1 (1.1 to 3.3)	96.3	<0.001	0.0–36.5	0.481	
Prospective	15	14967	633	4.1 (2.0 to 6.7)	97.8	<0.001	0.0–19.4	0.135	
Overall	18	32860	1060	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.8	0.997	0.079
Sites									
Hospital-based	15	31048	952	3.4 (2.2 to 4.9)	97.2	<0.001	0.0–11.1	0.377	
Population-based	3	1812	108	4.2 (0.0 to 20.7)	99.1	<0.001	0.0–10.0	0.741	
Overall	18	32860	1060	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.8	0.175	0.887
Regions									
Centre	9	23979	802	4.1 (2.2 to 6.5)	98.1	<0.001	0.0–14.9	NE	
East	1	484	102	21.1 (17.7 to 24.9)	–	–	NE	NE	
Littoral	5	3299	71	2.2 (1.1 to 3.6)	81.7	<0.001	0.0–8.7	NE	
North-West	1	2475	47	1.9 (1.4 to 2.5)	–	–	NE	NE	

Table 1 Continued

Group	No of studies	No of participants	No of cases	Prevalence, % (95% CI)	I², %	p_heterogeneity	95% prediction intervals	p_Egger test	p_difference subgroups
South-West	3	1296	36	1.7 (1.0 to 2.5)	95.4	<0.001	0.0–10.0	NE	
West	1	982	4	0.4 (0.2 to 1.0)	–	–	NE	NE	
Overall	19	31 515	1062	3.5 (2.3 to 5.0)	97.3	<0.001	0.0–12.5	NE	<0.001
Settings									
Rural	2	830	104	9.4 (7.5 to 11.5)	99.7	<0.001	NE	0.732	
Urban	11	24 440	603	2.3 (1.6 to 3.1)	90.3	<0.001	0.3–5.6	0.787	
Overall	14	25 270	707	3.1 (1.9 to 4.5)	96.1	<0.001	0.0–9.9	0.399	<0.001
Sex									
Female	6	8340	163	1.9 (1.0 to 3.1)	88.3	<0.001	0.0–7.3	0.611	
Male	3	13 218	342	1.7 (0.6 to 3.3)	96.1	<0.001	0.0–49.8	0.523	
Overall	9	21 558	505	1.8 (1.2 to 2.7)	92.3	<0.001	0.1–5.4	0.449	0.733
Study period									
Before 2010	9	15 080	543	4.1 (1.6 to 7.6)	98.7	<0.001	0.0–22.1	0.635	
2010 or later	9	17 780	517	2.9 (1.8 to 4.2)	93.1	<0.001	0.1–8.4	0.315	
Overall	18	32 860	1060	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.8	0.234	0.517
Sample size, median=514									
Lower than median	9	2937	190	4.9 (1.7 to 9.6)	95.6	<0.001	0.0–28.1	0.490	
Higher than median	9	29 923	870	2.7 (1.4 to 4.4)	98.4	<0.001	0.0–11.1	0.666	
Overall	18	32 860	1060	3.6 (2.3 to 5.2)	97.7	<0.001	0.0–12.8	0.439	0.212

*General population, blood donors and pregnant women.
†Healthcare workers, diabetic patients, elderly (>60 years), HIV-infected patients, hepatocellular carcinoma patients, sickle cell disease patients.
NE, not estimable because of insufficient observations.

The same finding was found in a near country.[47] This may be explained by the low level of education in rural settings compared with urban settings; this low level of education may be related to low awareness of the risk of HCV transmission. This underlines the need for specific interventions for rural settings in Cameroon.[48 49]

Only one-third of studies included in the review had low risk in their methodological quality; nevertheless, this had no effect on the HCV seroprevalence estimate, with other factors such as timing of data collection, sample size and publication bias. Only a large representative national epidemiological study conducted at the same time in all regions and all specific groups can give a more reliable and accurate overall seroprevalence of HCV infection. Therefore, a large and high quality study is needed to give an accurate estimate in the country.

To the best of our knowledge, this is the first systematic review and meta-analysis that focuses on HCV infection in Cameroon. We included more studies than previously published meta-analysis.[4 5] In addition, the prevalence in specific populations was estimated and the difference

between specific populations, sex, geographical regions, HCV screening tools, status regarding risk of acquiring HCV infection and residence areas were assessed. Strong and reliable methodological and statistical procedures were used. Across studies, HCV screening tools and their sensitivity and specificity may be different; this may impact estimates. Not all regions in Cameroon were represented and most of the included studies were hospital-based, making it difficult to generalise the findings of this review.

CONCLUSIONS

The seroprevalence of HCV infection in Cameroon varies across specific and general subpopulations. These findings indicate a high prevalence, which reveals the need for comprehensive and effective strategies to interrupt the transmission of HCV in the Cameroonian population. Specific attention is needed for the East region of the country, populations dwelling in rural settings and populations at high risk for HCV
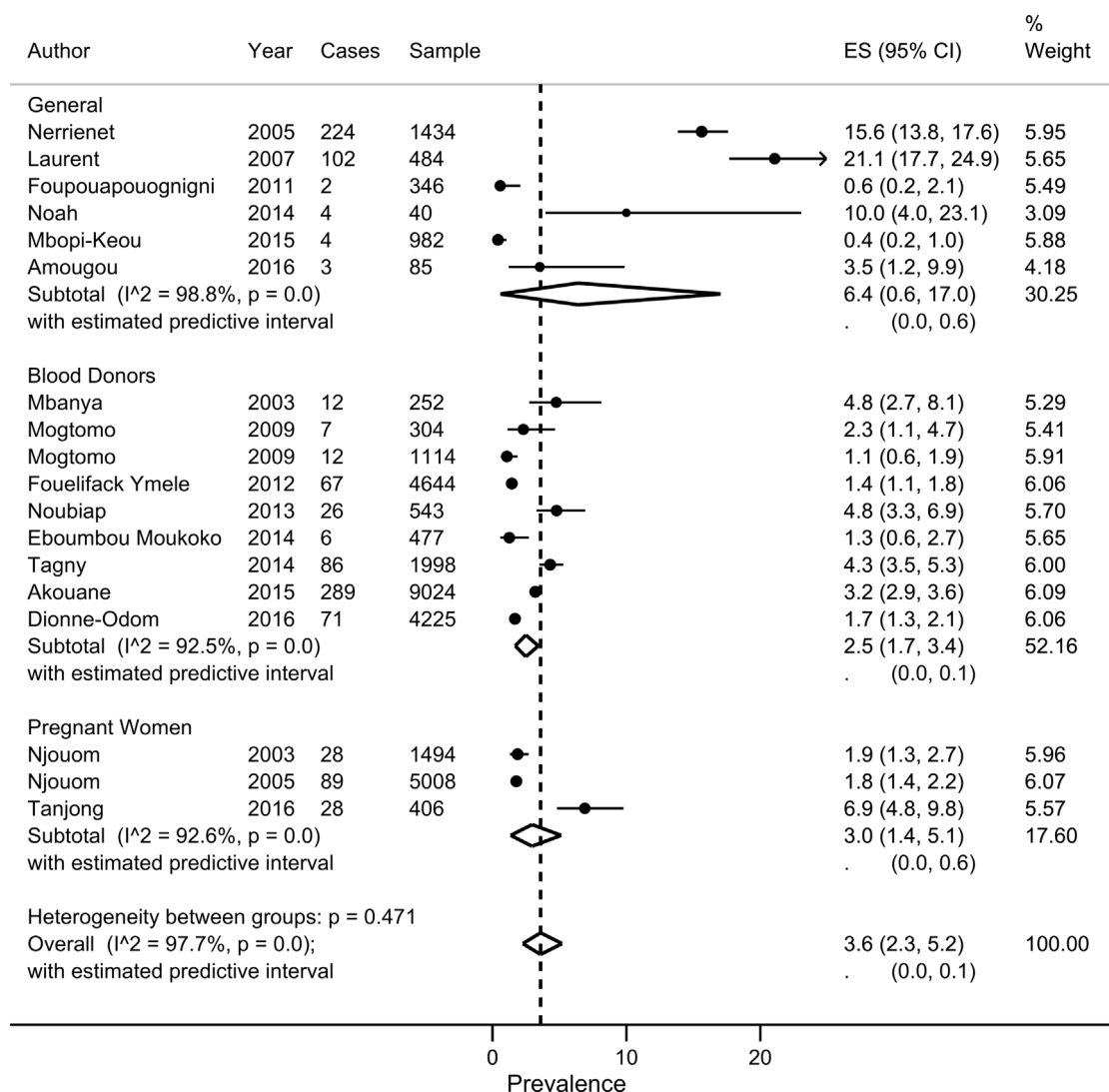

Figure 4 Forest plot of the prevalence of hepatitis C virus infection in subpopulations at low risk in Cameroon.

infection. A national representative study is needed to obtain better estimates of the seroprevalence of HCV in the country.

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