

**Original Article****Open Access****Hepatitis B and C viral infections and correlates among pregnant women in Ilorin, Nigeria: a cross-sectional study***¹Udeze, A. O., ²Udeze-Okey, C. N., ³Odebisi-Omokanye, M. B., and ¹Njoku, G. C.¹Virology Unit, Department of Microbiology, University of Ilorin, P.M.B 1515 Ilorin, Nigeria²Obstetrics and Gynaecology Ward, University of Ilorin Teaching Hospital, Ilorin, Nigeria³Medical Microbiology Unit, Department of Microbiology, University of Ilorin, P.M.B 1515 Ilorin, Nigeria*Correspondence to: udeze.ao@unilorin.edu.ng; austok90@yahoo.com; +2348135586003

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Abstract:

Background: Hepatitis B and C are significant viral infections in pregnancy with high risk of maternal and neonatal complications. This study was conducted to determine the prevalence of hepatitis B and C viral infections and correlates among pregnant women who attended antenatal care (ANC) unit of General and Civil Service Hospitals, Ilorin, Nigeria.

Methodology: This was a descriptive cross-sectional study of 282 consented pregnant women randomly selected from the ANC units of two hospitals in Ilorin. Blood samples were collected from the pregnant women and tested for hepatitis B virus (HBV) surface antigen (HBsAg) and anti-hepatitis C virus (HCV) antibody using Enzyme Linked Immunosorbent Assay (ELISA) technique. Socio-demographic and obstetrics information of the pregnant women and potential risk factors for HBV and HCV infections were collected using a pretested structured questionnaire. Statistical analysis was done using SPSS version 22.0

Results: Majority of the women were married (78.4%), from monogamous families (57.8%), do not share sharp objects (65.6%), have not received blood transfusion (65.3%), have no history of organ transplantation (91.1%), and multigravida (61.4%), in their first (36.9%), second (37.2%) and third (25.9%) trimesters of pregnancy. Overall, 22.3% and 1.4% tested positive for HBsAg and anti-HCV respectively. Family background of the study participants showed significant ($p < 0.05$) association with HBsAg positivity. None of the other analysed variables showed any significant association with both HBsAg and anti-HCV positivity.

Conclusion: This result showed high prevalence of HBV but low prevalence of HCV infections among pregnant women in the study setting. Improved surveillance and routine screening for HBV and HCV for women attending ANC is recommended to reduce disease burden and help achieve WHO goal of eliminating viral hepatitis as a major public health threat by 2030

Keywords: HBV; HCV; Maternal health; Neonatal health; Pregnancy

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Infections virales des hépatites B et C et corrélats chez les femmes enceintes à Ilorin, au Nigéria: une étude transversale*¹Udeze, A. O., ²Udeze-Okey, C. N., ³Odebisi-Omokanye, M. B., et ¹Njoku, G. C.¹Unité de Virologie, Département de Microbiologie, Université d'Ilorin, P.M.B 1515 Ilorin, Nigéria²Service d'Obstétrique et de Gynécologie, Hôpital Universitaire d'Ilorin, Ilorin, Nigéria³Unité de Microbiologie Médicale, Département de Microbiologie, Université d'Ilorin, P.M.B 1515 Ilorin, Nigéria*Correspondance à: udeze.ao@unilorin.edu.ng; austok90@yahoo.com; +2348135586003

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Résumé:

Contexte: Les hépatites B et C sont des infections virales importantes pendant la grossesse avec un risque élevé de complications maternelles et néonatales. Cette étude a été menée pour déterminer la prévalence des infections virales par les hépatites B et C et leurs corrélations parmi les femmes enceintes qui ont fréquenté l'unité de soins prénatals (CPN) des hôpitaux généraux et de la fonction publique d'Ilorin, au Nigéria.

Méthodologie: Il s'agissait d'une étude transversale descriptive portant sur 282 femmes enceintes consentantes sélectionnées au hasard dans les unités de CPN de deux hôpitaux d'Ilorin. Des échantillons de sang ont été prélevés sur les femmes enceintes et testés pour l'antigène de surface du virus de l'hépatite B (VHB) (HBsAg) et

l'anticorps anti-virus de l'hépatite C (VHC) à l'aide de la technique du test immuno-enzymatique (ELISA). Français Les informations sociodémographiques et obstétricales des femmes enceintes et les facteurs de risque potentiels d'infections par le VHB et le VHC ont été recueillis à l'aide d'un questionnaire structuré pré-testé. L'analyse statistique a été réalisée à l'aide de SPSS version 22.0.

Résultats: La majorité des femmes étaient mariées (78,4%), issues de familles monogames (57,8%), ne partageaient pas d'objets tranchants (65,6%), n'avaient pas reçu de transfusion sanguine (65,3%), n'avaient pas d'antécédents de transplantation d'organe (91,1%) et étaient multipares (61,4%) au cours de leur premier (36,9%), deuxième (37,2%) et troisième (25,9%) trimestres de grossesse. Dans l'ensemble, 22,3% et 1,4% ont été testés positifs pour l'HBsAg et l'anti-VHC respectivement. Les antécédents familiaux des participantes à l'étude ont montré une association significative ($p < 0,05$) avec la positivité de l'HBsAg. Aucune des autres variables analysées n'a montré d'association significative avec la positivité de l'HBsAg et de l'anti-VHC.

Conclusion: Ce résultat a montré une prévalence élevée du VHB mais une faible prévalence des infections par le VHC chez les femmes enceintes dans le cadre de l'étude. Une surveillance améliorée et un dépistage systématique du VHB et du VHC chez les femmes fréquentant les CPN sont recommandés pour réduire la charge de morbidité et contribuer à atteindre l'objectif de l'OMS d'éliminer l'hépatite virale en tant que menace majeure pour la santé publique d'ici 2030.

Mots clés: VHB; VHC; Santé maternelle; Santé néonatale; Grossesse

Introduction:

Viral hepatitis remains serious public health concern globally. Hepatitis B virus (HBV) and hepatitis C virus (HCV) are the leading causes of chronic hepatitis worldwide with significant human morbidity and mortality (1). Both infections share similar routes of transmission including perinatal transmission (2). The disease burden as a result of HBV results mainly from infections acquired perinatally (80–90%) or during early childhood (30–50%) (3). The rate of perinatal transmission of HCV is about 5.8% worldwide (4). Estimates from World Health Organisation (WHO) showed that 257 million people were living with chronic HBV infection in 2015, 1.5 million people were newly infected and 0.82 million died from HBV infection-related causes globally in 2019 (5, 6). Also in 2019, about 58 million people were infected with HCV globally, accounting for 0.75% of the total population (6). Highest prevalence of HBV and HCV is seen in sub-Saharan Africa and East Asia where the infections are highly endemic (7,8).

Pregnancy in women with chronic HBV or HCV infection is associated with mother-to-child transmission (MTCT) with an increased risk of maternal and neonatal complications including miscarriage, gestational diabetes mellitus, pregnancy-induced hypertension, placenta previa, preeclampsia, placental separation, fetal growth restriction, low birth weight, congenital abnormalities, and preterm delivery (4, 9-11). Approximately 90% and 80% of children infected with HBV and HCV respectively during delivery have a high risk of becoming chronic carriers (12,13). While HBV chronically infected children have about 15-25% chances of developing hepatocellular carcinoma (HCC) during old age, about 30% of HCV chronically infected children develop clinical symptoms in childhood or adulthood, and are at high risk of liver cirrhosis and HCC (14).

In 2016, the WHO set an ambitious goal to reduce 50% MTCT of HBV, less than 0.1% HBsAg in children by 2020, and elimina-

te viral hepatitis as a major public health threat by 2030 (15). In Nigeria and Ilorin particularly, previous studies on viral hepatitis have focused mainly on other subpopulations such as students, blood donors, HIV-infected persons etc (16-18). For pregnant women who constitute a more reliable sentinel population whose prevalence data may be extended to general sexually active heterosexual population (19), such studies remain relatively scanty.

Adequate knowledge of HBV and HCV infections in pregnancy is key to preventing MTCT and to achieving the WHO goal. In this study, we determined the level of HBV and HCV infections in pregnant women attending ANC unit of public hospitals in Ilorin. The resulting data would be valuable tool for the healthcare planners and caregivers to design and implement evidence-based interventions.

Materials and method:

Study setting and design:

This cross-sectional, hospital-based study was conducted between September and November 2022 in two hospitals in Ilorin, Nigeria. The two hospitals are General Hospital Ilorin, a state-owned tertiary hospital which serves as a reference for high-risk obstetric patients located in the center of Ilorin, and Civil Service Hospital, which is also a state-owned institution located in the Government-reserved area of Ilorin.

Ethical clearance:

Ethical approval for the study was obtained from the Ethical Review Committee (ERC) of Kwara State Ministry of Health, Nigeria (MOH/KS/EU/777/589). The ethical standards of the committee and the Helsinki Declaration of 1975 (revised 2000) were strictly adhered to in carrying out the study. The study participants' anonymity was maintained throughout the study. Informed consent was obtained from each participant before sampling. Those who did not wish to take part in the study were excluded.

Sample size calculation & method of sampling:

The study participants included 282 pregnant women who attended antenatal care (ANC) unit of two public hospitals. Sample size was determined using Fischer's formula (20). Simple random sampling technique was used to select the participants for the study.

Data and sample collection and preparation:

Socio-demographic and obstetrics information of the pregnant women and potential risk factors for HBV and HCV infections were collected using pretested structured questionnaire. About 5ml of venous blood was collected from each participant by a trained nurse/midwife. The plasma was separated by centrifugation at 3000 rpm for 5 minutes and stored at -20°C until ready for analysis.

Serology:

Hepatitis B surface antigen (HBsAg) and anti-HCV antibodies in the plasma were detected using commercially available Enzyme Linked Immunosorbent Assay (ELISA) kits (Diagnostic Automation, Inc., Calabasas, CA, USA). The results were read in a microplate reader at a wavelength of 450 nm within 30 min. All assay procedures and interpretation of results were carried out according to the kit manufacturer's instructions.

Statistical analysis:

Data were analysed using SPSS version 22.0. Descriptive statistics were used to summarize the study variables. All variables were summarized using frequencies and proportions. Chi-Square test was used to identify factors significantly associated with the prevalence of HBsAg and anti-HCV antibodies. A *p*-value ≤ 0.05 was considered to be statistically significant.

Results:**Socio-demographic, clinical and obstetrics/gynaecological characteristics of the study participants:**

A total of 282 pregnant women were included in this study; 221 (78.4%) were married, 52 (18.4%) were single while 9 (3.2%) were divorced. More than one half (57.8%) of the women were from monogamous families while 68 (24.1%) were from polygamous families. The remaining 51 (18.1%) were single mothers (Table 1). Almost two-third (65.6%) of the women claimed not sharing of sharp objects. Similarly, about two-third (65.3%) claimed not to have previously received blood transfusion. Majority 257 (91.1%) reported no history of organ transplantation (Table 1).

Regarding stage of pregnancy, 105 (37.2%) and 104 (36.9%) of the participants were in their 2nd and 1st trimesters of pregnancy respectively while 73 (25.9%) were in their 3rd trimester. The gravid status showed

that 173 (61.4%) were multi-gravidae while 109 (38.7%) were primigravidae (first pregnancy) as shown in Table 2.

Table 1: Sociodemographic characteristics and risk factors of HBV & HCV transmission among pregnant women attending General and Civil Service Hospitals in Ilorin, Nigeria

Variable	Number	Frequency (%)
Marital status		
Married	221	78.4
Single	52	18.4
Divorced	9	3.2
Marriage/Family type		
Monogamous	163	57.8
Polygamous	68	24.1
Single mother	51	18.1
Sharing of sharp objects		
Yes	97	34.4
No	185	65.6
Blood transfusion		
Yes	98	34.8
No	184	65.3
Organ transplantation		
Yes	25	8.9
No	257	91.1

Table 2: Distribution of pregnant women attending General and Civil Service Hospitals in Ilorin according to some obstetrics and gynaecological factors

Predictor	Number	Frequency (%)
Stage of pregnancy		
1 st trimester	104	36.9
2 nd trimester	105	37.2
3 rd trimester	73	25.9
Gravidity		
Primigravidae	109	38.7
Multi-gravidae	173	61.4

Prevalence of HBV and HCV infection:

Out of the 282 women screened for HBV and HCV, 63 tested positive to HBsAg and 4 tested positive to anti-HCV antibodies, giving seroprevalence rate of 22.3% and 1.4% for HBV and HCV respectively. There was no HBV/HCV co-infection detected in the study (Fig 1).

Prevalence and associated factors with HBV and HCV infections:

There was statistically significant association between seroprevalence of HBV and marriage/family type with significantly higher (*p*=0.000) prevalence of 32.3% among monogamous family than polygamous family (8.8%) and single mother (11.8%). Marriage/family type and marital status however, were not significantly associated with anti-HCV positivity. Other risk factors analysed such as sharing of sharp objects, blood transfusion and organ

transplantation were not significantly associated with HBV and HCV seroprevalence (Table 3). Similarly, there was no statistically significant

association ($p > 0.05$) between HBV and HCV seroprevalence, and obstetrics and gynaecological variables analysed (Table 4).

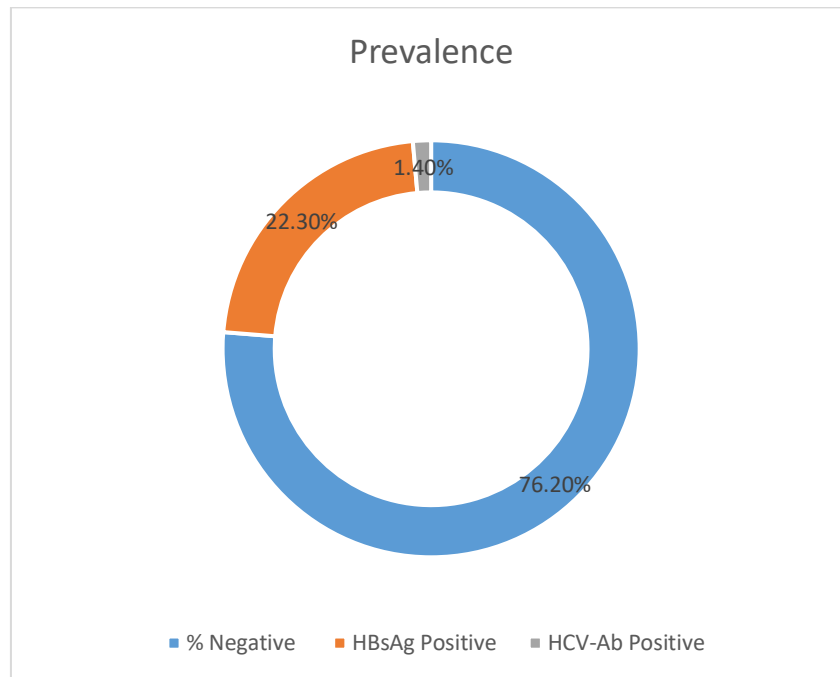


Fig 1: Seroprevalence of HBV and HCV infections among pregnant women attending General and Civil Service Hospitals, Ilorin

Table 3: Prevalence of HBV and HCV infection in association to Sociodemographic characteristics and some risk factors of transmission of pregnant women attending General and Civil Service Hospitals in Ilorin

Predictors	No tested	No (%) HBsAg positive	p value	No (%) anti-HCV antibodies positive	p value
Marital status					
Married	221 (87.7)	53 (24.0)	0.408	3 (1.36)	0.891
Single	52 (18.4)	8 (15.4)		1 (1.92)	
Divorced	9 (3.2)	2 (22.2)		0 (0)	
Marriage/Family type					
Monogamous	163 (57.8)	51 (32.3)	0.000	2 (1.23)	0.386
Polygamous	68 (24.1)	6 (8.8)		2 (2.94)	
Single mother	51 (18.1)	6 (11.8)		0 (0)	
Sharing of sharp objects					
Yes	97 (34.4)	19 (19.6)	0.422	2 (2.06)	0.508
No	185 (65.6)	44 (23.8)		2 (1.08)	
Blood transfusion					
Yes	98 (34.8)	24 (24.5)	0.527	1 (1.02)	0.680
No	184 (65.3)	39 (21.2)		3 (1.63)	
Organ transplantation					
Yes	25 (8.9)	5 (20.0)	0.769	1 (4.00)	0.253
No	257 (91.1)	58 (22.6)		3 (1.17)	

Table 4: Prevalence of HBV and HCV infection in association to some obstetrics and gynaecological factors of pregnant women attending General and Civil Service Hospitals in Ilorin

Predictor	No tested	No (%) HBsAg positive	p value	No (%) anti-HCV antibodies positive	p value
Stage of pregnancy					
1 st trimester	104 (36.9)	24 (23.1)	0.333	2 (1.9)	0.492
2 nd trimester	105 (37.2)	19 (18.1)		2 (1.9)	
3 rd trimester	73 (25.9)	20 (27.4)		0	
Gravidity					
Primigravidae	109 (38.7)	24 (22.0)	0.918	3 (2.8)	0.133
Multi-gravidae	173 (61.4)	39 (22.5)		1 (0.6)	

Discussion:

This study reports high prevalence of HBV (22.3%) but low seroprevalence of HCV (1.4%) infections among pregnant women attending ANC unit of two public hospitals in Ilorin, Nigeria. The seroprevalence rate of HBV infection reported in this study is appreciably higher than those earlier reported among pregnant women from different parts of the country. Seroprevalence rates of 9.4% (21), 10.9% (22), 11.5% (23) and 12.5% (24) have previously been reported in Nasarawa, Benue, Oyo and Edo States respectively, and similar rates have been reported from other African countries, including Kenya (25), Cameroun (26), Ghana (27) and Angola (28). However, high seroprevalence similar to the present study were previously reported from Ibadan, Oyo State (29), Jos, Plateau State (30) and Zaria, Kaduna State (31) in Nigeria. Endemicity rates for viral hepatitis in countries can be low (<2%), intermediate (2-8%) or high (>8%) (32). The prevalence rate in this study indicates high endemicity of HBV in Ilorin and reaffirms the WHO report which identified Nigeria as highly endemic for HBV (33).

Such high prevalence of HBV infection seen in our study can have far reaching implications on the general population. Most HBV infections in endemic regions including Nigeria have been found to occur predominantly during the perinatal period or in early childhood (34). Moreover, the rate of HBeAg seroconversion during the first 20 years of life is reportedly slow, leaving women of childbearing age who have contracted HBV infection in their early childhood still highly infectious to their infants (35). Therefore, the potential of having a generation of new borne babies with vertically acquired HBV from these mothers who are mainly in their 20s is very high.

Also worrying is that fact that a significant proportion of the victims will grow to become chronic carriers who will serve as major reservoir for continued HBV transmission (36). If this ugly trend is not reversed, it will hinder the realization of the WHO goal of eliminating viral hepatitis as a major public health threat by 2030 (15). There is therefore an urgent

need for some intervention measures such as administering hepatitis B immunoglobulin (HepB Ig) at birth and a birth dose of hepatitis B vaccine to reduce the risk of perinatal transmission. This have been found to greatly reduce the risk of perinatal transmission (37). In line with WHO recommendation, pregnant women should be screened for HBV infection. In addition, third-trimester antiviral prophylaxis, as an adjunct to birth dose of HepB Ig, and HepB vaccine, has been shown to significantly reduce perinatal transmission of Hep B (8,38) and therefore advocated in this study.

No immediate reasons can be advanced for the high prevalence of HBV recorded in this study. Analyses based on some harmful practices known to aid transmission of the infection including sharing of sharp objects, blood transfusion and organ transplantation shows no statistically significant association with the prevalence rate of the infection. This may not be unconnected with sampling error as there was unequal distribution of respondents to the different risk factors analysed. Men from monogamous families are more likely to be more promiscuous and hence more likely to contract the infection via extramarital affairs. Consequently, there is increased chance of transmission to their spouses, hence, the higher prevalence recorded among women from monogamous families in this study.

On the other hand, the 1.4% prevalence of anti-HCV in this study is comparable and in agreement with 1.3% earlier reported from a national cross-sectional study in Nigeria (39). The result of the present study shows that Ilorin is low in endemicity according to WHO which categorized HCV prevalence as high (>3.5%), moderate (1.5-3.5%) and low (<1.5%) (7) and may be reflective of low risk factors of HCV transmission in Ilorin and its environments. The prevalence in the present study is lower than the 3.9% earlier reported by another study in Ilorin (17). Unlike this earlier study conducted among HIV-infected patients, pregnant women in our study represents a more reliable indicator of prevalence studies, hence gives a more accurate picture of the prevalence in the general population. The rate in our study is however comparatively lower

than 6.5% prevalence earlier reported from Northern Nigeria among similar study group (40) as well as the global prevalence of 8% (41). Similarly, higher prevalence rates have been reported by other researchers from different parts of the country including 3.6% from Benin (24) and 14.9% from Enugu (42). Findings of the present study is however higher than the 0.5% reported previously in Anyigba, Kogi State, Nigeria (43) and 0.26% in Spain (44) among similar study population. Reports from different parts of the world including Congo, Ethiopia and USA have reported higher prevalence than the present study (41,45,46).

Despite the seemingly low prevalence recorded in our study, the clinical significance of the finding cannot be overlooked. Since there is presently no vaccine for HCV prevention, education of pregnant women should be intensified on the dangers of the infection and the need for prevention. Furthermore, there is presently no obstetrics guideline for routine screening of HCV among pregnant women in Nigeria, therefore, antenatal clinic visits offer a crucial time for targeting this population for health education and HCV screening. Since postpartum transmission of HCV is reportedly low (47), health education and screening of pregnant women for HCV before delivery will go a long way in reducing transmission of the virus during intrapartum period or in utero. This is particularly crucial since children are not routinely screened for HCV infection and assessed for liver disease (41). By so doing, incidence of vertically acquired HCV infections which otherwise would have been undetected with its attendant chronicity would be drastically minimized, a major step towards the realization of the WHO 2030 goal.

Despite sharing similar routes of transmission, there was no co-infection of HBV and HCV in this study. This is similar to earlier report from Gwagwalada (48) where no co-infection was reported among similar study group. This may be attributed to the low prevalence of HCV recorded in our study. This is contrary to earlier report from Cameroon where a high co-infection rate of 7.9% was reported (49). High HBV/HCV co-infection have also been reported from other study populations such as blood donors, commercial sex workers, intravenous drug users and haemodialysis patients (50).

Marriage/family type was a significant determinant of HBsAg positivity in this study. Women from monogamous family background were at increased risk of HBV acquisition than their polygamous and single women counterparts. No immediate reason can be adduced to this finding. No significant association between the demographics, risk factors of the study participants and both HBV and HCV infections were observed in this study. This result is similar to the two studies in Ghana that sho-

wed no significant association between socio-demographic characteristics and HBV infection among HIV-infected pregnant women population (51,52). Similar study which investigated HCV infection among pregnant women in the Democratic Republic of Congo also found no significant association between demographics, risk factors and HCV seropositivity (45). In contrast, studies from Ethiopia, Congo and Uganda reported significant association between socio-demographic factors such as marital status, age, and occupation with HBV infection among HIV-infected pregnant women population (53-56). Furthermore, significant association have been reported between some obstetrics/gynaecological factors as well as other risk factors of transmission and both HBV and HCV seropositivity in pregnant women (55).

The discrepancy between the current study and the comparatives may be attributed to the type of population studied, socio-economic status as well as cultural, behavioural and regional differences in risk factors. Furthermore, differences in sample size and methodology may also contribute to the observed disparity. In addition, genetic factors, level of education of the subjects tested and medical exposure among study settings including access to vaccination as well as divergence in the geographical distribution among the countries may be partly responsible.

Our study was limited by the fact that we did not test for HBeAg status to ascertain the level of risk of transmission to the babies. HBeAg positivity among childbearing-age women is a major determinant of perinatal HBV transmission. Also, the study utilized serological assay which may not give an accurate picture of the level of infection.

Conclusion:

This study showed high prevalence of HBV but low seroprevalence of HCV infections among pregnant women in Ilorin, reaffirming the high endemicity of HBV infection in Nigeria. Health education and enhanced interventions for the prevention of MTCT is strongly advocated. This will help in prevention of infection, reduction in disease burden and realization of the WHO 2030 goal.

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Contributions of authors:

AU conceived, designed and supervis-

ed the study. AU, NU, GN and MO were involved in the recruitment of participants, sample and data collection and analysis. AU drafted the manuscript. AU, NU, GN and MO read and approved the final manuscript.

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Conflict of interest:

Authors declare no conflict of interest.

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