Journal of Advances in Medicine and Medical Research

30(1): 1-11, 2019; Article no.JAMMR.49667
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

Malaria in Pregnancy: Prevalence and Risk Factors in the Mamfe Health District, Cameroon

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Authors' contributions

This work was carried out in collaboration among all authors. Authors FAE, NRN, AN and DN designed the study. Author FAE wrote the protocol and first draft of the manuscript. Authors FAE and NRN contributed the material for the study while authors FAE, NRN and LAE performed the statistical analysis. Authors FAE, NRN, DN and LAE managed the literature searches. Authors DN and AN supervised and revised the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2019/v30i130161
Editor(s):
(1) Dr. Sevgul Donmez, Faculty of Health Sciences, Gaziantep University, Turkey.
Reviewers:
(1) Sajida Sboui, University of Monastir, Tunisia.
(2) K. Ramesh Kumar, S. V. S. Medical College, India.
(3) Ibarhim Maman Laminou, Centre de Recherche M´edicale et Sanitaire, Niger.
Complete Peer review History: http://www.sdiarticle3.com/review-history/49667

Original Research Article

Received 05 April 2019
Accepted 20 June 2019
Published 06 July 2019

ABSTRACT

Background and Aim: Malaria remains a major public health problem and a global threat to humanity especially in sub-Saharan Africa. In a bit to combat malaria in Cameroon, about 8million Cameroonian received the insecticide treating nets (ITNs) in 2011. However, hospital based reported prevalence of malaria still remains high. Our objective was to determine the community based prevalence and possible risk factors of malaria in pregnancy in the Mamfe health district, south west region-Cameroon.
Methods: This was a community-based cross-sectional study involving 269 pregnant women in

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the Mamfe health district of Cameroon. Three out of the 5 health areas were randomly selected and pregnant women were later sampled by convenience and an interviewer administered questionnaire was done. Also rapid diagnostic test (RDT) for malaria was done for all the participants. Data was analysed using Epi info version 3.5.4 at a level of error of 5%.

Results: Of the 269 pregnant women who took part in the study, 106 (39.6%) were positive for malaria. Risk factors associated with developing malaria among them were: presence of mosquito breeding sites (OR=0.001, 95%CI; 0.02-0.27, p-value=0.001), not sleeping under Insecticide treated nets(ITNs) (OR=0.01, 95%CI; 0.01-0.03, p-value=0.001), bushes around houses (OR=0.24, 95%CI; 0.07-0.79, p-value=0.02) and not taking intermittent preventive treatment (IPT) (OR=0.08, 95%CI; 0.01-0.49 p-value=0.01). Majority of participant knew malaria can be prevented by sleeping under ITNs 75% (95%CI; 69.9-80.5) and uptake of IPT 23.8% (95%CI; 18.8-29.2).

Conclusion: Prevalence of malaria in pregnancy in the Mamfe health district is higher than reported by the regional delegation of public health for the south west. Risk factors include: mosquito breeding sites, bushes around compound, not taking IPT and none use bed nets are known to pregnant women. Interventions to fight against malaria in pregnancy should target intensification of health education on environmental hygiene and use of ITNs.

Keywords: Malaria; pregnancy; prevalence; risk factors; Mamfe; Cameroon.

1. INTRODUCTION

Malaria remains a major public health problem and a global threat to humanity especially in sub-Saharan Africa. According to reports by the World Health Organisation (WHO) about 219 million cases of malaria was reported in 2017 accounting for 435.000 deaths. Of these, 92% of the cases and 93% deaths occurred in Africa [1]. Globally, the prevalence of malaria is 92% for Africa region, 5% for South East Asia and 2% for the Eastern Mediterranean region [1]. In 2005, the WHO assembly set as a target the reduction of malaria morbidity and mortality by 75% in 2015. This major public health problem remains part of Millennium Development Goal (MDG6) which targets to halt by 2015 and begin to reverse the incidence of malaria and other major diseases, given that malaria accounted for 12% of post-neonatal child death globally in 2010 and 21.7% of the same deaths in Africa. It is also central to MDG 4, to achieve a 2/3 reduction in the mortality rate among children less than 5 years of age between 1990 to 2015. Malaria control is additionally expected to improve maternal health, MDG5 and MDG1 eradicating extreme poverty and hunger [2].

The situation is similar in Cameroon as malaria still remains a major public health problem in Cameroon affecting children and pregnant women. Cameroon is a country with diversified vegetation and topological landforms where the natural environment covers three ecological and epidemiological zones; the equatorial region in which malaria is endemic with transmissions throughout the year, the guinea savannah or tropical region in which transmission is seasonal between 3 to 6 months and the Sahel savannah where transmission is seasonal with durations less than three months [3]. In Cameroon, more than 1191257 cases were reported in 2017and this is most predominant amongst pregnant women and children below 5 years. The clinical morbidity rate is estimated at 41%, the mortality rate at 2.2% [4]. According to the World Health Organization (WHO)'s World Malaria Report 2018a total population of all the 24.1 million Cameroonians are stand at risk of malaria, with 71% of them living in high transmission areas and the rest living in low transmission areas [1].

According to the Cameroon Demographic Health Surveys 2004, Malaria Indicator Cluster Survey (MICS) 2006 and the National Malaria Control Program (NMCP) 2008 annual report, malaria accounts for 35 to 43% of all deaths in health units, 50 to 56% of morbidity among children under the age of five, 40 to 45% of medical consultations and between 30% to 47% of hospitalisations. It is also the cause of 26% of absences in the workplace and 40% of the health expenditure of households [3,4].

Plasmodium falciparum malaria is particularly dangerous in pregnancy and can have significant adverse consequences for both the mother and the developing foetus like still- birth, abortion, low birth weight (LBW), maternal anaemia and death. Malaria is responsible for 49% consultations and 59% of hospitalisations during pregnancy leading to abortions, premature labour and deliveries as

well as low birth weight, which exposes babies to early deaths and mothers during delivery [4,5,6].

In a bit to combat malaria in Cameroon about 8million Cameroonian received the long lasting insecticide nets in 2011. In order for these nets to actually save life it needs to be used correctly and consistently. Malaria is transmitted by the bite of an infected female Anopheles mosquito. The mosquitoes find favourable breeding grounds made up of pool of clean stagnant water usually in old motor tyres, open tins, pot holes, dishes and water logging plants such as cocoyam and plantains. Environmental factors play a key role in the prevalence of malaria. It has also been documented that people who live in poorly constructed houses with bushes around and stagnant water stand a higher risk of acquiring malaria infection and are more at risk [7]. Consequently, considering the attributes of malaria in pregnancy and its risk to both the foetus and mother, it is therefore imperative to identify other possible factors which can be linked to the prevalence of malaria in pregnant women.

In spite the above interventions, malaria in pregnancy (MIP) still remains a challenge and an important public health problem to public health authorities as the incidence of malaria in pregnancy is still high. In the South West Region, the prevalence of malaria in pregnancy stands at 22% and 21% in Mamfe health district [8]. It is possible that other factors contribute to the prevalence of malaria in pregnancy. Studies on the prevalence of malaria in pregnancy (MIP) carried out in Cameroon have been mostly clinic based [3,9,10].

As a result of this, the study is aimed to understanding the associated factors of the prevalence of malaria in pregnancy in Mamfe health district in order to generate information that would be used by the Malaria control unit (MCU) to improve on the malaria control interventions especially among pregnant women in Mamfe health district.

2. MATERIALS AND METHODS

2.1 Study Design

This was a community based cross-sectional study conducted in three randomly selected health areas out of the five health areas of the Mamfe Health District. The study targeted all pregnant women who accepted through a written concern to be part of the study were included.

2.2 Sample Size

Sample size was determined using the single proportion for a cross sectional survey [11,12]. This study estimated that prevalence of malaria in pregnancy was 22% [13] in the South West Region (Regional Malaria Control Unit-South West) with 5% precision; with a 95% level of confidence and a design effect of 1.0 [13]. After accounting for 10% of non-respondents, the total sample size was 290 participants.

$$n = \frac{Deffect \times Z^2 pq}{d^2}$$

where: n= sample size of the study, Z = standard normal deviate of 1.96, P= estimate of the prevalence of malaria in pregnancy, d= margin of error, q= (1-P) = 1- 0.22=0.78 and D_{effect} =1.0.

To determine the number of pregnant women to be sampled in each health area, we used probability proportionate to the size as shown in Table 1.

2.3 Study Procedure

In the health area, a bottle spinning model was done to decide on the directional line (Fig. 1). Convenient sampling was used at the final stage to select pregnant women.An interviewer administered questionnaire was used to collect data from the pregnant women and a rapid diagnostic test (RDT) done for each participant by the interviewers who were all nurses. Questionnaire was pre-tested in Bachuo-Akagbe health area by the principal investigator to ensure its reliability and validity before it can be used in the study.Thick and thin films were prepared by the laboratory technician and microspcopic examination were done to all the samples that were positive with RDTs. One hundred and six(100%) of the cases tested positive werere-examined by microscope by two laboratory technician for quality control measures.Only samples that were positive for both RDT and microscopy were considered as positive for malaria in the study. Apart from the malaria status, other variables where age, marital status, educational level, occupation and religion for demographics; parity, environmental and living conditions as well as malaria prevention practices like Intermittent Preventing Treatment (IPT) and ownership and use of Insecticide Treated Nets (ITNs).

2.4 Data Analysis

Data was entered into Epi-info version 3.5.4 for statistical analysis and the level of error was set at 5%. Statistical significant association at the bivariate level were put in a multiple regression model to adjust for any possible confounders and results presented in the form of Tables, pie-charts and graphs.

3. RESULTS AND DISCUSSION

3.1 Results

Socio-demographic characteristics of study population: A total of 290 pregnant women were recruited in the study, 269 questionnaires were completed and retained giving a response rate 92.8%. One hundred and seventy five 175(65.1%) of participant were from Mamfe health area, 49(18.2%) from Kajifu and 45(16.7%) from quarters in Kendem health area. The ages of participants ranged from 15 to 45 years with a mean age of 27.6 (95%CI 25.3 - 29.2) and SD= 6.1 years. Majority of the respondent 170(63.2%) are living with partner (cohabiting or married). One hundred and thirty-two, 132(49.1%) have attained secondary school, 112(41.6%) primary, 13(4.8%) university and 12(4.5%) have never been to school (Table 2).

Table 1. Determination of PW to be sample based on probability proportionate to size

Health area	Population of PW	Proportion of population of PW	Proportion sample
Kajifu	485	0.18	49
Kendem	401	0.15	40
Mamfe	1741	0.66	175
	2627	1	264

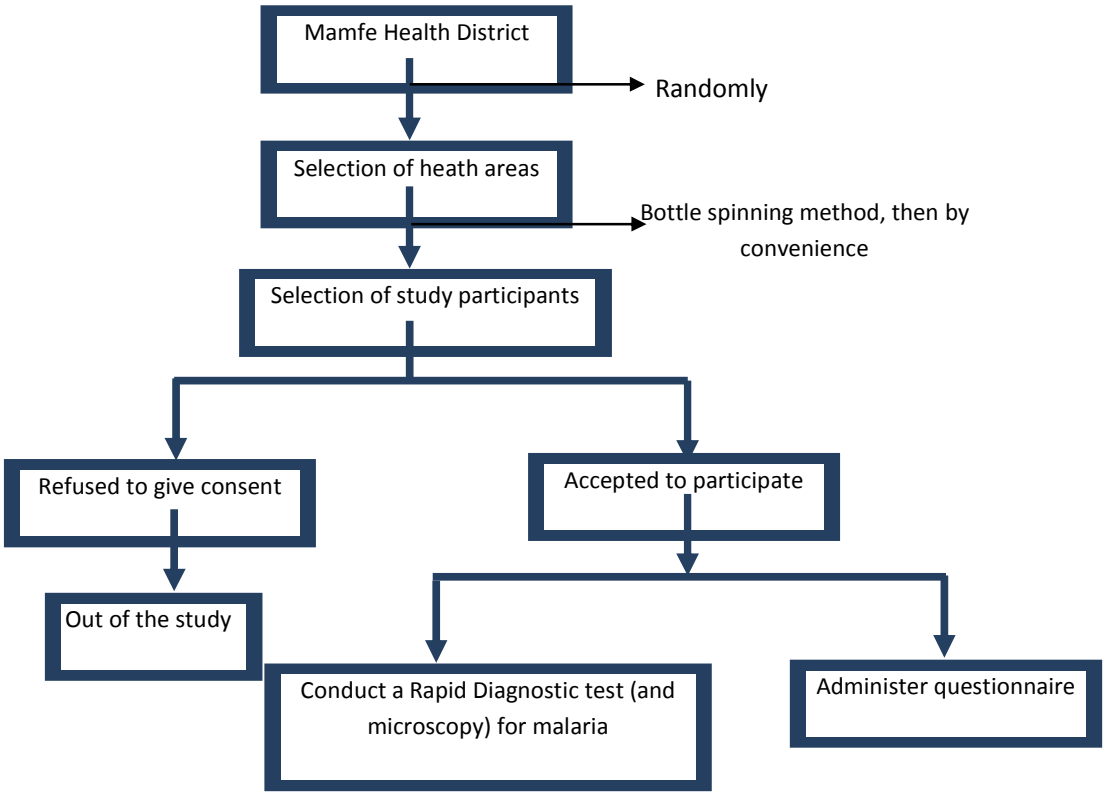

Fig. 1. Study procedure flowchart

Table 2. Socio-demographic characteristics of study population

Characteristics		Frequency (%)
Age		
	15-20	57(21.2)
	21-35	196 (72.9)
	36 years plus	16 (5.9)
Health area		
	Kajifu	49 (18.2)
	Kendem	45 (16.7)
	Mamfe	175 (65.1)
Marital status		
	Cohabiting	64 (23.8)
	Divorce	2 (0.7)
	Married	106 (39.4)
	Separated	8 (3.0)
	Single	85 (31.5)
	Widow	4 (1.5)
Educational level		
	Non	12 (4.5)
	Primary	112 (41.6)
	Secondary	132 (49.1)
	University	13 (4.8)
Occupation		
	Civil service	16 (59)
	Farming	108 (40.1)
	None	79 (29.4)
	Trading	12 (4.5)
	Others	54 (20.1)
Religion		
	Christian	265 (98.5)
	Muslim	4 (1.5)

Prevalence of malaria in pregnancy: One hundred and six (39.41%), of pregnant women in Mamfe health district were found to have be infected with Plamodium. The implicating species was *P. falciparum* in all the samples. This gave the prevalence of malaria among pregnant women inMamfe health district of 39.4% as demonstrated in Fig. 2.

Risk factors to malaria in pregnancy: Age of the woman, state of the building, state of the compound, presence of mosquitoes breeding sites, possession of bed nets, and sleeping under Insecticides Treated Nets (ITNs) among others were seen to be statistically significant contributors to development of malaria in pregnancy at the bivariate analysis (Table 3).

Associations found to be significant in the bivariate analysis (P-value <0.05) were included in the multivariate analysis to determine which factors best explained or predicted developing malaria in pregnancy. Table 4 shows that only presence of mosquito breathing sites, sleeping under ITNs, existence of bushes around houses and taking IPT were all found to be statistically associated with developing malaria in pregnancy.

3.2 Discussion

Malaria still remains a major public health problem. Several interventions have been put in place by public health authorities to fight malaria especially focusing on pregnant women and children less than five years who are the most vulnerable group. Determining the factors associated to malaria in pregnant women will help public health authorities and policy makers to link the interventions to combat this disease to the findings of this study.

Results from this study found that the prevalence of malaria among pregnant women in Mamfe health district is 39.4%(95%CI; 33.5-45.5) which is higher than that reported in the district data 22.0% and 22.9% in a clinic based study carried out in Sanaga-Maritime, Cameroon [8,14]. However, a study conducted Ngali, a rural

Table 3. Risk factors to malaria in pregnancy in a bivariate analysis in the Mamfe health district

Characteristics	OR 95%CI	Positive No. (%)	Negative No.(%)	Chi-square (X^2)	P-Value
Age					0.0001
<20 years	1	37(64.9)	20(35.1)	19.72	
21-35 years	3.82(2.05-7.09)	64(32.7)	132(67.3)		
36-50	4.07(1.24-13.36)	5(31.3)	11(68.7)		
Total		**106(39.4%)**	**163(60.6%)**		
Marital status					0.074
Married	0.61(0.36-1.01)	60(35.1)	111(64.9)	3.18	
Others	1	46(46.9)	52(53.1)		
Total		**106(39.4)**	**163(60.6)**		
Occupation					0.15
Civil service/trading	1.59(0.89-2.84)	84(42.2)	115(57.8)	2.09	
None/farming/others	1	22(31.4)	48(68.6)		
Total		**106(39.4)**	**163(60.6)**		
Educational level					0.927
None/primary	1	48(38.7)	76(61.3)	0.001	
Secondary/university	0.95(0.58 -1.55)	58(40.0)	87(60.0)		
Total		**106(36.4)**	**163(60.6)**		
Age of current pregnancy					0.088
1st trimester	1	12(63.2)	7(36.8)	4.84	
2nd trimester	2.79(1.03-7.61)	46(38.0)	75(62.0)		
3rd trimester	2.89(1.67-7.85)	48(37.2)	81(62.8)		
Total		**106(39.4)**	**163(60.6)**		
Number of pregnancies					0.205
One	1	47(46.1)	55(53.9)	3.17	
Two	1.67(0.89-3.16)	23(33.8)	45(66.2)		
Three and above	1.49(0.85-2.63)	36(36.4)	63(63.6)		
Total		**106(39.4)**	**163(60.6)**		
State of building					0.0001
Bad condition	3.48(1.99-6.06)	83(50.0)	83(50.0)	19.24	
Good condition	1	23(22.3)	80(77.7)		
Total		**106(39.4)**	**163(60.6)**		
State of compound					0.0001
Bushes around	3.83(2.28-6.44)	34(24.5)	105(75.5)	29.9	

Characteristics	OR 95%CI	Positive No. (%)	Negative No.(%)	Chi-square (X^2)	P-Value
No bushes around	1	72(55.4)	58(44.6)		
Total		**106(39.4)**	**163(60.6)**		
Presence of mosquito breeding sites					0.0001
Yes	6.82(3.88-12.01)	61(69.3)	27(30.7)	47.17	
No	1	45(24.3)	136(75.1)		
Total		**106(39.4)**	**163(60.6)**		
Possession of bed net					0.0001
Yes	1	64(29.8)	151(70.2)	39.68	
No	0.12(0.059-0.245)	42(77.8)	12(22.2)		
Total		**106(39.4)**	**163(60.6)**		
Sleep under ITNs					0.0001
Yes	1	9(6.3)	135(93.8)	116.09	
No	0.018(0.007-0.044)	58(78.4)	16(21.6)		
Total		**67(30.7)**	**151(69.3)**		
Start ANC					0.0001
Yes	1	42(25.1)	125(74.9)	35.93	
No	0.199(0.12-0.34)	64(62.7)	38(37.3)		
Total		**106(39.4)**	**163(60.6)**		
Distance from health facility as hindrance					0.0001
Yes	2.89(1.74-4.80)	61(54.0)	52(46.0)	16.3	
No	1	45(28.8)	111(71.2)		
Total		**106(39.4)**	**163(60.6)**		
IPT					0.0001
Yes	1	32(20.5)	124(79.5)	54.71	
No	0.132(0.08-0.23)	74(66.1)	38(33.9)		
Total		**106(39.6)**	**162(60.4)**		

Table 4. Covariates of developing malaria in pregnancy in a multivariate analysis in the Mamfe Health District

Covariates	AOR	95% C I	P-Value
Age (years)			
21-35	1		
Less than 20	0.39	0.08 - 1.98	0.26
36-50	8.9206	0.46 - 174.24	
Distance as a hindrance			
No	1		
Yes	0.8939	0.27 - 2.94	0.85
Possession of mosquito bed net			
Yes	1		
No	0.001	0.0001-1.000	0.97
Presence of mosquito breeding site			
No	1		
Yes	0.07	0.020- 0.270	0.0001
Sleeping under ITNs			
Yes	1		
No	0.01	0.001- 0.030	0.0001
Start ANC			
Yes	1		
No	0.067	0.103 - 4.390	0.680
State of building			
Good conditions of building	1		
Bad conditions of building	0.6349	0.192 - 2.099	0.457
State of compound			
No bushes around compound	1		
Bushes around compound	0.2392	0.072 - 0.796	0.020
Take Fansidar (SP)			
Yes	1		
No	0.0670	0.009 - 0.495	0.01

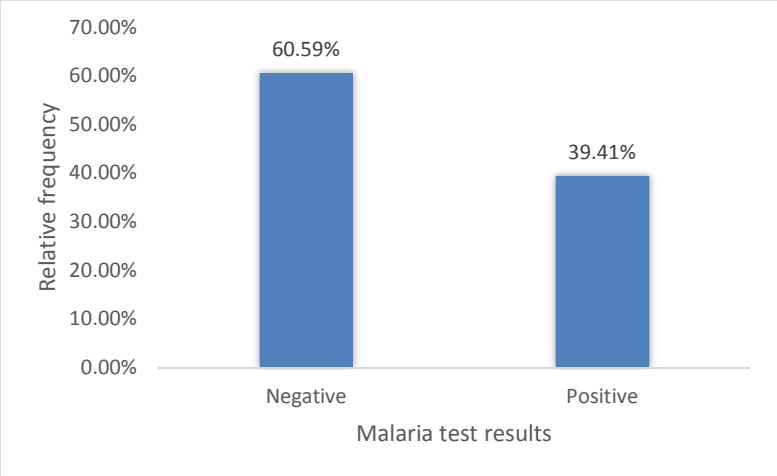

Fig. 2. Prevalence of malaria in the Mamfe health district

Cameroonian village with high transmission had a prevalence of 38%, which is similar to this study [15].

Like several other studies, the results show that women age, gestational age, marital status, parity, level of education, family size, women

occupation, can influence the risk of acquiring malaria among pregnant women.

Several studies have also justified that having houses surrounded with vegetation serves as hiding ground for mosquitos. The study found that pregnant women living in houses surrounded with bushes have an increased odd of having malaria. The findings are consistent with the findings of a study on individual and housing factors influencing the incidence of malaria in Ethiopia and in another study in Bomaka and Molyko in Cameroon [7,16,17].

The presence of breeding sites exerted a profound effect on malaria incidence among pregnant women in this study. The odds of having malaria was found to be high in pregnant women who have breeding closed to their residence compared to those without breeding sites (Adjusted OR=0.07, 96%CI; 0.02-0.27, p-value=0.001). The findings were endorsed by other studies in Uganda, Ethiopia, Cameroon and Sri Lanka. The studies found an increased risk of acquiring malaria among people living around mosquito breeding sites [7,16–19].

In this study not taking Fansidar for IPT was found to be associated with the development of malaria among pregnant women. Pregnant women who did not take at least one dose of fansidar for IPT had increased odds of reporting that they had suffered from malaria compared to those who had swallowed at least one dose Fansidar for IPT. Similar findings were reported in a clinic based study that the prevalence of malaria among pregnant women was associated with non- usage of Fansidar in pregnancy for IPT [20,21]. The study also found that pregnant women who do not sleep under ITNs have a higher chance of acquiring malaria in pregnancy. The findings are similar to studies in Liberian children, this was also consistent with studies in Nigeria which reveals that only 10.4% of pregnant women sleep under ITNs with a risk of developing malaria among pregnant women [22,23].

4. CONCLUSION

The study showed that the prevalence of malaria in pregnancy in Mamfe health district is higher than reported. Risk factors associated to developing malaria in pregnancy include: presence of mosquito breeding sites, having bushes around compound, not taking intermittent preventive treatment and not sleeping under insecticide treated bed nets. The pregnant women know sleeping under insecticide treated bed nets and administration of intermittent preventive treatment as the methods of malaria prevention. A good number however did not know any method of malaria prevention in Mamfe health district.

CONSENT

Participation in the study was completely voluntary and a written informed consent was obtained from the pregnant woman before the administration of the questionnaire. For participants who are less than 21 years, consent and assent were obtained from the participant.

ETHICAL APPROVAL

All authors hereby declare that the study have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki. Ethical approval was granted by the University of Buea Faculty of Health Science Ethical Review Board (FSH IRB). Ref: 2015/361A/UB/FHS/IRB.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle3.com/review-history/49667