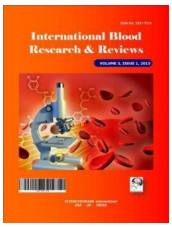

International Blood Research & Reviews

8(1): 1-10, 2018; Article no.IBRR.41271
ISSN: 2321–7219

Prevalence of Transfusion Transmitted Infections among Blood Donors in Madhya Pradesh, a Central State of India

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Authors' contributions

This work was carried out in collaboration between all authors. Author UCY designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors DCS and AA managed the analyses of the study and the literature searches. Author UK supervise the research work. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IBRR/2018/41271
Editor(s):
(1) Anamika Dhyani, Laboratory of Biochemistry & Molecular and Cellular Biology, Hemocentro-UNICAMP, Brazil.
Reviewers:
(1) Oti Baba Victor, Nasarawa State University, Nigeria.
(2) Sylvester Yao Lokpo, School of Allied Health Sciences, University of Health and Allied Sciences, Ghana.
Complete Peer review History: http://www.sciencedomain.org/review-history/24252

Original Research Article

Received 7th February 2018
Accepted 18th April 2018
Published 20th April 2018

ABSTRACT

Introduction: A Transfusion transmitted infection (TTI) is a virus, parasite, or other potential pathogen that can be transmitted in donated blood through a transfusion to a recipient. This transmission is one of the most dreaded complications of blood transfusion.
Aims and Objectives: The present study is aimed at evaluating the prevalence of TTIs among the blood donors in Madhya Pradesh, a central state of India
Materials and Methods: The present five years (1st January 2012 to 31st December 2016) study is a retrospective analysis of one million three hundred thirty-six thousand one hundred fifty-six (1,336,156) blood donor's record at Madhya Pradesh Aids Control Society (MPSACS) Bhopal; donors donated their blood at National Aids Control Organization (NACO) supported blood banks, Madhya Pradesh, India. With the permission of MPSACS, donor's data was collected, retrieved, tabulated, summarized and compared statistically by frequency distribution and percentage proportion. Chi-square (X^2) test was applied to evaluate the significant *(p-value)* ratio of difference

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statistically.
Results: In the present study, 91.1% were voluntary blood donors and rested 8.9% replacement blood, donors. Male to female ratio of blood donors were male 94% and female 6%. TTIs prevalence in the study was 1.75 % (p<0.001) while individual infections prevalence was; HbsAg 1.16, Syphilis 0.37%, HCV 0.09%, HIV 0.08%, and Malaria 0.04%.
Conclusion: Low prevalence of TTIs was reported in the present study, so hereby we have concluded that a healthy transfusion service is must for the health care system of the state/country. 100% Voluntary blood donation by Regular, voluntary, non-remunerated blood donors from low-risk populations and Careful TTIs testing, preferable NAT to reduce the window period are the key factors to ensure the safe blood to the needy.

Keywords: Transfusion transmitted infections; voluntary blood donors; prevalence; Madhya Pradesh and India.

1. INTRODUCTION

Blood transfusion is a key component of modern day health care, and therefore it is of utmost importance to ensure that blood and blood products meet the appropriate national standards of safety and efficacy for transfusion and benefit blood recipients in their clinical management process [1]. The transfusion of blood and blood products is much safer than ever before but far from attaining "zero risk" level at the present moment [2]. There are various types of diseases, that can be transmitted to the recipient via blood transfusion, are collectively known as transfusion Transmitted Infections (TTIs). These disease transmissions are one of the most dreaded complications of blood transfusion [2]. Every year, millions of people are exposed to avoidable, life-threatening risks through the transfusion of unsafe blood [3]. There is a risk of 1 to 2 per 1000 recipients, to receive contaminated blood with viral, bacterial or parasitic agents. However, there is 50% risk of serious morbidity and mortality for the patients if blood transfusion is not done or undertaken [4]. There is a long list of viruses, parasites, and bacteria, which can be transmitted through blood transfusions. Among the important transfusion-transmitted infections are; (a) viruses-human immuno-deficiency virus (HIV-I/II), hepatitis B virus (HBV), hepatitis C virus (HCV), parvovirus B-19 and cytomagalovirus (CMV) etc [5], (b) Bacteria- Treponema Pallidum, Yersinia enterocolitica, etc (c) Parasites-Plasmodium sp, Filaria, Babesia microti etc (d) Emerging- Prions [6]. An unsafe blood transfusion is very costly both human and economic point of view. Morbidity and mortality resulting from transfusion of infected blood have far reaching consequences, not only for the recipients themselves but also for their families, their communities and the wider society [7,8]. As per guidelines of National AIDS Control organization (NACO) of India, it is mandatory to test each and every blood unit for HIV, HCV, HbsAg, Syphilis and Malaria [9, 10]. Avoiding paid donors, selecting blood donors through questionnaires, and limiting the number of transfusions can prevent transmission of infections. The testing for specific antibodies is the final measure for eliminating unsafe blood [11]. Voluntary donors have been reported to be the safest group of donors because they usually have better health seeking behavior than the replacement blood donors and their intention is to donate blood to an unknown patient out of compassion [12].

Present study is aimed to estimate the sero-prevalence of Transfusion Transmitted Infections (TTIs) among voluntary and replacement donors over a period of five years at blood banks of Madhya Pradesh with collaboration of Madhya Pradesh State AIDS control Society (MPSACS) Bhopal, India.

2. MATERIALS AND METHODS

In the present Five years study (1st January 2012 to 31st December 2016), a total of 1,336,156 blood units were collected at National Aids Control Organization (NACO) supported Blood Banks from healthy blood donors. Donors selection criteria includes; age, weight, satisfactory response to donor's questionnaire, physically examination, hemoglobin (Hb g/dl) estimation (≥ 12.5 gm in female and ≥13 gm in male), etc. Our donors were Voluntary Donors (VD) and Replacement Donors (RD). Replacement donors were donors who donated blood for ailing patients and were family members, close relatives and friends of recipient. The voluntary donations were obtained from walk in donors at blood bank and in voluntary blood donation camps organized by different institutions, neighboring colleges, different social

and political organizations. Professional and paid donors were carefully eliminated. Written consent from the donor was also taken prior to donation. 3 ml blood in plain vial and 2 ml blood in EDTA (ethylene diamine tetra acetic acid) vial taken from the satellite bag. All samples were screened for transfusion transmitted infections; HIV, HbsAg, HCV, Syphilis and malaria. Tests were performed with commercially available Elisa kits and rapid card method. These kits are either supplied by National AIDS Control Society (NACO) or purchased at local level are as follows/ alternative:

1) HIV antibodies detection Microlisa HIV 1 &2 (J Mitra & co. Pvt. Ltd)
2) HCV antibodies detection Microlisa 3rd Generation (J Mitra & co. Pvt. Ltd)
3) HbsAg antigen detection, Elisa kit. (J Mitra & co. Pvt. Ltd)
4) Syphilis: Rapid Plasma Reagin (PPR) for syphilis (Span Diagnostic)
5) Malaria Card Method (Pan Malaria card, J Mitra) One step rapid Immuno-Chromatographic test for: *P. vivax* and *P. falciparum*.
6) Rapid card test for HIV, HCV and HbsAg (J Mitra & co. Pvt. Ltd)

Presently, Nucleic Acid Test (NAT) is not available at our centers. Serovigilance for all the test results was performed at different State Reference Laboratory (SRL) of Madhya Pradesh. The sero-positive blood units were discarded as per guidelines of NACO. The five years TTIs data from NACO supported blood banks of Madhya Pradesh and donor's particulars was collected, retrieved, tabulated, summarized and compared statistically by frequency distribution and percentage proportion. Chi Square (X^2) Test was applied to evaluate the significant *(p value)* ratio of difference statistically.

3. RESULTS

A total 1,336,156 blood units were collected from selected donors during the study period, out of them 91.1% (n=1,217,842/1,336,156) were voluntary blood donors and rest 8.9% (n=118,314/1,33,6156) were replacement blood donors, statistically significant (*p<0.001*). An increasing pattern in voluntary blood donation was observed in the study from the year 2012 to 2016; statistically significant which was shown in Table 1.

Male to female ratio of blood donors in the study was male 94% (n=1,255,957/ 1,336,156) and female 6% (n=80,199/1,336,156), statistically significant (p< 0.001), shown in Fig. 1.

Overall prevalence of transfusion transmitted infections in the study was 1.75 % (n=25,224/ 1,336,156), statistically significant (*p*<0.001) while individual Infections prevalence was; HIV 0.08% (n=1,201/1,336,156) (*p<0.001*), HbsAg 1.16 % (n=16,670/1,336,156) (*p<0.001*), HCV 0.09% (n=1,335/1,336,156) (*p<0.001*), Syphilis 0.37% (n=5,410/1,336,156) (*p<0.001*) , and Malaria 0.04% (n=608 /1,336,156) (*p<0.001*) (Fig. 2). A decreasing pattern in the prevalence of TTIs and individual infections was shown in Fig. 3.

4. DISCUSSION

In the present study out of 1,336,156 donations, voluntary blood donations were 1,217,842(91.1%) and replacement donations were 118,314(8.9%) where as national data of voluntary blood donation was79% in 2015-16 from baseline of 54.4% at the beginning of NACP III (2007-2012) [13]. Higher frequency of voluntary blood donors (91.1%) in the study is a healthy sign for the transfusion services of Madhya Pradesh as well as India. Increase in voluntary donation in Madhya Pradesh may be due to better implementations of the national programs launched by NACO, department of Health, Government of India. The safest blood donors are regular, voluntary, non-remunerated blood donors from low-risk populations [14,15].

Table 1. Increasing pattern of voluntary donation in the study

S. no.	Year	Total donors	Voluntary vs replacement donor		P value
			Voluntary donors	Replacement donor	
1	2012	223600	190731 (85.3%)	32869 (14.7%)	(*p<0.001*)
2	2013	236969	211613 (89.3%)	25356 (10.7%)	(*p<0.001*)
3	2014	272370	246767 (90.6%)	25603 (9.4%)	(*p<0.001*)
4	2015	283594	265728 (93.7%)	17866 (6.3%)	(*p<0.001*)
5	2016	319623	303003(94.8%)	16620 (5.2%)	(*p<0.001*)
	Total	1336156	1217842(91.1%)	118314(8.9%)	(*p<0.001*)

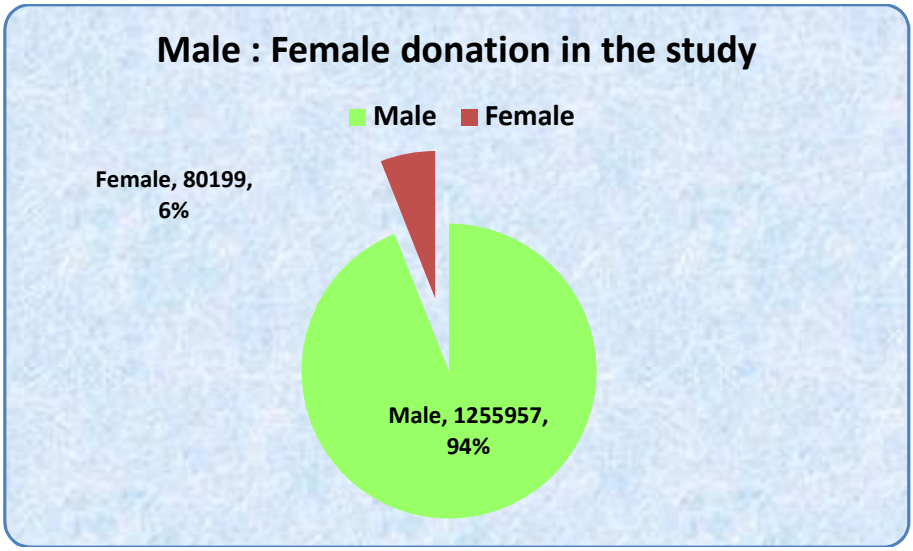

Fig. 1. Male to female ratio in the study

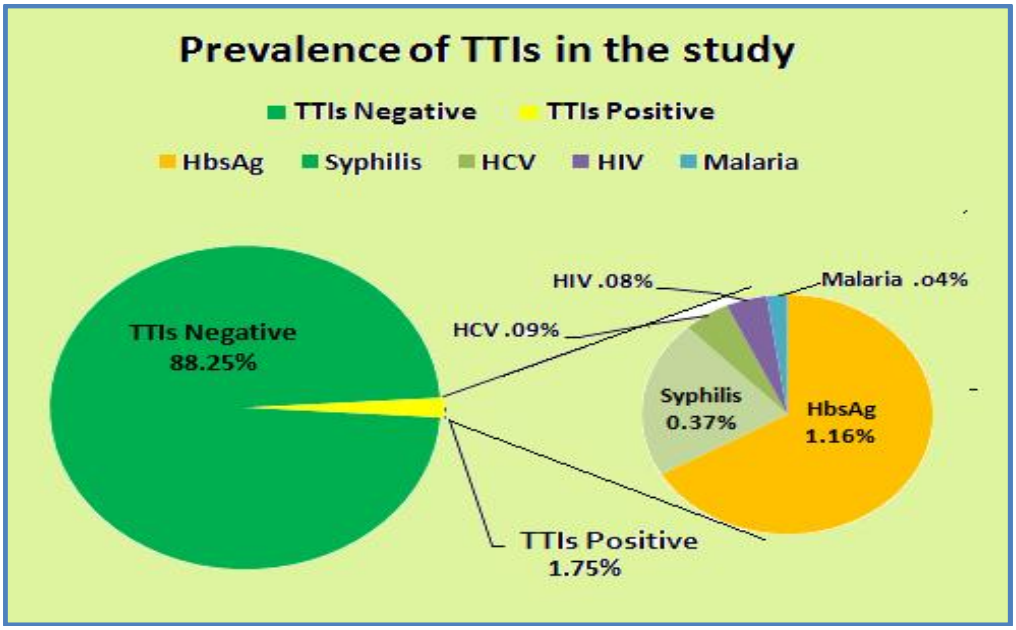

Fig. 2. Prevalence of TTIs in the study

In the present study It was obvious from the result that blood donation was male dominated; male 94% (n=1,255,957/ 1,336,156) and female 6% (n=80,199/1,336,156). It is because of the facts that larger populations of females in India are usually underweight and anaemic as per the donor's selection criteria [16]. Our results are in agreement with previous report among blood donors in India which indicated that female gender is less disposed to blood donation [16].

Transfusion of blood and blood components is a life saving measure and help people worldwide. At the same time however blood transfusion is an important mode of transmission of infections to the recipient. In developing countries the prevalence of TTIs is much higher and quite far from attaining a zero risk level at the present moment [17].

The prevalence of transfusion Transmitted Infection in the present study was 1.75%,

similarly reported by leena MS et al. (1.35%) [18]. Higher TTIs prevalence was reported by Chougale R A et al. (2.47%) [19] and Mandal et al. (2.93%) [20]. Prevalence of individual infections in the present study was ; HIV 0.08%, HbsAg 1.16 %, HCV 0.09%, Syphilis 0.37%, and Malaria 0.04% and a decreasing pattern from the year 2012 to 2016 was reported (Fig. 3). No notable variation in sero-prevalence of TTIs between voluntary / replacement and male/ female donors was observed in the present study. Age distribution of TTIs among the donors was also statistically insignificant. The prevalence of TTIs among Indian blood donors is ranging from; HBV—0.66% to 12%, HCV—0.5% to 1.5%, HIV—0.08% to 3.87% and syphilis—0.8% to 3% [21]. With every unit of blood there is 1% chance of transfusion associated problems including TTIs [22]. The sero-prevalence studies from the different parts of India were summarized in Table 2 to show the TTIs burden in different parts of India.

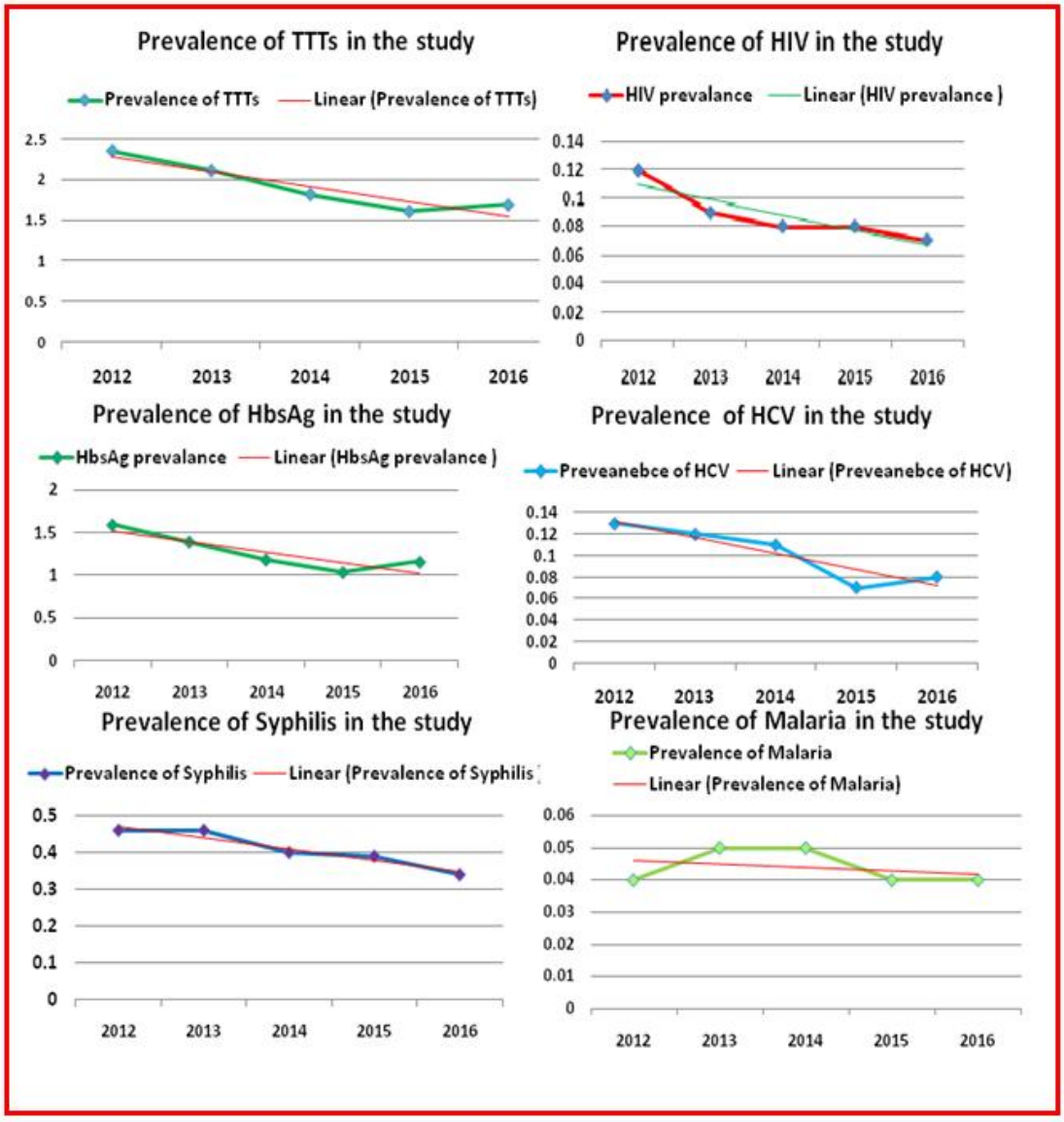

Fig. 3. Decreasing pattern of TTIs from the year 2012 to 2016 in the study

Table 2. Prevalence of transfusion transmitted infections in different parts of India

Place	Donors tested	HIV reactive	HbsAg reactive	HCV reactive	VDRL reactive	MP positive	Reference
Mangalore	9599	6(0.06%)	33(0.34%)	6(0.06%)	11(0.11%)	1(0.01%)	17
Dehradun	6751	9 (0.13%)	67(0.99%)	13(0.19%)	42(0.62%)	0(0.00)	21
Ahmednagar	5661	4(0.07%)	62(1.09%)	42(0.74%)	4(0.07%)	--	23
Bhopal	5008	26(0.51%)	149(2.97%)	29(0.57%)	12(0.23%)	--	24
Lucknow	39060	170(0.44%)	497(1.27%)	90(0.23%)	111(0.28%)	--	25
New Delhi	28966	163(0.56%)	646(2.23%)	192(0.66%)	--	--	26
Ludhiyana	44064	37(0.08%)	290(0.66%)	483(1.09%)	373(0.85%)	--	27
Gwalior	67132	91(0.13%)	2360(3.51%)	161(0.24%)	114(0.17%)	21(0.03%)	28
Ahmedabad	92778	151(0.162%)	907(0.977%)	101(0.108%)	218(0.234%)	------	29
Andhra Pradesh	6939	19 (0.27%)	49(0.71%)	10 (0.14%)	7(0.10%)	9(0.129%)	18
Madhya Pradesh	1336156	1201(0.0 8%)	16670 (1.16%)	1335(0.09%)	5410 (0.37%)	608 (0.04%)	Present Study

In the present study, the major infection among the TTIs was Hepatitis B (1.16%) followed by syphilis (0.37%), HCV (0.09%), HIV (0.08%) and Malaria (0.04%). High prevalence of HbsAg 3.09% (n=2448/79162) from Medical College, Gwalior was also reported by Arya A et al. in [30]. A very high prevalence of HBV had been reported from the different tribal population of India (4.4 to 37.8%) [31-36]. The high endemicity of HBV infection in the tribal populations has been attributed to inbreeding, poor hygienic living conditions, close person-to-person contact and certain socio-culture practices that may facilitate transmission of HBV [37]. A low prevalence e of HBV was reported from United States 0.4% [38] and from Bahrain is 0.58% [39] while higher prevalence among blood donors was reported from northern Ghana, African continent 11.51% [40] and Burkina Faso, West Africa (13.4%) [41].

Sero-prevalence of HIV in present study was 0.08%, while higher prevalence was reported in studies by Mathai et al in Kerala (0.2%) [42], Chandra T et al. in Uttar Pradesh (0.23%) [43], Sawke N et al. 2010 from Bhopal Madhya Pradesh (0.51%) [24] and Pallavi P et al. from Lucknow utter Pradesh (0.55 %) [25] while low prevalence was reported by Fernandes H et al. 2010 from Mangalore (0.06%). Present study showed the decline pattern in HIV prevalence from year 2012 to 2016 (Fig. 3).

The seroprevalence of HCV among blood donors in our study (0.09%) was much lower than the other parts of India; 0.28%, 0.84%, 0.85%, 1.0% and 1.4% in the studies from Rajasthan [44], Andhra Pradesh, [45] Uttar Pradesh [43], Haryana [22] and Kerala [42] respectively. Geographical variation in the seroprevalence of HCV had also been documented by Sun et al. in Taiwan [46]. Studies in Nigeria [47], Ethiopia [48] and Nepal [49] have showed a seroprevalence of HCV 3.6%, 0.7% and 0.64%, respectively.

In the present study prevalence of Syphilis in blood donors was 0.37 % while low prevalence was reported by Pallavi et al. (0.23%) [25], and higher prevalence was reported by Arora et al. (0.9%) [22] and Kumar A et al. (1.05%) in Bastar region, Chhattisgarh in their studies [50]. Decreasing trend in sero-prevalence was observed in the study period from the year 2012 to 2016 (Fig. 3). A high prevalence from Nigeria (0.9%) [51], and low prevalence from Israel (0.047%) [52] was reported.

Prevalence of Malaria in the present study was 0.04% which is comparable with the reports from Mangalore (0.01%) [17], Gwalior (0.03%) [28] and Andhra Pradesh (0.129%) [18]. Indian population resides in malaria endemic areas*;* 80% of malaria reported in the country is confined to areas where 20% of population resides - in tribal, hilly, hard-to-reach or inaccessible areas [53].

5. CONCLUSION

A Low prevalence of TTIs was reported in the present study, so hereby we are concluding that a healthy transfusion service is must for the health care system of the state/country. 100% Voluntary blood donation by Regular, voluntary, non-remunerated blood donors from low-risk populations and Careful TTIs testing, preferable NAT to reduce the window period are the key factors to ensure the safe blood to the needy.

CONSENT

The author(s) declare that written informed consent was obtained from the blood donors before being recruited for donation.

ETHICAL APPROVAL

All author(s) hereby declare that all procedure have been examined and approved by the appropriate ethics committee of MPSACS, Bhopal, India and research have therefore been performed in accordance with the ethical standards laid down in the 1964 declaration of Helsinki.

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.sciencedomain.org/review-history/24252