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THE TREND OF MALARIA IN GOA (INDIA): RETROSPECTIVE RECORD BASED STUDY

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HOW TO CITE THIS ARTICLE:

R. Rahul, Nitin Dhupdale. "The Trend of Malaria in Goa (India): Retrospective record based study". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 83, October 15; Page: 14609-14618, DOI: 10.14260/jemds/2015/2076

ABSTRACT: BACKGROUND: Malaria is one of the most widespread and fatal vector borne diseases found in India. The high level of morbidity and mortality associated with this disease makes it a disease of public health importance. Goa is known endemic area for malaria and has witnessed many outbreaks of malaria in recent past with increased levels of mortality. The National Vector Borne Diseases Control Programme (NVBDCP) is operational in the State and the country since many years. The current study is aimed at reviewing the achievements under this programme in Goa. **MATERIALS AND METHODS:** The study is based on the retrospective data of malaria cases diagnosed and treated at the all Health Care Units located in different parts of Goa. This data is generated at each Health Care Unit which is forwarded to NVBDCP every day for compilation. The data on the malaria cases and deaths due to malaria over last six years (2006 to 2011) was analyzed for the study. **RESULTS:** Goa witnessed a sudden rise in incidence of malaria cases from 3.55 per 1000 population in 2006 to 6.82 in 2007. With the aggressive implementation of control measures by NVBDCP and all health care units the incidence of malaria was brought under control from 6.79 per 1000 in 2008 to 0.67 per 1000 in 2011. The proportion of pl. falciparum is also kept under control (25.43%). Study shows that adult male (Male: female ratio 5:1) population is affected more as compared to children and female population. The migrant labor community is proportionately more infested (Six times more at risk) by malaria as compared to local native residents. A high proportion of cases are reported from Urban Health Care units indicating that Goa has more urban clustering of cases. **CONCLUSION:** The burden of Malaria disease is fortunately on declining trend in Goa over the last six years. The prominent contributing factors which have helped in the interruption of malaria transmission are: 1) Increased level public awareness generated in the community by the health units by conducting health education activities, 2) Prompt detection of malaria parasite by laboratory examination of blood smears, 3) Treatment of the cases by using of quality drugs, 3) Quality surveillance of fever cases reported to health care units, 4) Implementation of Integrated vector control. The current reduction in the burden of malaria cases and deaths is a forward step towards achievement malaria elimination in Goa.

KEYWORDS: Malaria, Epidemiology, trend, Goa, India.

INTRODUCTION: More than 100 years after the discovery of malaria transmission by Sir Ronald Ross in 1897 in India, malaria still remains as one of the most widespread and potentially fatal infectious diseases. This makes it a disease of great public health importance globally, with almost half of world's population exposed to the risk of contracting it in around 90 countries.¹

Worldwide Malaria affects 300-500 million people annually, 90% of them are cases from Africa alone. As per WHO, 91% of malaria deaths are occurring in Africa alone and 86% among these are children less than five years of age. Annually South-East Asia region contributes to almost 2.5

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million cases and India alone contributes to 75% of the cases.² In South-East Asia region 1.2 billion people are exposed to the risk of acquiring malaria and majority of them live in India.

India reported almost 1.6 million cases and 1018 deaths in 2010. Around 26% of the population lives under high transmission zone whereas 18% of the population is living under malaria free zone. National Annual Blood Examination Rate (ABER) was reported as 10.5% for past four years.³ the state of Goa has successfully achieved many national health targets; however malaria continues to be a public health issue for a long time.

Goa is a small state spread across 3702Km² with a population of 1.344 million.⁴ the geography of Goa is quite conducive for mosquito breeding. The warm tropical climate is ideal for mosquito breeding. Goa receives an annual average rainfall of 3000mm along with an annual average humidity of around 65% is beneficial to breeding of mosquitoes.⁵ The main vectors responsible for the transmission of malaria are *An. stephensi* in the coastal belt, while *An. fluviatilis* is a vector in the eastern hilly region of the state. The preferred breeding sites of *An. stephensi* are wells, overhead tanks, curing waters and masonry tanks while *An. fluviatilis* preferred stagnant water pockets in the streams and river beds, stone quarries and rice paddies. Besides *An. culicifacies* is also found in low densities in the sub-coastal belt of Goa where it breeds in irrigation channels, ponds and rice paddies.⁶

The National Vector Borne Diseases Control Programme (NVBDCP) is operational in Goa and Country since many years. This study is an attempt to assess the trend of malaria in the context of ongoing Malaria control programme in Goa. It was against this backdrop that the current study was undertaken to assess the changing trends of malaria cases in this state for the past 6 years (January 2006 to December 2011). The study is also aimed at identifying population groups who are at a higher risk of contracting malaria in Goa.

METHODOLOGY: This study is based on the retrospective malaria surveillance data compiled by the National Vector Borne Diseases Control Programme (NVBDCP) unit at the Directorate of Health services (DHS) in Goa. Each Health Care Unit such as Primary Health Centre (PHC) or Urban Health Centre (UHC) under Directorate of Health services is responsible to detect and report every case of malaria occurring in their jurisdiction. The data generated by every Health Care Unit is forwarded on day to day basis to NVBDCP office in Goa for storage and compilation. This valuable data is used in the current study to detect the trends of malaria cases in the state from January 2006 to December 2011.

RESULTS: The data on malaria indices of Goa (Table 1) shows that the ABER was favorably above the 10% which is recommended in the control programme. The annual average slide positivity rate was observed to decline from maximum of 2.7 in 2007 to 0.3 in the year 2011. A total of 33205 cases of malaria and 52 deaths were reported from January 2006 to December 2011. At national level a total 9263207 cases of malaria and 6698 deaths were reported during the same period and Goa contributed 0.35% of the total burden of malaria in the country. The incidence of malaria in Goa was noted to double from 3.55 per 1000 population in 2006 to 6.82 in 2007 and continued at same level in 2008. This trend was seen to decline by 50% in 2009 onwards every year till it settled down to 0.67 in 2011. Similarly the *pl. falciparum* percentage was also noted to reduce from a peak of 31.2% in 2007 to 11% in 2011. The malaria specific death rate was around 1.39 per 1000 population from year 2006 to 2007 however it doubled in 2008 to 2.13 and remained almost same in 2009. Only one death occurred in 2010 and two deaths were reported in 2011.

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The National data reveal a small dip in the total number of Malaria cases from 2005 to 2006 however there was a steep rise in the number of deaths recorded from 963 in 2005 to 1707 in 2006. Thereafter there was a gradual drop in the number of deaths over next two years from 1055 in 2008 which remained same till 2010 and reduced drastically in 2011 to 463. The percentage of falciparum malaria was maintained at around 51.53% throughout the study period. (Figure 1)

The proportion of malaria cases were more among adults as compared to young patients and ranged from 90±3%. Thus, malaria is predominantly infesting adults in Goa. (Table 2) The male to female ratio of malaria was 5:1 (Table 3). The certain Urban and semi-Urban Health Care units have contributed more number of cases as compared to other areas in the state. The five Urban Health Care units have reported 68% of total malaria cases detected during the study period (Table 4). The most probable reason for this phenomenon may be due to ongoing large scale construction activities which lead to temporal clustering of labourers who are vulnerable to malaria.

The dominant species of malaria parasite prevalent in Goa was *pl. vivax* (Graph 1) (Table 5). During the last six years *pl. vivax* malaria constituted 74.57% of the total malaria cases occurred in Goa. The proportion of *pl. falciparum* was 25.43% which is very low as compared to national falciparum percentage of 51.53% during the study period.

The other species were not reported during this period. Majority (85.92%) of malaria cases occurred in residents who have migrated from other states of India in pursuit of livelihood to Goa.

Many of them work as construction labor force and some as hotel boys, so on (Table 6). The migrant laborers were six times more at risk of acquiring malaria in the state as compared to the local resident population. The most probable explanation appears be that a migrant laborer resides in temporary huts erected at construction sites until the work is completed. They are exposed to frequent infective mosquito bites over long period of time. They do not adopt any protective measures against these bites.

The occurrence of malaria cases follows a certain seasonal variability and the malaria transmission coincides with the monsoon season which begins in later half of May and remains till September. Malaria cases begin to rise in May and peak in June to August and start dropping from September to October and returns to very low intensity in November.

DISCUSSION: The incidence of Malaria in Goa is declining with few deaths attributable to malaria. This reduction in malaria cases may be attributed to following initiatives taken by the NVBDCP unit.

The NVBDCP has stepped up the information and communication activities in the state. Publishing informative news columns and phone-in programmes on radio as well as television has enhanced public awareness about malaria. Informative posters are displayed in local languages at every Health Center and pamphlets on malaria are distributed widely. The Health Care units actively engage in delivering health talks to general public as well as school children on regular basis. Every Health Care unit is well equipped with a laboratory to detect malaria parasite from blood film. The laboratory technicians placed at health care centers are well trained to identify the malaria parasite.

The Doctors in the Government Health Care units are well oriented to investigate every fever case for malaria parasite. Every case detected is treated using standard drugs supplied by NVBDCP. Malaria Drug policy published by NVBDCP.⁷ which is utilized to manage every case of Malaria.

The uncomplicated falciparum malaria is treated by using artesunate combined treatment (ACT) regimens as some areas such as Aldona, Panjim, Candolim and Margao have developed chloroquine resistance.⁸

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The complicated cases are admitted to hospitals and treated appropriately by using quinine or other potent anti-malaria drugs which have been instrumental in saving many lives. The NVBDCP also has a cadre of workers known as Surveillance workers who are responsible to visit every house in their jurisdiction and obtain blood smears from all residents with fever. The peripheral Health workers attached to Health Care Centers are trained to collect all the information on malaria and submit to NVBDCP on regular basis. Goa Medical College helps in the form of reporting all the malaria cases detected and admitted at College hospital on day today basis. The Goa Medical College is major referral center for the treatment of serious and complicated cases of Malaria.

The NVBDCP has been distributing the Insecticide treated bed nets at subsidized cost to all construction labor force which has resulted in reduction of incidence of malaria among them. The NVBDCP also supplies the required insecticides and fogging machines, spraying equipments to Health care units to be used in appropriate situations. A hand held fogging machine is also made available to every Health Care unit to carry out fogging activity whenever necessary. The larvivorous fish is made available at many Health Care Units. Many members of public utilize this facility and details of the extent of use of larvivorous fish were not available for analysis.⁹ The NVBDCP and Health department is working with close liaison with the Local authorities such as District collectors, etc. to curb creation of mosquito-genic conditions. For example the Local bodies such as the Municipal authorities were oriented regarding prevention of mosquito breeding techniques during monsoon season by timely clearance of drains.

A cleanliness drive is encouraged in every part of state. Many such campaigns were organized throughout the state of Goa. Every In-charge of Health Care unit is empowered by Legislative act to post a fine on any builder responsible for creation of mosquito-genic conditions at their construction sites. Every construction laborer should mandatorily have a Health card and if anyone is found not complying is liable to be fined.

These health cards have details of a particular laborer who is screened for malaria and it has to be renewed after a definite period. The NVBDCP also provides technical and financial support to the Health Care Units to control the malaria Situation in Goa. Monitoring and supervision of programme is done on regular basis. HIMS system is in place to manage the huge data generated which can be accessed by all health authorities. The NVBDCP has engaged the Department of Preventive and Social Medicine at Goa Medical College to evaluate the Behavior Change Communication Strategy implemented in the state annually since 2006.¹⁰

An economic recession in 2008 tumbled all stock markets globally, which led to abrupt reduction in construction business. This phenomenon led to reduction in migration of labour force and thereby reducing the transmission of malaria. This factor has contributed significantly to reduction in the malaria incidence to great extent.

After a serious epidemic of malaria occurred in 1986-88 in Panjim, a Field Station of National Institute of Malaria Research was established on the request of Govt. of Goa on 6th Sept. 1989 with objectives to ascertain the factors responsible for malaria outbreak, study bio-ecology of malaria vector(s), demonstrate malaria control with bio-environmental measures, transfer malaria control technology to the state and provide research support to the state NVBDCP and strengthen malaria control activities.⁶ This Goa unit has conducted many research activities which have helped the State NVBDCP to achieve the current reduction in Malaria.

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The Limitation of Study: The study is based on the retrospective data which is compiled by Health workers with sole intention of formal reporting and may be subject to errors introduced by handlers of data during compilation process. The data on the use of Rapid Diagnostic kits was not available for analysis. The data on the place of origin of the migrant population could not be established as this vital information was not documented. The detection of a case by particular Health care Unit does not imply that the malaria was acquired in that particular area as a person could have been infected elsewhere before reaching the treating Health facility. It is difficult to comment whether the migrant labor force is importing malaria into Goa or they are the victims of malaria. The private health care facilities are managing many malaria cases which are often not reported hence this information may have not been reflected in this data.

CONCLUSION: The trend of malaria cases in Goa is favorably on decline which is a good achievement. The credit for this achievement could be attributed to vital role played by NVBDCP and Health Care Units. Though Goa contributes small fraction of Malaria burden to the nation however the success achieved at Goa could be used as a role model for the successful control and elimination of malaria from India. The details of place of origin of the migrant laborer can help in early detection of cases and their treatment. More attention has to be given to private Health Care facilities for their significant contribution.

Year	Estimated Population Of Goa ¹	ABER ²	SPR ³	Incidence of malaria ⁴	PF% ⁵	Malaria deaths	Malaria Specific Death rate ⁶	API ⁷
2006	1409643	19.7	1.8	3.55	23.9	7	1.39	3.6
2007	1428305	24.9	2.7	6.82	31.2	11	1.12	6.8
2008	1446967	27.5	2.5	6.79	27.8	21	2.13	6.8
2009	1472312	28.3	1.2	3.43	20.9	10	1.97	3.4
2010	1477331	31	0.5	1.60	11.6	1	0.42	1.6
2011	1520216	26.9	0.3	0.67	11	2	1.68	0.78

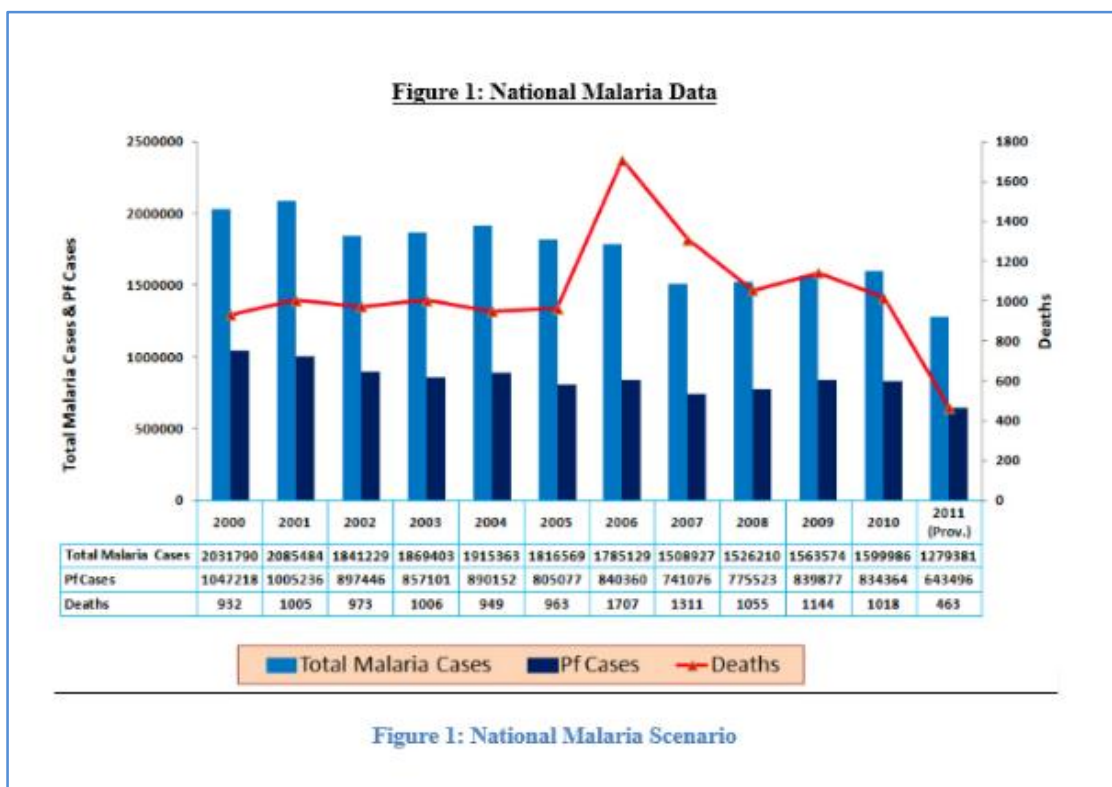
Table 1: Malaria indices of Goa over past six years

1. Population estimates generated by Directorate of health services based on current birth rates,
2. Annual Blood Examination rate,
3. Slide positivity rate, 4: Incidence per 1000 population,
4. Plasmodium falciparum percentage,
5. Malaria specific death rates per 1000 population
6. Annual parasite incidence.

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Year	Malaria cases	falciparum malaria cases	Deaths
2006	1785129	840360	1707
2007	1508927	775523	1311
2008	1526210	839877	1055
2009	1563574	839877	1144
2010	1599986	834364	1018
2011	1279381	643496	463
Total	9263207	4773497	6698

Table2: National Malaria data



Year	Age groups in years		Total
	0-15 (%)	+15(%)	
2007	1244(12.7)	8511(87.2)	9755
2008	889(9.05)	8938(90.95)	9827
2009	371(7.33)	4685(92.66)	5056
2010	200(8.44)	2168(91.55)	2368
2011	115(9.7)	1074(90.3)	1189
Total	2819(10)	25376(90)	28195

*Age wise data for year 2006 was not available.

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Year	Gender		Total
	Males (%)	Females (%)	
2009	4289(84.8)	767 (15.2)	5056
2010	1974(83.4)	394 (16.6)	2368
2011	984(82.7)	205 (17.3)	1189
Total	7247(84.14)	1366(15.86)	8613

Table 3: Distribution of malaria cases according to gender**

**Data from year 2006 to 2008 was not available for analysis.

Urban Health Care unit	Year of reporting					
	2006	2007	2008	2009	2010	2011
UHC ² Panaji	1633	1525	2028	1470	366	195
UHC ² Mapusa	40	580	417	111	13	21
PHC ³ Candolim	1288	2625	2958	1071	435	216
UHC ² Margao	937	1162	1116	458	277	236
UHC ² Vasco	157	132	495	266	184	220
Total of urban health units	4055 (80.1)* ₁	6024 (61.7) * ₁	7014 (71.3) * ₁	3376 (66.7) * ₁	1275 (53.8) * ₁	888 (74.8) * ₁
Goa Total	5010	9755	9827	5056	2368	1189

Table 4: Malaria cases reported by health care units

*Figures in parenthesis are percentages,

1Percentages of cases in these areas are compared to total number of cases in Goa.

2: Urban Health Centre; Primary Health center

Year	Types of malaria species		Total
	pl. falciparum (%)	pl. vivax (%)	
2006	1196(23.8)	3814(76.2)	5010
2007	3047(31.8)	6708(68.7)	9755
2008	2732(27.8)	7095(72.2)	9827
2009	1056(20.8)	4000(79.2)	5056
2010	275(11.6)	2093(88.4)	2368
2011	135(11.4)	1054(88.6)	1189
Total	8441(25.43)	24764(74.57)	33205

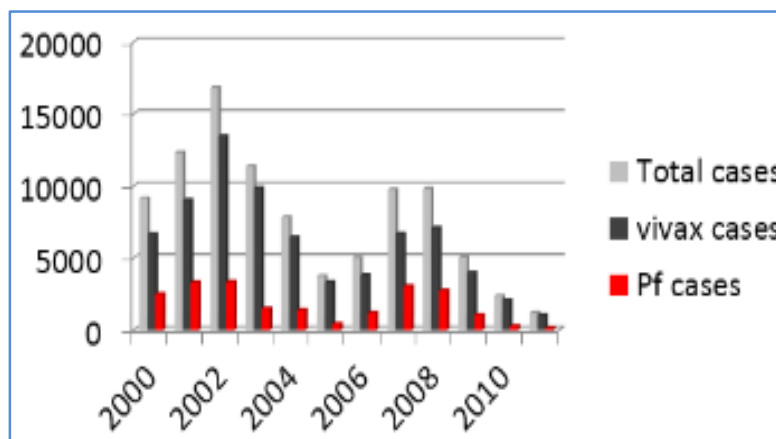
Table 5: Types of malaria parasite species detected in Goa

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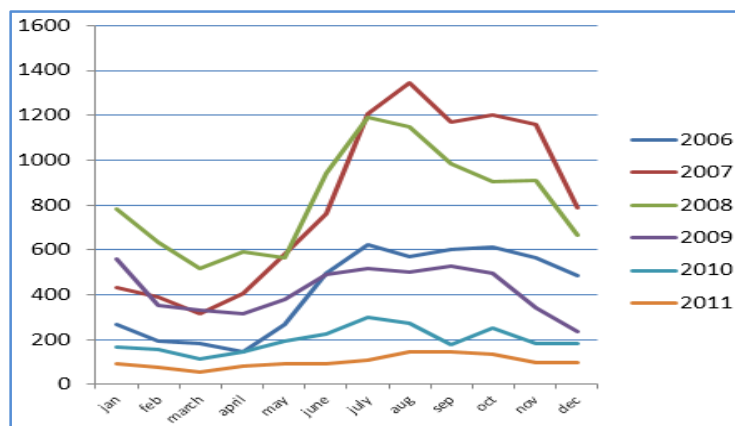
years	Type of Population		Total
	Local Population (%)	Migrant Population (%)	
2007	1496 (15.34)	8259 (84.66)	9755
2008	1375 (14.0)	8452 (86.0)	9827
2009	610 (12.07)	4446 (87.93)	5056
2010	376 (15.88)	1992 (84.12)	2368
2011	112 (9.42)	1077 (90.58)	1189
Total	3969 (14.08)	24226 (85.92)	28195

Table 6: Distribution of malaria cases among local and migration*

*Data of 2006 was not available for computing

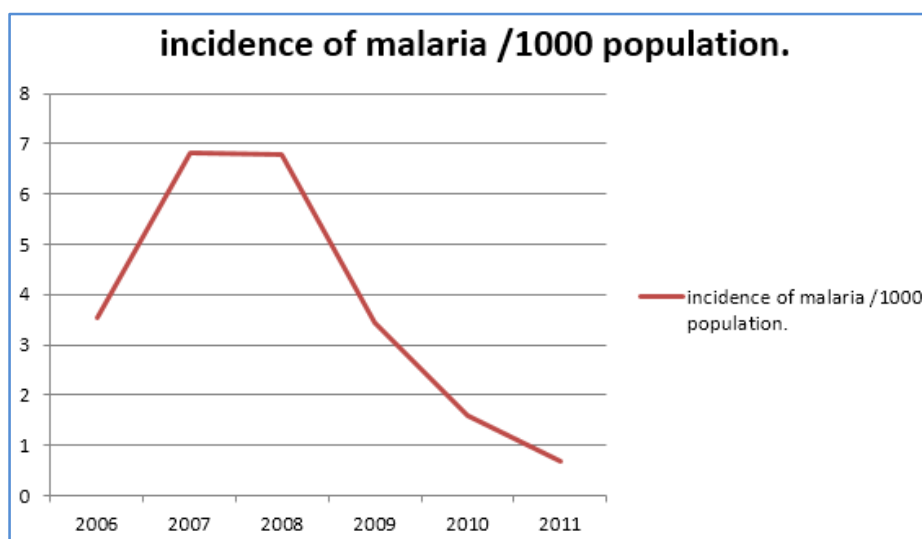


Graph1: species of malaria cases.



Graph 2: Monthly variation in the incidence of malaria cases over past 6 years

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Graph 3: Trend of Malaria Incidence in Goa

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FINANCIAL OR OTHER

COMPETING INTERESTS: None

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Date of Submission: 23/09/2015.
Date of Peer Review: 24/09/2015.
Date of Acceptance: 05/10/2015.
Date of Publishing: 15/10/2015.