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MALARIA: GENDER DIFFERENCE IN PATIENTS SUFFERING FROM ACUTE MALARIA

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Abstract:

Background: *Frequency of malaria infection had been changing around regions over world related to environmental factors and diseases. Male gender is affected more frequently in the areas where malaria had been remained frequent. Studies had suggested the protective role of gender in acquiring diseases.*

Objective: *The main aim concerned with study was to find out the gender difference (male and female) in subjects suffering from malaria.*

Design: *This was across sectional study.*

Setting: *This study was conducted during the period from January 2017 to December 2017 in the department of medicine at PMC hospital Nawabshah Sindh, Pakistan.*

Sample Size: *After satisfying the selection criterion, 385subjects from either gender with malaria infection were recruited in the study.*

Material and Methods: *The history and clinical examination was performed by experienced health care personal. The subjects were analyzed for different variables as age, gender, clinical features malaria, and presence of malaria parasite. Blood was collected and analyzed for malaria parasite.*

Results: *In **385** diagnosed patients **of** malaria, 191(49.6%) male and 194(50.4%) were females. Gender grouping was done and different groups were analyzed for malaria parasite positive.*

Conclusion: *This research had shown that female gender was slightly more affected from malaria infection than males.*

Key Words: *Malaria, Malaria Parasite, Gender.*

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INTRODUCTION:

Malaria is a protozoan parasitic vector borne infectious disease caused by genus Plasmodium [1]. Malaria is thought to be responsible for 85% burden of infectious diseases throughout world. Malaria is the one of the most important cause of mortality and morbidity in the tropics and subtropics. WHO (World Health Organization) had declared malaria as the main killer of humans being and is responsible for 300 to 500 million clinical cases per year. Malaria is labelled as the cause of about 1.5 to 2.7 million deaths annually around world [2].

Malaria an extremely life intimidating parasitic ailment produced by Plasmodium, the plasmodium enter the host RBCs where they reproduce and frequently lead to the rupture of infected RBCs.In 2014 about 02 billion individuals were at risk of malaria infection around the world, of them 84% were living in the sub Saharan Africa [3][4][5].Malaria is the leading cause of mortality and morbidity throughout world. Young African children, pregnant females, travelers of all age groups belonging to non-endemic regions are more vulnerable to infection by the parasite [3][6].Plasmodium falciparum is the most lethal species from all five species that can infect humans. The virulence of plasmodium falciparum depends upon rosetting property of RBCs, which is the capability of infected RBCs to surround themselves with uninfected RBCs[7][8][9][10].Malaria infection is more common in male subjects as compared with female subjects, and also plasmodium vivax is more common than the plasmodium falciparum [11][12].This study will help in making public health policies keeping in the view of gender aspect. This study will determine the frequency of malaria in different genders in malarial patients to find out whether genders have any protective role in the different forms and types of malaria. There are two important logics of this study, first of all there is paucity of studies on this subject and secondly most of studies carried out on this subject are retrospective. To establish the relationship between malaria and gender needs more research in Pakistan. This study estimates the risk of acquiring malaria in relation to different groups of gender in Pakistan.

OBJECTIVE: The main aim concerned with study was to find out the gender difference (male and female) in subjects suffering from acute malaria.

Operational Definitions:

Malaria:

The malaria is an infectious disease, affecting humans and caused by protozoan parasites of Plasmodium family. Malaria is conveyed when an infected Anopheles mosquito bites human being. Up to now 5 species of plasmodium had been identified, p falciparum, p. ovale, p.vivax, p. malariae and p. knowleski causing rare disease in humans. The species P. knowlesi rarely causes disease in humans. The disease caused by plasmodium ranges from asymptomatic, mild to life threating disease especially with p. falciparum. Malaria is diagnosed by thick and thin blood films or by rapid diagnostic tests which are based on antigen.[14][15]

DESIGN: This was across sectional study.

SETTING: This study was conducted during the period from January 2017 to December 2017 in the department of medicine at PMC hospital Nawabshah Sindh, Pakistan.

SAMPLE SIZE: After satisfying the selection criterion, 385 subjects from either gender with malaria infection were recruited in the study.

Inclusion criteria: All male and female subjects above the age of 20 years, with clinical history of malaria and positive malaria parasite antigen (MP ICT Antigen) were included.

Exclusion Criteria: Patients not willing for taking part in study, known cases of blood disorders, Hepatis B surface Ag, sickle cell disease were excluded from study.

Ethical consideration

Approval of study was sought from the hospital ethics committee PMCH Nawabshah. Permission for data collection will be taken from the head of department of the Medicine. Written informed consent will be obtained from adult subjects while ensuring that the data will be kept confidential. Subjects will be thoroughly informed about the objectives and methods of the study.

MATERIAL AND METHODS:

The history and clinical examination was performed by experienced health care. The subjects were analyzed for different variables as age, gender, malarial features, and presence of malaria parasite. Data was collected through interview based questionnaire. Venous blood was collected and analyzed for malaria parasite. From 1.6 million populations the sample size was calculated with 50% distribution rate, 95% confidence level and 5% margin of error through Rao-software calculator for sample size calculation was used. Sample size consisted 385 participants. Subjects grouping were done with positive antigen for malaria parasite to analyze the frequency of gender and malaria parasite.

RESULTS:

In **385** diagnosed patients of malaria, 191(49.6%) male and 194(50.4%) were females. Gender grouping

was done and different groups were analyzed for malaria parasite positive. The female ratio was slightly higher than male ratio in current study.

The mean age of diseased subjects was 39.06 years with standard deviation of 16.35 years, the age of subjects ranged between 20 years to 93 years. In control group including 385 subjects, the mean age of subjects was 38.75 years with standard deviation of 15.78, minimum age 21 years and maximum age was 90 years. **Table 1.**

Non parametric chi square test were performed for diffent variable of study which were statistically significant like patients age <0.000, control age 0.000, patients age group 0.000, controls age group 0.000, gender of patients 0.878, gender of control 0.386, address of patient 0.000, malarial parasite 0.000 and Geimsa satin 0.009. **Table 2.**

Young age population was dominant in our study, majority of patients 232(60.3%) were from 20-40 years age group, 116(30.1%) of patients in middle age group and 37(9.6%) cases were from old age. **Table 3**

Residence ratio was dominant from rural set up as compared to urban setup. There were 291 (75.6%) subjects who belonged to rural areas while 94 (24.4%) subjects were resident of urban areas. MP ICT Antigen testing was positive in 385 patients while Geimsa staining for malaria parasite was positive in 218(56.6%) and negative in 167(43.4%) patients. There was dominancy of plasmodium vivax in present study, 239 (62.1%) suffered from malaria due plasmodium vivax, patients out of these 118/239 (49.40%) male while 121/239 (50.60%) were female. Plasmodium Falciparum was noted in 146 (37.9%) patients, from which73/146 (50.00%) male and 73/146 (50.00%) were from female gender. **Figure 1**

Plasmodium vivax was detected in 239/385 subjects, 149/239 of them were from young age group (68/149 male and 81/149 were female), in middle aged subjects 65/385 p. vivax was seen in 65/239 subjects (34/65 male and 31/65 female), while in old age p.vivax was seen in 25/239 out of them 16/25 male and 9/25 were female. Plasmodium falciparum was detected in 146/385 subjects, 83/146 of them were from young age group (42/146 male and 41/146 were female), in middle aged 51/146 (27/51 male and 24/51 female), while in old age p.falciparum was seen in 12/146 out of them 4/12 male and 08/12 were female. Chi square test of age of patient and control group was checked and pearson chi square was 666.932, df 4, likelihood ratio of 580.223, linear by linear association 354.751, pearson R was 0.961, spearman correction was 0.959 and asymp. Sig (2-sided) <0.000, which was highly significant from statistics point of view. **Table 4**

Chi square test for malarial parasite and gender of patient was checked and pearson chi square was .014, df 1, likelihood ratio of 0.014, linear by linear association 0.014, pearson R was -0.006, spearman correction was 0.006 and asymp. Sig (2-sided) 0.905, which was not significant from statistics point of view. **Table 5**

Chi square test for malarial parasite, age and gender of patient was checked in the cross-tabulation and pearson chi square was statistical significant for young age group of patients .527, df 1, likelihood ratio of 0. 527, linear by linear association 0.525, pearson R was -0.048, spearman correction was -0.048 and asymp. Sig (2-sided) -0.048 which was not significant from statistics point of view. Chi square test for malarial parasite, age and gender of patient was checked in the cross-tabulation and pearson chi square was statistical significant for middle age group of patients .005, df 1, likelihood ratio of 0.005, linear by linear association 0.005, pearson R was -0.067, spearman correction was 0.006 and asymp. Sig (2-sided) <0.946 which was not significant from statistics point of view. Chi square test for malarial parasite, age and gender of patient was checked in the cross-tabulation and pearson chi square was statistical significant for For young old group of patients 3.070, df 1, likelihood ratio of 3.102, linear by linear association 2.987, pearson R was -0.228, spearman correction was -0.006 and asymp. Sig (2-sided) -0.084 which was not significant from statistics point of view. **Table 6 & 7**

On further checking of different correlation of variables of study had shown that there is statistically significant correlation between age and malaria gender of patient and control groupgemisa stain and malaria parasite. While on other hand other variables of study had shown no relation as shown in **table 8.**

Table 1. Descriptive Statistics of age of patients and controls

	N	Minimum	Maximum	Mean	Std. Deviation
Age in years	385	20.00	93.00	39.0675	16.35545
Control age	385	21.00	90.00	38.7558	15.78626
Valid N (listwise)	385				

Table 2. Non parametric chi-square Test Statistics

	Patient age in years	control age in years	Patient age group	Control age group	gender of patient	Gender Of control	Address of patient	malarial parasite	gemsa stain
Chi-Square	259.184[a]	392.501[b]	149.927[c]	135.122[c]	.023[d]	.751[d]	100.803[d]	22.465[d]	6.756[d]
Df	36	57	2	2	1	1	1	1	1
Asymp. Sig.	.000	.000	.000	.000	.878	.386	.000	.000	.009

Table 3. age group * malarial parasite Crosstabulation

Variable		malarial parasite		Total
		plasmodium vivax	plasmodium falcipaurum	
age group	young age 20-40 years	149	83	232
	middle age 41-60 years	65	51	116
	old age >60 years	25	12	37
Total		239	146	385

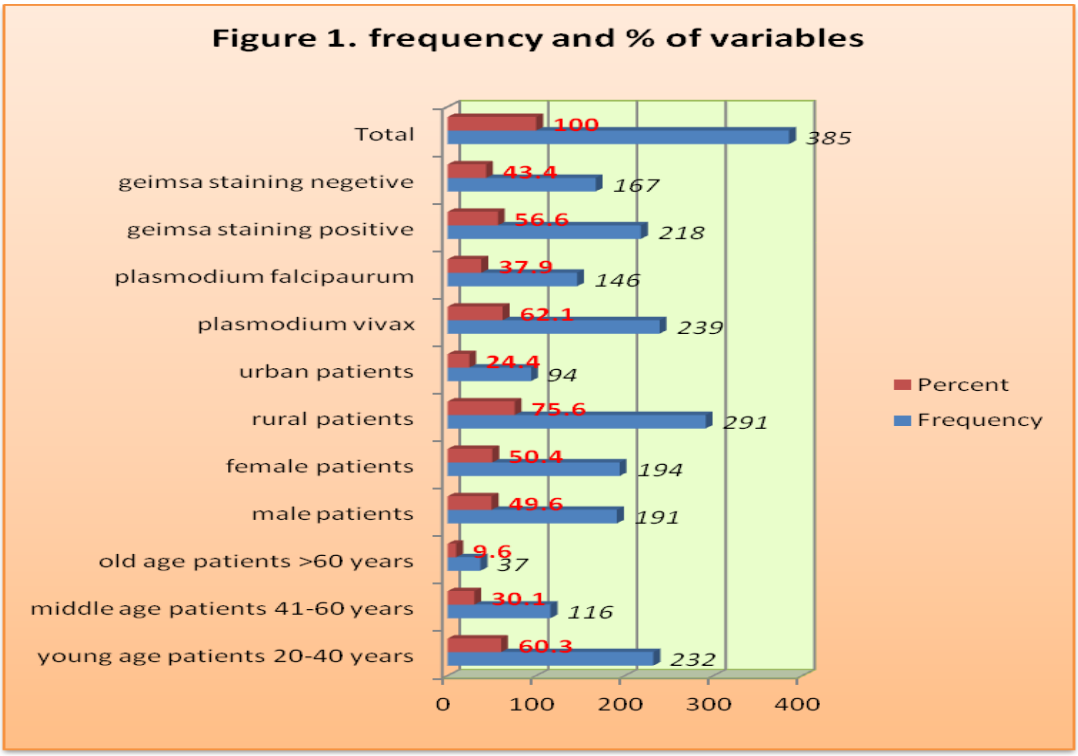

Table 4. Frequency & Percent Patient Group & Control Group with **Chi-Square Tests & Symmetric Measures**					
	Patient Group		Control Group		
Variable	Frequency	Percent	Frequency	Percent	
Young Age 20-40 Years	232	60.3	227	59	
Middle Age 41-60 Years	116	30.1	116	30.1	
Old Age >60 Years	37	9.6	42	10.9	
Male	191	49.6	184	47.8	
Female	194	50.4	201	52.2	
Total	385	100	385	100	
Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)		
Pearson Chi-Square	666.932[a]	4	0.000		
Likelihood Ratio	580.223	4	0.000		
Linear-by-Linear Association	354.751	1	0.000		
Symmetric Measures					
		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	0.961	0.01	68.157	.000[c]
Ordinal by Ordinal	Spearman Correlation	0.959	0.012	66.526	.000[c]

Table 5. Malarial Parasite * Gender Of Patient Crosstabulation					
			Gender Of Patient		
			Male	Female	Total
Malarial Parasite	Plasmodium Vivax	Count	118	121	239
		% within malarial parasite	49.40%	50.60%	100.00%
	Plasmodium Falcipaurum	Count	73	73	146
		% within malarial parasite	50.00%	50.00%	100.00%
Total		Count	191	194	385
		% within malarial parasite	49.60%	50.40%	100.00%
Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.014[a]	1	0.905		
Continuity Correction[b]	0	1	0.988		
Likelihood Ratio	0.014	1	0.905		
Fisher's Exact Test				0.917	0.494
Linear-by-Linear Association	0.014	1	0.905		

Symmetric Measures					
		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-0.006	0.051	-0.119	.905[c]
Ordinal by Ordinal	Spearman Correlation	-0.006	0.051	-0.119	.905[c]

Table 6. Malarial Parasite * Gender Of Patient * Age Group Crosstabulation

age group				gender of patient		Total
				male	female	
Young Age 20-40 Years	Malarial Parasite	Plasmodium Vivax	Count	68	81	149
			% within malarial parasite	45.60%	54.40%	100.00%
		Plasmodium Falcipaurum	Count	42	41	83
			% within malarial parasite	50.60%	49.40%	100.00%
	Total		Count	110	122	232
			% within malarial parasite	47.40%	52.60%	100.00%
Middle Age 41-60 Years	Malarial Parasite	Plasmodium Vivax	Count	34	31	65
			% within malarial parasite	52.30%	47.70%	100.00%
		Plasmodium Falcipaurum	Count	27	24	51
			% within malarial parasite	52.90%	47.10%	100.00%
	Total		Count	61	55	116
			% within malarial parasite	52.60%	47.40%	100.00%
Old Age >60 Years	Malarial Parasite	Plasmodium Vivax	Count	16	9	25
			% within malarial parasite	64.00%	36.00%	100.00%
		Plasmodium Falcipaurum	Count	4	8	12
			% within malarial parasite	33.30%	66.70%	100.00%
	Total		Count	20	17	37
			% within malarial parasite	54.10%	45.90%	100.00%

Table 7. Malarial Parasite * Gender Of Patient * Age Group Crosstabulation

Chi-Square Tests

age group		Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
young age 20-40 years	Pearson Chi-Square	.527[a]	1	0.468		
	Continuity Correction[b]	0.347	1	0.556		
	Likelihood Ratio	0.527	1	0.468		
	Fisher's Exact Test				0.495	0.278
	Linear-by-Linear Association	0.525	1	0.469		
	N of Valid Cases	232				
middle age 41-60 years	Pearson Chi-Square	.005[c]	1	0.946		
	Continuity Correction[b]	0	1	1		
	Likelihood Ratio	0.005	1	0.946		
	Fisher's Exact Test				1	0.548
	Linear-by-Linear Association	0.005	1	0.946		
	N of Valid Cases	116				
old age >60 years	Pearson Chi-Square	3.070[d]	1	0.08		
	Continuity Correction[b]	1.96	1	0.162		
	Likelihood Ratio	3.102	1	0.078		
	Fisher's Exact Test				0.157	0.081
	Linear-by-Linear Association	2.987	1	0.084		
	N of Valid Cases	37				

Symmetric Measures

age group			Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
young age 20-40 years	Interval by Interval	Pearson's R	-0.048	0.066	-0.724	.470[c]
	Ordinal by Ordinal	Spearman Correlation	-0.048	0.066	-0.724	.470[c]
	N of Valid Cases		232			
middle age 41-60 years	Interval by Interval	Pearson's R	-0.006	0.093	-0.067	.947[c]
	Ordinal by Ordinal	Spearman Correlation	-0.006	0.093	-0.067	.947[c]
	N of Valid Cases		116			
old age >60 years	Interval by Interval	Pearson's R	0.288	0.157	1.78	.084[c]
	Ordinal by Ordinal	Spearman Correlation	0.288	0.157	1.78	.084[c]
	N of Valid Cases		37			

Table 8. Correlations Of Different Variables Of Study.

		Age In Years	Control Age	Age Group	Control Age Group	Gender Of Patient	Gender Control Group	Address	Malarial Parasite	Gemsa Stain
Age In Years	Pearson Correlation	1	.996**	.929**	.928**	-.056	-.029	.044	.044	.000
	Sig. (2-tailed)		.000	.000	.000	.273	.573	.390	.386	.994
Control Age	Pearson Correlation	.996**	1	.924**	.929**	-.052	-.025	.037	.044	.002
	Sig. (2-tailed)	.000		.000	.000	.309	.629	.467	.393	.970
Age Group	Pearson Correlation	.929**	.924**	1	.961**	-.053	-.025	.051	.024	-.019
	Sig. (2-tailed)	.000	.000		.000	.303	.625	.318	.642	.710
Control Age Group	Pearson Correlation	.928**	.929**	.961**	1	-.029	-.003	.063	.001	-.021
	Sig. (2-tailed)	.000	.000	.000		.574	.951	.215	.981	.680
Gender Of Patient	Pearson Correlation	-.056	-.052	-.053	-.029	1	.964**	-.004	-.006	-.023
	Sig. (2-tailed)	.273	.309	.303	.574		.000	.931	.905	.659
Gender Control Group	Pearson Correlation	-.029	-.025	-.025	-.003	.964**	1	.000	-.002	-.012
	Sig. (2-tailed)	.573	.629	.625	.951	.000		.986	.963	.808
Address	Pearson Correlation	.044	.037	.051	.063	-.004	.000	1	.004	-.034
	Sig. (2-tailed)	.390	.467	.318	.215	.931	.986		.931	.508
Malarial Parasite	Pearson Correlation	.044	.044	.024	.001	-.006	-.002	.004	1	.104*
	Sig. (2-tailed)	.386	.393	.642	.981	.905	.963	.931		.041
Geimsa Stain	Pearson Correlation	.000	.002	-.019	-.021	-.023	-.012	-.034	.104*	1
	Sig. (2-tailed)	.994	.970	.710	.680	.659	.808	.508	.041	

DISCUSSION:

District Shaheed Benazir Abad (Nawabshah) is roughly the geographical center of Sindh province of Pakistan, spread over 4239.4 km^2 with density of 240/km^2 withtotal population of 1,612,847, from them 833,935 (51.7%) males and 778,883 (48.3%) are female. By percentage, population of SBA below age of 15 years is 45%, between 15-65 years is 52.2%, above 65 years is 02.8% and the population growth rate is 03.09%. SBA is agricultural area, large population; 1,123,510 (69.7%) lives in rural areas and 489,337 (30.3%) is urban population. SBA is considered as one of the warmest area in Pakistan, with summer temperature reaching as high as 53 °C. The climates of area are usually hot and dry [16][17].

Malaria is somewhat common in Pakistan. The available epidemiological data from various areas of Pakistan are insufficient to accurately know the incidence of various types of malaria in population [18].An inadequate extent of epidemiological studies had been related with alterations among males and females in disease occurrence and risk aspects. Data from available studies done in different areas of Pakistan had shown the dominancy of male gender over female gender and also high infection rates with plasmodium vivax [19][20].

Study done by Yasinzai et al. observed that infectious rate of malaria was observed high (07.18%) in male subjects as compared that of female subjects with infection rate of 06.66% [21].

Also study by Ibrahim et al. had shown the infection rate was higher in males as that of females that was 636 (68.90%) in males and 287 (31.09%) in females.[22]

In current study we observed that most of malarial cases 62.1% were due to plasmodium vivax with about equal gender distribution of 1:0.98 female male to ratio, a slight dominancy of female subjects. The reason could be due to those women in the rural areas work in the fields so they have equal chances to be infected by plasmodium. Gender association varies in different regions somewhere male gender is dominant and elsewhere female gender was noted dominant with slight to notable dominancy. Infection caused by plasmodium vivax was observed slightly higher in female subjects in comparison to male with F:M

1:0.98, but this was almost equal in subjects infected with plasmodium Falciparum M:F (1:1). The prevalence of plasmodium falciparum infection is not significantly influenced by gender. No significant association was noted between plasmodium load, gender and age groups [13], as also noted in current study.

Age of the subjects, educational status, occupation (a logger or agriculturist), and travel history and immunity level may have role in acquiring the malaria infection. Women with HIV and pregnancy especially first or second pregnancy carry a high risk of acquiring infections as seen in study from Kisumu County, an endemic malaria area in Kenya where females were noted to have malaria 40% higher than male subjects possibly could be due to two reasons first high prevalence of HIV and second pregnancy especially primi or secondi gravida [23].

Most of reports from Pakistan had shown that the male gender is affected more than the female subjects, but this dominancy is not so much high. Male to female ratio of 1.23:1 was presented by a local study conducted at Ayoub teaching hospital Abbottabad Pakistan with dominant plasmodium vivax [19].

In a study conducted in Guangdong, China had shown that males are about 3.6 times higher as compared with women [25].

Raul C et al. in their report had shown that male were1.2 times more prone to get the malaria infection. [26].
An study conducted by Ibrahim et al. had also shown that male population suffered from malaria more than female subjects with M:F of 2.21:1 respectively. The high numbers of malaria cases 39.21% were seen in middle aged population followed by 37.81% in young subjects [22]. In current study young age population was dominant, majority of patients 232(60.3%) were from 20-40 years age group, 116(30.1%) of patients in middle age group and 37(9.6%) cases were from old age.

Studies discussed above had concluded that malaria was dominantly slightly more common in male gender in different setups with different cultures. Our setup a Muslim setup is now towards change, previously female dress was so big that almost all parts of body were covered in clothes, but now due to modification in life style and dresses, more urbanization of population with improper planning for living standards are the important risk factors for the diseases. Also the area of study is hot and dry the major occupation of people is farming and usually females are involved more in forming in rural community. Residence ratio was dominant from rural set up as compared to urban setup. There were 291 (75.6%) subjects who belonged to rural areas while 94 (24.4%) subjects were resident of urban areas. Current research had shown a slight increase in female gender ratio than male population as compared to others. List of factors may be contributing to that; this is why it may need further more efforts to evaluate the exact reasons for that.

CONCLUSION:

It is concluded from current study that acute malaria infection is common and widely spread all over district Shaheed Benazir Abad. Female population was affected slightly more than the male population. Most of the population affected belonged to young group. The common plasmodium affecting population at high was P vivax. Proper education of the population through seminars at community level, internet, media and other available resources of education is needed. Availability of diagnostic material, protective measures, proper treatment and availability of drugs should be assured at Basic Health Unit level is needed to control the disease.

Conflict of Interests

The author declares no conflict of interest for this study.

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