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Community awareness, knowledge, and practice on prevention of mosquito-borne diseases in the state of Maharashtra

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Abstract
Background: Mosquito-borne diseases are increasing problems in various parts of the world, causing high mortality and morbidity for humans. It has revealed a great threat to public health in India. This survey was conducted to study the Community Awareness, knowledge, and practices on prevention of mosquito-borne diseases in the state of Maharashtra.
Methodology: A cross-sectional observational study was carried out in the five regional divisions of the state for a period between January 2021 to April 2021. The study was carried out with the help of a pre-tested questionnaire. The data collected was then statistically analyzed and percentage calculation was done.
Result: The survey was conducted among 1290 people from various regions and districts of Maharashtra. 23.9% of the respondents were not aware of the mosquito species. 76.6% think that mosquitoes bite in the evening time. 94.4% of the population had awareness regarding the mosquito egg-laying habitat. 83.8% of the population relied on mosquito repellents and chemical insecticides as a precautionary measure. 84.9% never visited the government department and around 56.8% of the population were dependent on social media as a source of information. About 46.5% did not have any idea regarding the Dry day celebrations.
Conclusion: There's a crucial need to increase Community Awareness about practices and methods to prevent mosquito-borne diseases amongst people. The efforts need to be enhanced and escalated to achieve community awareness.

Keywords: mosquito, Community Awareness, public health, survey

Introduction
The major factor of communicable diseases is vector-borne diseases (malaria, dengue, filariasis) in India and also in many other Asian countries. Mosquito-borne diseases are causing a rise of problems in tropical cities where there is population growth, urbanization, and migration happening. It has emerged as a serious health problem amongst the public. *Culex quinquefasciatus, Anopheles stephensi, and Aedes aegypti* are the three prime vectors responsible for millions of deaths worldwide. According to the report, Malaria is the most prevalent infectious disease with around 216 million people at risk from the disease. There were about 0.84 million cases of malaria and 194 deaths in India in the year 2017 [1]. This deadly disease still has high morbidity and mortality rates [2]. The central part of India is said to be endemic to malaria with around 90% of the people at risk [3]. Three countries accounted for 99.5% of estimated cases in the region, India is the largest contributor (87.9%), followed by Indonesia (10.4%) and Myanmar (1.2%). India recorded a 60% reduction in reported cases compared with 2017 and a 46% reduction compared with 2018.
India, Indonesia, and Myanmar accounted for 48%, 30%, and 9% reduction in total reported deaths in the region, respectively [4]. Whereas Dengue is the most rapidly growing mosquito-borne disease in the world. The incidence of the disease has increased almost 30 fold in the past 50 years [5]. The tropical and subtropical regions record about 3.9 billion dengue infections every year in about 128 nations. The instances of dengue fever and the deaths

caused by the disease are seen to be increasing every year in India. About more than 31,117 people were infected and around 48 deaths due to dengue were reported in the year 2017 [6]. In people were infected and around 48 deaths due to dengue were reported in the year 2017 [6]. In the state of Maharashtra, the National Vector Borne Disease Control Program (NVBDCP) recorded 17710 malaria cases and 20 deaths in the year 2017 [7]. The Government of India runs the National Vector Borne Disease Control Program (NVBDCP) for the control and prevention of various vector-borne diseases. The significant reduction of transmission of infection by mosquitoes, can be achieved through various environmental management methods which include elimination or reduction of the mosquito breeding sites and also adapting to improved personal protection measures. As there is no vaccine available for mosquito-borne diseases, the only way to prevent the infection is through a change of behavior and environmental control measures. Community participation is far below expectation despite the various educational approaches and mass communication programs. Control of vector-borne diseases relies on the knowledge and awareness of people [8]. To develop a suitable and effective public health education strategy, it is necessary to understand the awareness level, knowledge of the community, and their practices about vector-borne diseases. The present study was conducted with this background to determine the community knowledge, awareness, and practices in the state of Maharashtra.

Methodology

Study pattern

A cross-sectional study using a Google form-based questionnaire was conducted. The survey was conducted to assess the awareness regarding the mosquito-borne disease and to understand the status of community awareness. The data were collected from the period between January 2021 and April 2021.

Study area

The questionnaire was circulated from various regions and districts of Maharashtra covering all 5 regional divisions of the state. The regional divisions include the Marathwada, Konkan, Khandesh, Western Maharashtra & Vidarbha. The state of Maharashtra experiences an average annual rainfall of 1146.5 mm [9].

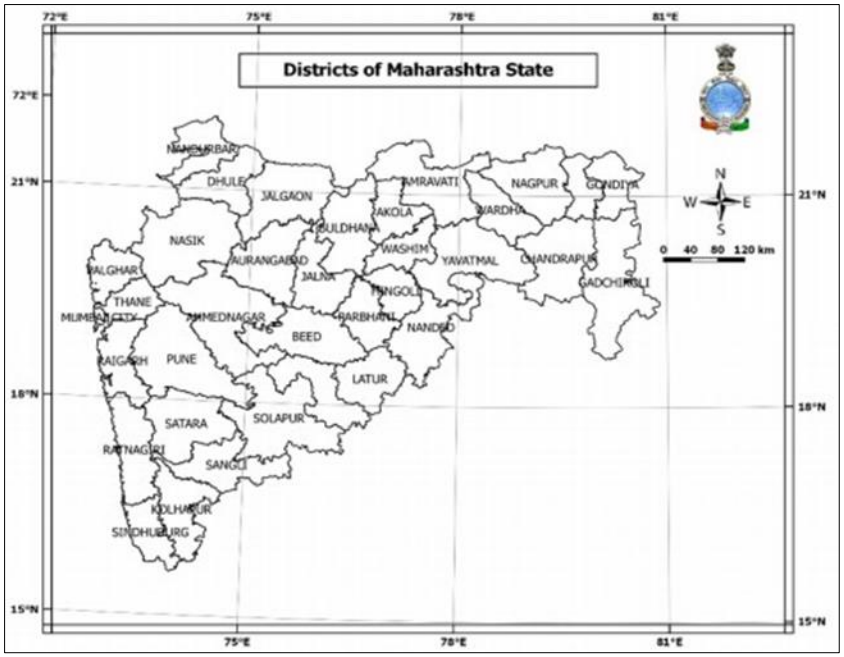

Fig 1: Location of the districts of Maharashtra

Population sampling and sample size

The survey form was circulated by the means of social media platforms in the selected 5 regional divisions of the state. The consent of the participating individuals was taken before filling the form. The total sample size of the study was 1290 respondents from the various districts of Maharashtra. The survey included responses from all 5 regional divisions of Maharashtra. The number of responses from different regions of Maharashtra i.e Marathwada, Konkan, Khandesh, Vidarbha, and Paschim Maharashtra was 697,346,109,136 and 94 respectively. The study included both males and females from the adult age group.

Table 1: Number of respondents

Regions	Respondents
Marathwada	697
Konkan	346
Khandesh	109
Vidarbha	136
Paschim Maharashtra	94

Data collection and analysis

A pre-tested and pre-designed questionnaire was used for the survey conducted under the guidance of the Department of Life sciences, Ramnarain Ruia Autonomous College, Mumbai. The questionnaire was formed using Google forms. The questionnaire included 22 questions formulated in a manner to obtain information about the perception and awareness regarding mosquito-borne diseases among the individuals. The respondents were also asked about the monthly expenditure incurred for the protection from a mosquito bite and their willingness to further participate in any such programs related to community awareness. The collected data was validated at regular intervals and was fed in Microsoft excel. The result was then tabulated and further statistical analysis and percentage calculation was done.

Result and Discussion

The study was conducted in various districts of Maharashtra among 1290 respondents about the awareness regarding the mosquito-borne diseases and precautions taken by the people and also to understand ways to approach the government to avoid it.

1. Awareness regarding mosquito species

According to the study, which we conducted on mosquito species awareness it showed that 76.1% i.e 982 of the total respondents were aware of the mosquito species while 23.9% had no idea about the mosquito species.

Table 2: Awareness regarding mosquito species

Awareness regarding mosquito species	Respondents	Percentage (%)
Yes	982	76.1
No	308	23.9
Total	1290	100

Nanjesh *et al*., 2017 reported that 89.5% of the respondents think that malaria was spread by mosquitoes while 76.5% of the participants replied dengue. 17 % of the respondents think that filariasis is caused by mosquitoes and around 6.5 % of the people did not have an idea about the diseases spread by mosquitoes [10].

Similar observations were seen in a study by Prakash *et al*., 2017, he reported that 74.39% of the respondents think that Malaria is caused by mosquitoes while 36.30% of the people replied dengue. 6.46% of the population think that kala-azar is caused by mosquitoes.

From the previous findings and the observation from our study it was seen that most of the people were not that aware about the mosquito species and the diseases caused by the specific mosquito species.

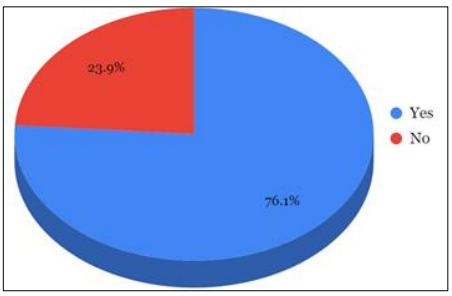

Fig 2: Awareness regarding mosquito species

2. Awareness regarding mosquito bites

From the survey, it was seen that 76.9% of the total respondents think that mosquitoes bite at night time while few people from the population i.e 6.8% and 5 % people think that mosquitoes can bite at midnight or daytime. 11.9% of the people also gave the various responses majority of them think that mosquitoes can bite at any time of the day (Figure 2).

Table 3: Awareness regarding mosquito bites

Awareness regarding mosquito bites	Respondents	Percentage (%)
Day	65	5
Night	988	76.6
Midnight	88	6.8
Others	149	11.6
Total	1290	100

Potdar *et al*., 2019, reported that 8.7% of the participants responded that mosquitoes bite at day time while 35.8% of the participants think that mosquitoes bite at night. 17.1% of the population think that mosquitoes can bite at both the time of the day i.e. day and night. 38.3 % of the respondents did not have a clear idea about the mosquito bite timings [11].

Dhawan *et al*., 2014, studied that the maximum number of people (97%) think mosquitoes bite at Nighttime or during dusk. While 76% of the respondents think that mosquitoes bite at dawn. 59 % of the respondents thinks that mosquitoes bite in the daytime. 73% of the respondents think that mosquitoes can bite at both the time i.e day and night [12].

Begonia *et al*., 2013, stated surprisingly that around 30.18% of the respondents were unaware that dengue mosquitoes mostly bite in the afternoon time [13].

Potter *et al*, 2016, reported in a study that across Western Australia the majority of the individuals (76.9%) were bitten at home followed by 48.6% being bitten while doing recreational activities. 8.9% of the individuals were being bitten at work [14].

A study by Stadtländer *et al*., 2005 stated that according to WHO, the Aedes mosquitoes usually bite in the daytime [15].

As per the above observations, it was seen that people were not much aware of the mosquito biting timings and the fact that the biting time varies from species to species of the mosquitoes.

- **Awareness regarding mosquito egg-laying habitat**

It was studied from our survey that 94.4% participants are aware that mosquitoes can lay eggs only in water, only a few i.e. 4% think that mosquitoes can lay eggs on the soil as well. 1.6% of the participants did not have a clear idea about the mosquito egg-laying habitat

Table 4: Awareness regarding mosquito egg-laying habitat

Awareness regarding mosquito egg-laying habitat	Rspondents	Percentage (%)
Water	1218	94.4
Soil	52	4
Other	20	1.6
Total	1290	100

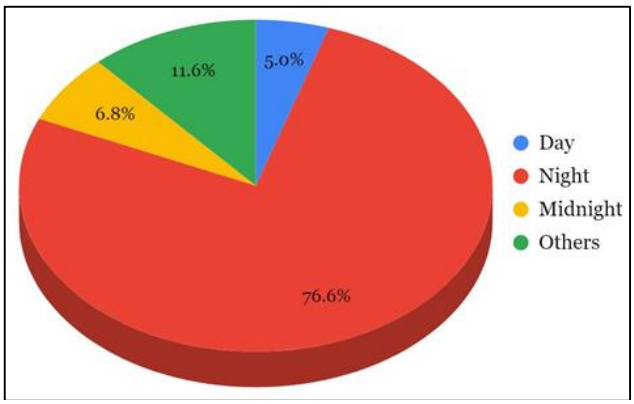

Fig 3: Awareness regarding mosquito bite timings

Similar observations were seen by Patel *et al*. 2011, more than 54.2% think that mosquitoes breed in drains or polluted water. 11.6% of the people responded that mosquitoes breed in clean water. Only 7.2% of the people responded that mosquitoes breed at garbage sites or near green plants [16].

Kulkarni *et al*., 2017 reported that 36.6% of the respondents think that drainage and garbage are the breeding place for mosquitoes while 22.5% of the respondents think that garbage and stagnant water are the common breeding place. 0.83% of respondents think stagnant water is a breeding place for mosquitoes [17].

Boratne *et al*., 2010 reported that 60.69 % of people responded that mosquitoes breed in stagnant water while 4.24 % replied coconut shells [18].

In a study by Sharma A.K *et al*., 2007, it was seen that the majority of the individuals from the Bastar district of Madhya Pradesh were not aware of mosquito breeding places. From the observations of the present study, it was seen that the majority of people were aware that mosquitoes breed in water [19].

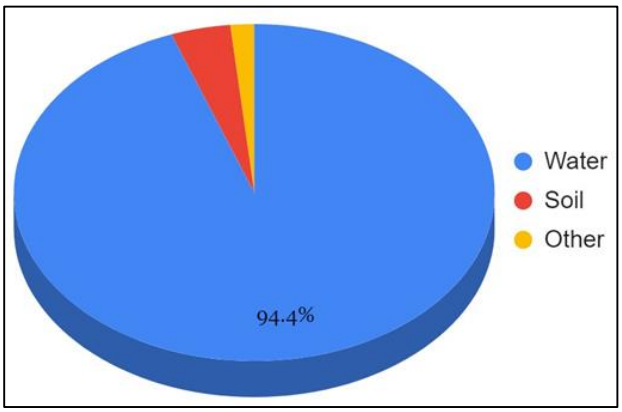

Fig 4: Awareness regarding mosquito egg-laying habitat

Household's practices on prevention of mosquito-borne diseases

The respondents were asked to select multiple methods they used as a precaution against mosquito bites, it was seen that a maximum number of people (83.8%) used mosquito repellents like coil, odomos as a protective measure followed by the use of mosquito net (33.4%). It was seen that around 53.1% of the people preferred window screening. Only 2.6% of the respondents did not use any measures.

The bite of an infected mosquito can lead to serious illness, the WHO provides standard precautions against mosquitoes, which should be used by people to prevent themselves from mosquito bites. From the present study, it was seen that the respondents did not follow a standard way against mosquitoes; their choice of the precautionary measures was influenced by each other.

Table 5: Awareness regarding precautions undertaken for mosquito bite

Household's practices on prevention of mosquito-borne diseases	Respondents	Percentage (%)
Mosquito repellents(coil, odomos, Mortin)	1081	83.8
Mosquito net	431	33.4
Screening of window	672	52.1
Don't use any measure	33	2.6
Total	1290	100

*Multiple responses

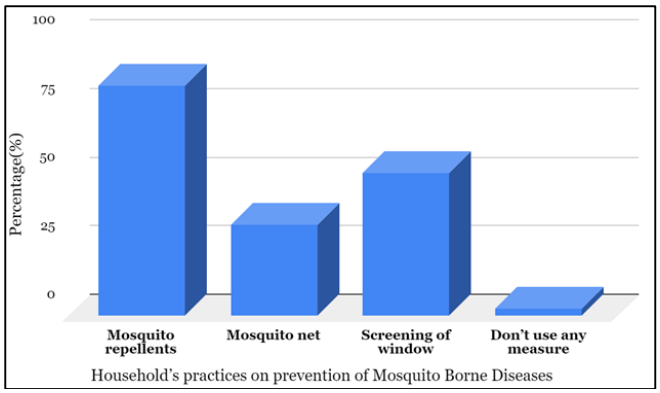

Fig 5: Household's practice on prevention of mosquito-borne disease

It was seen that similar results were found in a study by Patel *et al*., 2011. The study reported that 61.4% of the respondents used various forms of mosquito repellents like mosquito coils, creams, mats, and vapors. Around 10% of the people used mosquito bed nets. Only 3% of the population replied to the screening of windows/doors. 39% of people were not taking any measures. 20.4% of the respondents mentioned the use of fans as a measure to avoid mosquito bites.

Guleri *et al*., 2019 reported that 22.5% of the respondents used mosquito coils/spray/agarbatti while 19% of the population used electric mosquito repellents. It was seen that the majority of the population i.e. 36% used electric mosquito bats. Odomos was used by a very small number of people (0.5%), Only 6.5% of the respondents use traditional neem smoke as a way of precaution to avoid mosquito bites [20].

Potdar *et al*., 2019 reported that 40.4 % of the respondents used odomos/liquid vaporizer while 25.8 % of the people used chemical spraying as a method of prevention.17.2 % of the population preferred screening of windows, mosquito nets.

Snehalatha K.S. *et al*., 2003 reported that 73% and 99% of the rural and urban respondents from the Pondicherry area were found to use personal protection measures [21]. From the study, It was seen that there was a significant association of literacy status with the use of personal protective measures

- **Visited the government department regarding mosquito-borne diseases**

It was studied from the survey that almost 84.9% of the total

respondents have never visited government departments related to mosquito-borne diseases and it was also seen that they did not have any idea about the existence of such departments. Only 15.1% of the population had visited the government department related to mosquito-borne diseases.

Table 6: Visit government department related to mosquito-borne disease

Visited government department regarding mosquito-borne diseases	Respondents	Percentage (%)
Yes	195	15.1
No	1095	84.9
Total	1290	100

Gupta *et al*., 2014 reported that 52% of the people approached health care professionals for mosquito-borne diseases related information while 41% of the respondents approached various health facilities for the information [22].
Nanjesh *et al*., 2017 reported that 48.5% of respondents replied that the health practitioner had not come for active surveillance while 41.5% visited general practitioners for seeking health-related consultations followed by 28.5% of people consulted physicians and private hospitals.

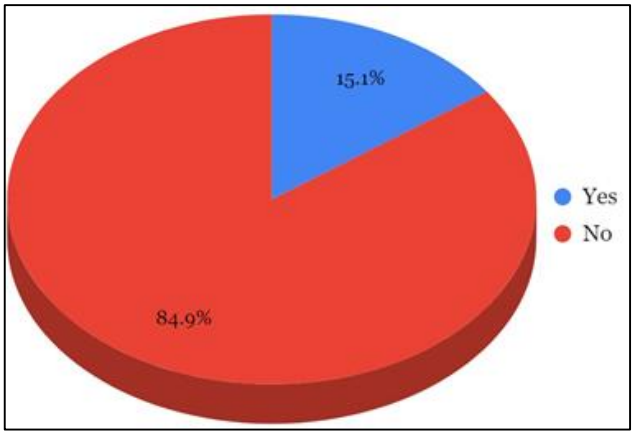

Fig 6: Visited government department regarding mosquito-borne diseases

Awareness regarding mosquito related Dry day celebration

From the survey, it was seen that 59.5% of the people knew about the Dry day Celebration while the rest 40.5% of the respondents did not have any idea about the Dry day Celebration. From the present study, it is seen that many people have been infected in the past 2 years by mosquito-borne diseases and as there is no vaccine available against the disease, it is our sole duty to take precautionary measures and try to maintain our surroundings clean.

Table 7: Awareness regarding mosquito related Dry day

Awareness regarding mosquito related Dry day celebration	Respondent	Percentage (%)
Yes	768	59.5
No	522	40.5
Total	1290	100

Shinde *et al*., 2019, reported similar observations only a few people i.e. 30% celebrated the dry day while 60% of the respondents were aware of the Dry day celebration but didn't follow it, while 10% did not have any idea about the Dry day celebration [23].
Joshi *et al*., 2008, reported that 48.1% of the respondents from the Nepal area replied the removal of collected water from ditches and spraying insecticide can help control mosquito-borne diseases [24].
The household must follow a dry day at least once a week where all the utensils, pots, and tanks are emptied and cleaned.

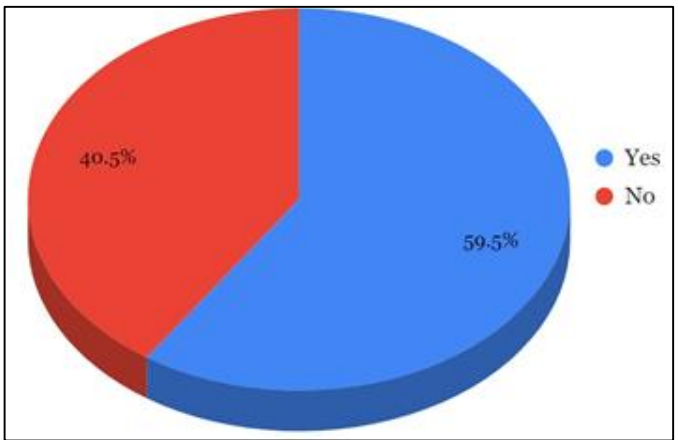

Fig 7: Awareness of mosquito related dry day

- **Source of Information**

It was studied from the survey that social media was the most common source of information (56.8%) regarding MBDs followed by Television (22.8%) and Newspaper (9.8%). Radio was the least widespread source of information regarding mosquito borne diseases with only 1.1% obtaining information from it.

Source of Information	Respondents	Percentage (%)
Social Media	733	56.8
Newspaper	127	9.8
Radio	14	1.1
Television	294	22.8
Other	122	9.5
Total	1290	100

Boratne *et al*., 2010, reported that the maximum number of respondents (75.93%) received information regarding mosquito-borne diseases from Television while 16.43 % of the participants received the information from health care providers. 12.84% of the population received information from newspapers. Radio was the least used source, only 8.18 % of the respondents replied Radio. 9.86% of the population received information from various other sources.
Niraj Pandit *et al*., 2010, studied that 77.5 % of the respondents received the information from Television while 34.7 % received information from Newspaper and magazines. 22.5 % of the people relied on the Radio for the information. 18 % of the respondents replied friends and relatives as the source of information followed by 15.4 % replying to hoardings and banners as a source of information [25].

The National Vector Borne Disease control program launched by the Government of India is an active initiative against mosquito-related problems.

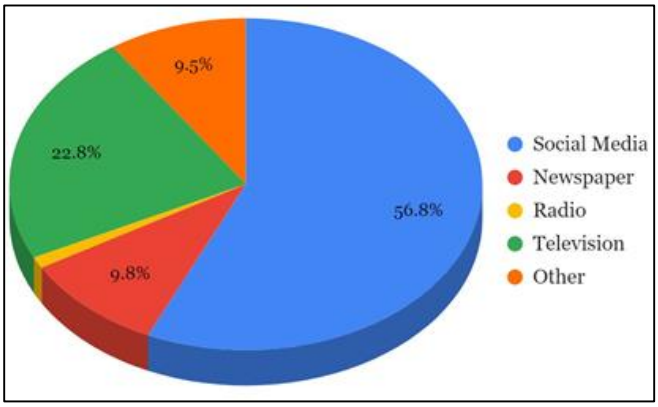

Fig 8: Source of Information

Monthly Expenditure incurred by people for precaution against mosquito

The monthly expenditure incurred by the households for precaution against mosquitoes ranged from ₹100 to ₹2000 and it was also seen that some respondents incurred ₹10,000 to ₹25,000. It was reported from the study that the money spent by the respondents on the treatment of mosquito-borne disease ranges between ₹50,000 -1 lakh. It was seen from the survey that 13.6% of the respondents had lost a family member due to mosquito-borne disease hence it becomes necessary that households should take appropriate precautionary measures.

Babu B.V. *et al*., 2007, reported that the maximum monthly expenditure/household in the urban area in the state of Orissa was around ₹470 and that in the rural area was ₹497 [26].

Joseph *et al*., 2015, reported that the monthly expenditure on permanent methods was found to be more in urban areas ₹700 and ₹300 in the semi-urban area while the expenditure on temporary methods was ₹100 and ₹60 in urban and semi-urban areas respectively [27].

The number of people affected and the expenditures incurred for the prevention and treatment of mosquito-borne disease indirectly leads to being a burden on the economy.

Statistical Analysis

The data obtained from respondents in the google form pooled for statistical analysis to ensure correlation association of various attributes. For the present study, the knowledge and awareness of preventive measures undertaken is independently studied. With attributed mass media and biting time, if hypothesis rejected then the coefficient of contingency studies to know the strength of attributes as dependent one

Independent statistical analysis between the attributes of mass media and precautionary measures reject the null hypothesis with P value 0.002833 and conclude that both are dependent on each other, where as the strength of Association (C) 0.747553, indicates that very high association between role of mass media in prevention of mosquito borne disease through campaigning of various preventive practice against mosquito nuisance as a vector to disease.

Additionally the statistical study between bite timing of mosquito and precautionary measures indicates high association with coefficient of contingency C=0.700208 and reject null hypothesis of independent attribute with P Value 0.012926.

The Knowledge and awareness about precautionary measures followed to avoid mosquito borne diseases acquired through mass media and also the biting time preference are dependent. The resurgence and reemergence of MBDs can be prevented through more preferable and effective survey and conveying the message through the mass media on various aspects.

Conclusion

The present study showed that the respondents from the state of Maharashtra had limited awareness regarding mosquito species and the time of a mosquito bite. It was observed from the study that the majority of the people were aware of the breeding place of the mosquitoes, but were not aware that it varies from species to species of mosquitoes. The measures used by the individuals were not standardized and there is a serious need to follow standard protocols against mosquitoes. The majority of the population relies on mosquito repellents and chemical insecticides as a protective agents. There must be awareness regarding mosquito-borne diseases and the methods of prevention from the Government but it was seen that only 15.1% of the respondents knew about the department and visited it. A large number of the population was dependent on social media as a source of information regarding mosquito-borne diseases instead of the Government departments. The survey showed that there was only 59.5 % awareness regarding the mosquito Dry day celebration. The government along with the people should take initiatives in creating more awareness regarding mosquito-related problems.

Recommendations and suggestions

Information regarding various preventive and control measures should be spread among the population. It is necessary that the individual follows a dry day at least once a week and maintains cleanliness in the surroundings. The basic information should be taught to children at the school level itself. NGO's, stakeholders, community volunteers along with government bodies should conduct various programs to spread awareness amongst the people.

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