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Effectiveness of dengue fever eradication program in Southern Punjab, Pakistan: A cross-sectional survey

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Abstract
Dengue was epidemic in Pakistan previously but now it has become endemic in disease-affected areas like Punjab. This cross-sectional was planned to determine that why dengue fever has been decreasing in southern Punjab, Pakistan and to highlight the positive effects of the dengue control programs launched in southern Punjab. The majority (76%) of the respondents were educated. Most of them (88%) were familiar with mosquitoes' involvement in the dissemination of diseases like dengue fever. Approximately 52% of respondents reported that media was the main source of awareness, while 32% dealt with mosquitoes by themselves. About 41% and 28% surveyed people used oil and net as a preventive measure against mosquitoes, respectively. While the 23.2% of graduates use the net as a preventive measure against mosquitoes. Concluding, disease management programs are more successful when people are educated as they adopt preventive measures more efficiently.

Keywords: *Aedes agypti*, awareness, dengue, mosquito, disease

1. Introduction
Dengue infection, endemic in more than 100 countries, is one of the most rapidly spreading *Aedes* mosquito-borne diseases [1–3]. The earliest known documentation of symptoms resembling dengue fever was reported in the medical literature in 1779 and 1780 [4]. Recent modeling of global dengue burden estimated around 390 million people is affected by dengue fever annually [5]. This is much higher than the figure reported by the World Health Organization, which reported 50–100 million dengue infections per year [1]. Arbo-virus (DENV), the casual organism of dengue fever, is categorized into four antigenically distinct serotypes: DENV-1, DENV-2, DENV-3, and DENV-4, and their relative prevalence vary temporally [6, 7]. Infection with one serotype does not provide immunity against the other serotypes, rather puts the individual at a greater risk to develop Dengue Haemorrhagic Fever (DHF) actually it increases vascular permeability, hypovolemia, and abnormal blood clotting mechanisms. The DHF is a potentially deadly complication with symptoms similar to those of dengue fever, but after several days the patient becomes irritable, restless, and sweaty and the "Dengue Shock Syndrome (DSS)" is characterized by bleeding that may appear as tiny spots of blood on the skin (petechiae) and larger patches of blood under the skin (ecchymosis), if the infection is continued subsequently [1].
In Pakistan, the first serologically confirmed case of dengue fever was reported in the city of Karachi in 1994 [8]. The number of cases has subsequently increased from 4,500 reported in Karachi in 2005 to 21,204 cases in the country in 2010. In Lahore alone, 17,531cases and 300 deaths from dengue fever were confirmed in 2011. Some people believe these figures do not depict the actual burden of the disease in the country, the true burden being more than reported [9].
The *Aedes aegypti* (L.) and *A. albopictus* (Skuse) (Diptera: Culicidae) are commonly known vectors of dengue fever in southeast Asia (Pakistan) [10, 11]. These mosquitoes breed both in man-made (plant pots, tires, water jars, etc.) and natural containers (bamboo, bromeliads, coconut shells, etc.). They are more cosmopolitan in their feeding habitats and rest both inside homes and outside them, making control difficult. Additionally, they are active during daytime [12, 13].

Most research on dengue vectors has focused on the biological and behavioral characteristics of these insects [14, 15], the efficacy of specific interventions [16] and delivery strategies for vector management [17]. The attitude of gaining knowledge about a specific disease or pest is very important in the management of that disease/problem [18, 19]. A survey has been conducted 2014 in Dhaka 2014, Bangladesh exhibited that concluded, 92% of the community person had heard DF while 94% knew that mosquitoes were responsible to both dengue and its vector [2] and in Saudi Arabia similar study had been shown [3]. Owing to the importance of survey about dengue fever information, the present study was designed to determine that why dengue has been decreasing in southern Punjab and to highlight the positive effects of the dengue control program in southern Punjab.

2. Material and Methods

2.1 Data collection

A cross-sectional study was conducted to assess the knowledge, attitude, and practices regarding dengue in southern Punjab, Pakistan during 2015-2016. When the number of dengue cases started decreasing in the southern area of Punjab, Pakistan.

This study was specifically conducted to find out the effects of awareness programs launched by local governments in reducing dengue and its vector. Data of survey were collected from different areas of southern Punjab, Pakistan during 2013-2014. A sample size of 440 subjects was required to fulfill the objectives of our study. A comprehensive questionnaire in English was devised for this study according to the guidelines of Itrat *et al*. [20]. The Face-to-face interviews were conducted based on the questionnaire (comprised of 20 questions). Respondents were personally interviewed and informed about the objectives of the study. A few interviews were also conducted in the local languages of the areas in order to facilitate information collection.

2.2 Data management

The data regarding knowledge and practices were scored following the methodology [21]. The data were managed in SPSS to find out the frequency and percentage. Gender was scored 0 for male respondents and 1 for female respondents. To determine basic knowledge, respondents were asked whether they were familiar with mosquitoes or not. A score of 0 was given to the respondents who were aware of the word mosquito, and a score of 1 was awarded to the respondents unaware of the term mosquito. Respondents were asked that do they knew about the breeding sites of the mosquito vector of dengue? A score of 0 was given if they were aware of containers serving as breeding sites, a score of 1 was given if they were aware of water reservoirs being used as breeding sites, and a score of 2 was given if they knew that tree holes in forests were breeding sites. Similarly, they were asked about diseases transmitted by mosquitos. They were given a 0 score if they knew that malaria was transmitted by mosquitoes, they were given a 1 score if they knew that dengue was transmitted by mosquitoes, and they were given a 2 score if they knew that both of these diseases are transmitted by mosquitoes. Another question was asked about the mode of disease transmission by mosquitos. A score of 0 was awarded if the respondent answered "by biting", a score of 1 was awarded if the respondents answered "by contamination of food and water", and a score of 2 was given if the response was "no idea". Respondents were asked about the mosquito species responsible for transmitting dengue. Scores of 0, 1, 2, or 3 were awarded if their answer was *Aedes* spp., *Anopheles* spp., *Culex* spp., or "do not know", respectively. They were also asked that if someone is experiencing dengue fever then what should he do? A score of 0 was awarded to the respondents who replied "seek a doctor", a score of 1 was awarded to the respondents mentioning "self-medication", and a score of 2 was given to those responding "do not know". Similarly, other question regarding symptoms of dengue and methods adapted for vector control, and source of information were asked.

2.3 Statistical Analysis

The data were tabulated and analyzed by chi- square test of association, binary logistic and ordinal logistic regression models using SPSS software in the form of percentage and frequencies (Version 10.0 for Microsoft Windows, SPSS Inc., Chicago, IL) [22].

3. Results

3.1 Demographic features

About half of the (440 total) respondents were male (50.7%) and half were female (49.3%) (Table 1). A majority (70.7%) of the people sampled were 18-25 years of age because they replied keenly about questions, while few respondents (2.7%) were more than 40 years old. A significant majority (76.6%) of the respondents were graduates, while only a few of the respondents were illiterate (3.2%) or had post-graduate degrees (2.0%) (Table 1).

3.2 Respondents' knowledge regarding dengue fever and its vectors

A majority (88.9%) of respondents were aware of the role of mosquitoes in outbreaks of some important diseases (Table 2). A comparatively high number of the respondents (68.6%) were aware of the role of mosquitoes in spreading both malaria and dengue.

Despite the fact that most respondents were aware of the role of mosquitoes in transmission of dengue, only 24.1% knew that species of *Aedes* are the dengue vector (Table 2). Many respondents thought that species of *Anopheles* (27.5%) or *Culex* (16.8%) are dengue vectors, and the largest percentage of respondents (31.6%) admitted that they did not know the species of mosquito that are vector dengue. In southern Punjab, a majority of respondents (56.6%) were aware of all of the symptoms of dengue fever (Fig. 1).

Nearly half (46.4%) of the respondents knew that boxes, pots, and canes (iron box) were breeding sites of mosquitoes (Table 2). So 40.9% respondents said that they eliminated standing water to get rid of mosquitoes and the associated diseases (Table 3). A majority of respondents (73.6%) were aware that the mode of transmission of dengue was from mosquito bites (Table 2). In addition, 37.0% of respondents thought that this disease is transmitted by the insect vector primarily at night.

3.3 Preventive measures

The highest percentage of respondents reported that they used repellent oil (41.1%) or insecticide-impregnated nets (28.6%) as a preventive measure against mosquitoes (Table 3). Highly educated people adapted preventive measures against mosquitoes, with 39.8% of them using oil and 30.3% using impregnated nets as a control measure (Table 3).

A majority (65.9%) of the respondents said that they would visit a doctor in case of a dengue incidence, while only 8.0% of the respondents had no idea how to deal with an emergency situation? The percentage of participants who sought a doctor

was highest among educated persons and they also suggested that in the case of a dengue incidence the affected persons should visit a doctor.

3.4 Best source of awareness

Many respondents (31.6%) dealt dengue by themselves and did not seek other persons to guide them about dengue, while the majority of persons (65.9%) responded that they will try to seek a doctor in case of emergency. Over half of the respondents (52.0%) believed that the media was the best source of awareness concerning mosquito control (Table 3).

Table 1: Demographic features of respondents belonging to southern Punjab, Pakistan

Demographic feature	Number (Percentage)
Gender	
Male	223 (50.7)
Female	217 (49.3)
Age (years)	
18-25	311 (70.7)
26-40	117 (26.6)
Over 40	12 (2.7)
Education	
Illiterate	14 (3.2)
Up to Primary	21 (4.8)
Up to high School	59 (13.4)
Up to Graduation	337 (76.6)
Post-Graduate	9 (2.1)

Multan (30° 11' 44 N; 71° 28' 31 E),

Table 2: Awareness of respondents of southern Punjab about breeding sites, biting times, and role of mosquitoes in disease transmission

Level of education								
Sr.	**Question**	**Response**	**Illiterate**	**Primary**	**Matric**	**Graduate**	**Post-graduate**	**Total**
No			**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
1.	Familiar with	Yes	0 (0.0)	21 (4.8)	56 (12.7)	314 (71.4)	5 (1.1)	391 (88.9)
	Mosquitoes	No	14 (3.2)	s	3 (0.7)	23 (5.2)	4 (0.9)	45 (10.2)
2.	Disease	Malaria	2 (0.5)	3 (0.7)	6 (1.4)	49 (11.1)	3 (0.7)	60 (13.6)
	due to	Dengue	4 (0.9)	1 (0.2)	6 (1.4)	59 (13.4)	5 (1.1)	75 (17.0)
	Mosquitoes	Both	8 (1.8)	17 (3.9)	47 (10.7)	229 (52.0)	1 (0.2)	302 (68.6)
3.	Dengue	*Aedes spp.*	0 (0.0)	9 (2.1)	10 (2.3)	83 (18.9)	4 (0.9)	106 (24.1)
	Causing	*Anopheles spp.*	8 (1.8)	4 (0.9)	11 (2.5)	98 (22.3)	0 (0.0)	121 (27.5)
	Mosquitoes	*Culex spp.*	6 (1.4)	1 (0.2)	8 (1.8)	54 (12.3)	5 (1.1)	74 (16.8)
		Do not know	0 (0.0)	7 (1.6)	30 (6.8)	102 (23.2)	0 (0.0)	139 (31.6)
4.	Symptoms	Fever	0 (0.0)	8 (1.8)	19 (4.3)	82 (18.6)	0 (0.0)	109 (24.8)
	of dengue	Skin rashes	7 (1.6)	1 (0.2)	4 (0.9)	32 (7.3)	1 (0.2)	45 (10.2)
		Nose bleeding	0 (0.0)	2 (0.5)	4 (0.9)	30 (6.8)	1 (0.2)	37 (8.4)
		All	7 (1.6)	10 (2.3)	32 (7.3)	193 (43.9)	7 (1.6)	249 (56.6)
5.	Mosquitoes	Boxes, pots, canes	4 (0.9)	8 (1.8)	27 (6.1)	165 (37.5)	0 (0.0)	204 (46.4)
	Breeding	Ponds, rivers	9 (2.0)	13 (3.0)	30 (6.8)	139 (31.6)	3 (0.7)	191 (43.4)
	Sites	Forests	1 (0.2)	0 (0.0)	2 (0.5)	33 (7.5)	6 (1.4)	42 (9.5)
6.	How they	Biting	7 (1.6)	19 (4.3)	47 (10.7)	258 (58.6)	0 (0.0)	324 (73.6)
	Transmit	Contaminating	0 (0.0)	2 (0.5)	7 (1.6)	52 (11.8)	4 (0.9)	65 (14.8)
	Disease	No idea	7 (1.6)	0 (0.0)	5 (1.1)	27 (6.1)	5 (1.1)	44 (10.0)
7.	Biting	Dawn	0 (0.0)	3 (0.7)	5 (1.1)	44 (10.0)	3 (0.7)	55 (12.5)
	time of	Morning	6 (1.4)	3 (0.7)	3 (0.7)	33 (7.5)	0 (0.0)	45 (10.2)
	Mosquitoes	Afternoon	0 (0.0)	1 (0.2)ss	5 (1.1)	31 (7.0)	3 (0.7)	38 (8.6)
		Night	8 (1.8)	10 (2.3)	24 (5.5)	118 (26.8)	3 (0.7)	163 (37.0)
		Any time	0 (0.0)	4 (0.9)	24 (5.5)	111 (25.2)	0 (0.0)	139 (31.6)

Table 3: Awareness and adoption of different control measures of mosquitoes by respondents of southern Punjab, Pakistan in relation to their education level

Respondents' education level and percentage of adoption								
Sr.	**Features**	**Classes**	**Illiterate**	**Primary**	**Matric**	**Graduate**	**Post-graduate**	**Total**
No			**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
1.	Preventive Measures Against Mosquitoes	Repellent oil	6 (1.4)	7 (1.6)	30 (6.8)	134 (30.5)	4 (0.9)	181 (41.1)
		Aquatic Net	6 (1.4)	9 (2.0)	9 (2.9)	102 (23.2)	0 (0.0)	126 (28.6)
		Insecticides	2 (0.5)	1 (0.2)	11 (2.5)	51 (11.6)	0 (0.0)	65 (14.8)
		Other	0 (0.0)	4 (0.9)	9 (2.0)	50 (11.4)	5 (1.1)	68 (15.5)
2.	Source used for mosquito control	Personal doctor	0 (0.0)	7 (1.6)	21 (4. 8)	111 (22.2)	0 (0.0)	139 (31.6)
		Media	8 (1.8)	13 (3.0)	32 (7.3)	180 (40.9)	4 (0.9)	229 (52.0)
		Friends	6 (1.4)	1 (0.2)	6 (1.4)	46 (10.5)	5 (1.1)	64 (14.5)
3.	First activity in case of Fever	Go to doctor	0 (0.0)	12 (2.7)	43 (9.8)	229 (52.0)	6 (1.4)	290 (65.9)
		Self-treatment	5 (1.1)	7 (1.6)	15 (3.4)	88 (20.0)	0 (0.0)	115 (26.1)
		Take advice	9 (2.0)	2 (0.5)	1 (0.2)	20 (4.5)	3 (0.7)	35 (8.0)
4.	Preventive Measures of dengue	Mosquito management	0 (0.0)	5 (1.1)	26 (5.9)	114 (25.9)	1 (0.2)	146 (33.2)
		Remove standing water	8 (1.8)	10 (2.3)	24 (5.5)	135 (30.7)	3 (0.7)	180 (40.9)
		Medication	6 (1.4)	6 (1.4)	9 (2.0)	88 (20.0)	5 (1.3)	114 (25.9)

n: frequency of people, %: percentage of peoples

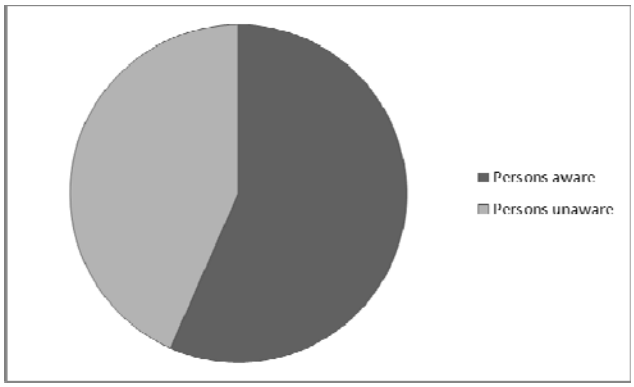

Fig 1: Percent awareness of dengue symptoms in different families

4. Discussion

Dengue fever is currently a major health issue in southern Punjab, and it has been well managed through community participation in the affected areas. Training and awareness of management options for control of mosquito-borne diseases are necessary for dengue management [23]. Integrated pest management of the mosquito vectors is the best approach to control dengue fever [24-26]. The *Aedes aegypti* and *A. albopictus* have been reported as common vectors of dengue fever in India [27]. In peri-urban areas, *A. aegypti* develops faster at larval stage than *A. albopictus*. Standing water in plastic, iron and rubber containers is the best breeding place of *A. aegypti* and *A. albopictus*. Urbanization extends contaminated areas and greatly contributes to spreading diseases. Therefore, the habitat of people plays an important role in spreading of diseases [28].

Insects play the most important role in spreading of some diseases because they are mobile [29, 30]. In the present study, a majority of surveyed people claimed that they clean their houses, but diseases still spread because the surrounding environment was not cleaned regularly. Household pests cause severe problems in developing countries [29-31]. In sub-tropical areas of Pakistan, mosquitoes cause major problems [32, 33], which was recognized by a number of participants of the survey. Mosquitoes are a global problem and they are found in close association with human beings [34]. The survey recorded that respondents were able to identify mosquitos, but not the exact species or vector of dengue fever. Many people suffer from diseases transmitted by mosquitoes [35, 36] and respondents were aware of the periods of mosquito profusion. Active periods, places for breeding, and contaminated places were responsible for mosquito development. The awareness of mosquitoes breeding sites and adoption of precautionary measures are essential to minimize the chances of the contact of larval mosquitoes with food. Mosquitoes may be controlled by the removal of breeding sites i.e. standing water [27] however; integrated chemical control is still the primary way to control household pests in urban areas [37, 38].

This survey was conducted to learn about their attitude regarding dengue, its vector and precautionary practices in southern Punjab. An important reason for this study was to find out the reasons for the recent successes of the dengue control program launched by the Punjab government in southern Punjab. This information will help to fill out the gaps in the awareness of the population and the control program of this serious disease in Pakistan and other areas of the world. Awareness and education play a vital role in suppressing any disease and its vector, especially dengue and *Aedes* mosquitoes.

5. Conclusion

It is concluded that young people with a high level of education mostly adopted preventive measures against mosquitoes. The lack of awareness, low education level, and improper management of dengue may be one of the major reasons for the ineffectiveness of dengue eradication program in other areas. So for the successful eradication of dengue, more attention should be paid to the education and awareness of dengue and proper management strategies should be adopted as major tactics in the control programs.

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