

# 'Seven Plus One' a unique approach to assess the knowledge, attitude and practices for dengue prevention and control among frontline workers of a teaching institution in Rishikesh, Uttarakhand

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## ABSTRACT

**Background:** Dengue which is an arboviral disease transmitted by *Aedes aegypti* mosquito, drastically affected communities worldwide. It has been showing consistently a rising trend in developing country like India. **Study Objectives:** To assess the knowledge, attitude and practices (KAPs) related to the prevention and control of dengue fever (DF) among frontline staff members at a medical teaching institution in Rishikesh, Uttarakhand. **Materials and Methods:** A community-based cross-sectional study was conducted at a medical teaching institution in Rishikesh, Uttarakhand. Out of 830 frontline workers only 208 workers were recruited in a study by the simple random selection method. A semi-structured interview questionnaire was applied to assess the KAPs of participants. Attitude was assessed by four-point Likert scaling. Statistical analysis was done using SPSS version 23 for Windows. **Results:** A total of 208 participants were interviewed. Majority were male (70.2%) with the age group of 31 to 45 years (71.2%). Majority (50.5%) of participants were educated up to higher secondary and working as a security guard (78.8%). Most (72.6%) of the respondents said the rainy season was the most common outbreak season for dengue. Most (63.6%) of the participants were aware that dengue is transmitted by mosquitoes. The majority (49%) of participants strongly agreed that dengue is a fatal disease. **Conclusion:** There is an urgent need to prevent and control the epidemics of dengue by adoption of seven plus one model which contributes in reducing the overall burden in healthcare delivery system.

**Keywords:** Attitude, dengue, knowledge, practices, seven plus one

## Background

Dengue virus was first isolated in Calcutta in 1945.<sup>[1]</sup> In 1996, Delhi faced a large number of dengue morbidity and mortality.<sup>[2]</sup> There was a rise in the average annual number of dengue fever (DF) and dengue haemorrhagic fever (DHF) cases reported by WHO from 1955–2007. Almost all states of

India are affected by this increasing trend of dengue.<sup>[3]</sup> There is an increased number of dengue cases from 2015 to 2019 in India, but under reporting is seen in 2020 due to the COVID-19 pandemic.<sup>[4]</sup> Even focused national programs have been run by the Government of India to tackle dengue outbreaks but still, an increasing trend in dengue cases has been found in a couple of years. The ideal condition for mosquito breeding is optimum temperature with high humidity.<sup>[5]</sup> Every person should take responsibility to keep a clean and risk-free environment to prevent dengue. Community participation has to be encouraged to prevent and control dengue transmission. There is an urgent

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need to have a pragmatic approach to deal with vector-borne disease control program which has to be reflected at the policy level. Cleanliness is the key to dengue-free environment. Mosquito breeding sites can easily be restrained by disposing of the collected water, especially during monsoon or rainy season.

By understanding the man-made connection with the dengue outbreak, the concept of ‘seven plus one’ was developed and introduced in 2019 in the Dehradun District of Uttarakhand.<sup>[6]</sup> The main objective of this model was to create a trained multi-disciplinary team in the community that focused especially on the inert behaviour and pseudo-dependency on the health system to express their inertia and resistance for their own duty and responsibility for their own health. Campaigning through audio and visual lectures to sustain activity which ensures people work effectively. With this model, there was a significant drop in morbidity and mortality due to dengue in Uttarakhand.<sup>[7]</sup> Continuous efforts should be taken to make our surroundings free from dengue virus outbreaks. It has to be made for the community understanding that cleaning their home only is not going to reduce the transmission, at least the flight range of vectors need to be covered. Approximately, 333 meters (flight range of mosquito) from their own house may reduce the transmission and thus all community members need to participate in this initiative.<sup>[8]</sup> The present study aimed at assessing the knowledge, attitude and practices (KAPs) regarding dengue among frontline workers in a medical teaching institution with seven plus one initiative which is based on the community mobilization for the active participation in dengue prevention as source identification, source reduction and awareness. The specific objectives of the study were to assess the KAPs regarding dengue among frontline workers at the premises of a medical teaching institution. This active community participation and mobilization for a certain period under supportive supervision will bridge the knowledge gaps among frontline workers by learning by doing process.

## Materials and Methods

A cross-sectional study was conducted among the frontline workers during the months of August 2021 to October 2021 in a medical teaching institution, Rishikesh, Uttarakhand. Out of 830 frontline workers 208 were selected for the study by using simple random selection method. A semi-structured interview questionnaire was applied to assess the KAPs of participants. Considering the 86% prevalence of knowledge regarding dengue<sup>[9]</sup> with absolute precision of 5% and 95% confidence interval and 10% nonresponse rate, by using the formula ‘ $Z^2 PQ/L^2$ ’ the sample size came out to be 208. Frontline staff working in the tertiary care institute included for the study. Severely ill, bedridden patients and people not willing to participate in the study were excluded from the study. The survey was carried out using a semi-structured questionnaire between August 2021 and October 2021. The questionnaire for knowledge, attitude and practices (KAPs) consisted of 17 questions, with six focusing on knowledge, nine on attitude and two on practice. Scores for

KAP were calculated by assigning a value of 1 to correct answers, while incorrect or ‘unsure’ responses received a value of 0. Each participant received a total score, and percentages were calculated based on the total KAP scores. Those achieving 50% or more were deemed to possess sufficient knowledge, and participants with 100% correct responses were classified as having adequate practices. Others were categorized as insufficient knowledge and inadequate practices. Four-point Likert scaling was used to assess the attitude of participants. Frontline workers like sanitary workers, housekeeping and security guards were among the responders. The socio-demographic information, knowledge and attitude regarding the symptoms, spread of dengue, its management and preventive practices against mosquitoes were collected after getting the informed consent. The data were entered into Microsoft Excel version 2019 and later analysed by using IBM SPSS version 23 for Windows. Descriptive analysis was used for the socio-demographic characteristics and KAPs among participants. Chi-square test was used to find the association between knowledge and dengue preventive practices. To predict the different socio-demographic factors affecting knowledge and practices, binary logistic regression was applied. *P* value less than 0.05 was considered to be significant. Graph was plotted for the observed data using Microsoft Excel.

## Concept of seven plus one

‘Seven plus one’ model envisaged the possible plausibility with these concepts from evidences:

- (1) Development of adult Aedes mosquito from the larva stage takes 7–10 days.<sup>[10]</sup> Seven plus one comprises of collective and comprehensive destruction of breeding spots by community participation everyday till seventh day then once a week amenable to reduction in adult Aedes mosquitoes to grow in numbers.
- (2) Extrinsic incubation period (EIP) of Aedes mosquito is the time between when mosquito takes infectious blood meal from viremia human host and the time, it gets infectious to other human also varies from 8–12 days as a mean 6.5 to 8, approx. 7 days.<sup>[11]</sup> The seven plus model encompasses with destruction of adult mosquito through adulticidal insecticide through fogging (pyrethroid, etc.) which also reduces the numbers of existing infectious adult mosquito in environment within EIP which also help to reduce the transmission of infection.
- (3) Intrinsic incubation period (IIP) of dengue is time period between bite of the infectious mosquito to human host to onset of infectiousness and transmission of infection to other mosquitos. Human-to-mosquito transmission can occur 2 days before the symptoms to 2 days after the symptoms have resolved. The IIP also varies between 3–14 days and 4–10 days. The mean IIP was estimated at 4–7 days.<sup>[11]</sup>
- (4) The seven plus activity consists of isolation of all fever cases in their home till the blood investigation for dengue comes positive. All fever cases in the community during dengue season (August to October) were asked to wear full sleeves, use mosquito nets during daytime and take absolute rest with

quarterly dose of Paracetamol 500 mg which will reduce the inflammatory process in order to avoid catastrophic cytokine storm.<sup>[12]</sup> This preventive measure for symptomatic patients will minimise the transmission of dengue from man to mosquitos.

The seven plus one model has the following three phases:

Phase 1: First two days of the phase comprise various activities like the making and training of multi-disciplinary team, sketching a map of suspected areas, selection of potential breeding site, inspection of breeding sites with a validated checklist, active disease surveillance of household fever cases for suspected dengue and local area awareness among selected spot with information education and communication (IEC).

Phase 2: The main component of this phase is the destruction of mosquito breeding sites via outdoor anti-larvicidal spray, implementation of larvicidal like 'temefos' applied in stagnant water and mosquito larvicidal oil (MLO) in dirty drain water and adult insecticide measures. This is done in the middle of three days.

Phase 3: This is a reinforcement phase in last two days done through intensive IEC and community mobilization for indoor-outdoor sanitation, post-intervention analysis of breeding sites, random inspection of household breeding sites and penalty for not carrying out precautionary measures and continued monitoring and surveillance.

The concept on 'one' describes active intervention with breeding points destruction and awareness for dengue prevention and action, once in a week most probably on Sunday for an hour. This is essential to break the mosquito life cycle, and thus, it does not allow *Aedes aegypti* to grow in our domestic area.

## Results

A total of 208 participants were interviewed. Baseline characteristics of all participants are given in Table 1. Majority were male (70.2%) and belong to 31 to 45 years of age (71.2%). Majority (50.5%) of participants were educated up to higher secondary and working as a security guard (78.8%).

Extent of knowledge regarding vector and the breeding site were listed in Table 2. Most (63.6%) of the participants were aware that dengue is transmitted by mosquito; however, only 23.6% among them had responded that the causative agent was *Aedes aegypti*. Although more than the half of the respondents said that mosquito bites in the daytime, around 24% said that no specific pattern of mosquito bites was present. In response to the breeding site of mosquito, 61.1% were aware that dengue mosquitoes breed in clean and stagnant water. Most (72.6%) of the respondents said rainy season was the most common outbreak season. When asked about the common symptoms, headache and fever were the most common response (54.3%), followed by low platelet count (24.5%), pain abdomen (11.1%)

**Table 1: Socio-demographic characteristics of the participants (n=208)**

Characteristics of respondent	No. of respondents (n=208)	Percentage
Gender		
Male	146	70.2
Female	62	29.8
Age in years		
18-30	44	21.2
31-45	148	71.2
46-60	16	7.6
Literacy status		
Illiterate	10	4.8
Primary	17	8.2
Lower Secondary	39	18.8
Higher Secondary	105	50.4
Diploma, Graduation or above	37	17.8
Employment status		
Housekeeping	34	16.2
Security	164	78.8
Technical/Engineering staff	10	4.8

**Table 2: Knowledge regarding dengue transmission, vector and their habitats**

Variables	Frequency	Percentage
Mode of spread		
Mosquito	132	63.6
Flies	3	1.4
Bacteria	3	1.4
Don't know	70	33.6
Dengue-causing mosquito (n=132)		
Aedes aegypti	49	37.1
Aedes albopictus	17	12.9
Anopheles	13	9.9
Don't know	53	40.1
Mosquito biting time		
Day	119	57.2
Night	36	17.3
No specific pattern	50	24.0
Don't know	3	1.5
Breeding site		
Clean, flowing water	26	12.5
Clean, stagnant water	127	61.0
Dirty flowing water	13	6.3
Dirty stagnant water	38	18.3
Don't know	4	1.9
Outbreak season		
Summer	10	4.8
Winter	11	5.2
Rainy season	151	72.6
Both summer and rainy	23	11.0
Don't know	3	1.4
Common complains		
Headache and fever	113	54.3
Low platelet	51	24.5
Pain in abdomen	23	11.1
Vomiting	16	7.7
Don't know	5	2.4

and vomiting (7.7%). Majority of participants had knowledge regarding dengue transmission, vector and their habitats; however, the knowledge gap would be bridged by their active participation and mobilization for dengue prevention initiatives under seven plus one.

Table 3 contains the results of attitude of participants towards dengue. The majority (49%) of them strongly agreed that dengue is a fatal disease. Most of them (50%) strongly agreed that dengue is managed by hospitalization and infusion of platelets. The majority (66.8%) of participants strongly agreed that cleaning of clogged drainage in and around the residence will help in prevention and control of dengue. Sustainability of any programme needs positive attitude towards work, constant support and togetherness which have been reflected among study participants during seven plus one initiative.

Table 4 illustrates the practices to prevent dengue among frontline workers. Majority (61.1%) of them replace the stored water from various containers on daily basis. This practice would be very useful in dengue prevention. When asked about the frequency of fumigation, most (36.5%) of the participants responded to it sometimes.

### Practices regarding mosquito breeding sites

A trained multi-disciplinary team of health personnel identified multiple mosquito breeding sites in the various parts of medical teaching institution [Figure 1] which are spread over an area of more than 100 acres of land. A total of 138 such breeding sites were identified and simultaneously appropriate measures were taken like application of anti-larval agents and destruction of mosquito breeding sites [Figure 2]. A few mosquito breeding sites could not be approached and thus informed to the appropriate authority, e.g. municipality for appropriate action against those sites. To avoid the unwanted waterlogging and the formation of new mosquito breeding sites, continuous monitoring and evaluation were also done at regular intervals of 7 days.

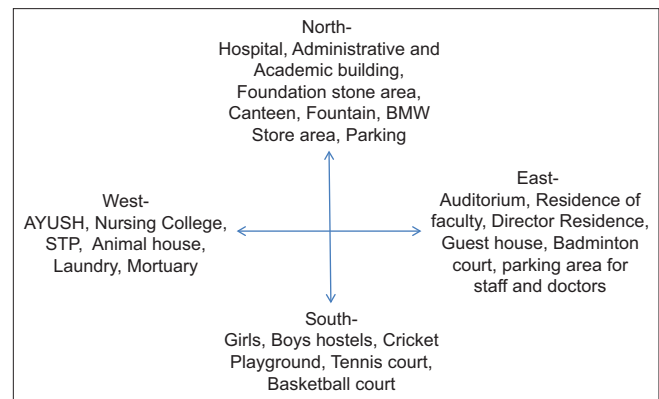
Table 5 shows the practices enforced under seven plus one initiatives observed to be significantly ( $P < 0.05$ ) associated with the knowledge of participants.

As mentioned in Table 6, socio-demographic profile of the participants was reported to be associated with knowledge and practices of dengue prevention. The knowledge component of the participants was segmented into sufficient (>50% correct response) and insufficient (<50% correct response) on the basis of knowledge score. After applying bivariate logistic regression, female participants have 4 times higher knowledge (cOR: 4.219 (CI: 2.011-8.851);  $P < 0.001$ ) than the male participants. This higher knowledge among female could be due to active participation in this seven plus one initiative. The participants of age group 46–60 years were found to have higher knowledge in comparison with other age group (cOR: 4.864 (CI: 1.321-17.917);  $P < 0.017$ ).

Adequate practices regarding dengue prevention were observed among females, higher age groups and educated participants but it was found to be statistically insignificant ( $P > 0.05$ ). Higher practices regarding dengue prevention among female participants could be due to their domestic presence in the community and their active involvement.

## Discussion

The current study enumerates KAP about dengue, its prevention and control among the 208 frontline workers in a teaching institution with the help of seven plus one model. In this study,



**Figure 1:** Multiple mosquito breeding places in the various parts of tertiary care hospital. (BMW—Biomedical waste, STP—Sewage treatment Plant)

**Table 3: Attitude towards dengue prevention, control and management**

Statements	Strongly agree	Agree	Not sure	Disagree
Dengue is a fatal disease	102 (49%)	25 (12%)	60 (28.9%)	21 (10.1%)
Dengue fever can be managed by paracetamol and rest	70 (33.7%)	95 (45.7)	37 (17.8%)	6 (2.8%)
Dengue is managed only by hospitalization and infusion of platelets	104 (50%)	30 (14.4%)	44 (21.2%)	30 (14.4%)
Dengue can be prevented by using repellents and full sleeves clothing	73 (35.1%)	72 (34.6%)	45 (21.6%)	18 (8.7%)
Dengue can also be prevented by having juice of giloy and papaya and also by stubble burning	30 (14.4%)	22 (10.6%)	4 (1.9%)	152 (73.1%)
Dengue can be prevented and controlled by itself and nothing to do for this	5 (2.4%)	2 (1%)	3 (1.4%)	198 (95.2%)
Dengue is prevented only by fumigation	61 (29.3%)	14 (6.7%)	56 (26.9%)	77 (37.1%)
Cleaning of clogged drainage in and around the residence will help in prevention and control of dengue	139 (66.8%)	65 (31.2%)	2 (1%)	2 (1%)
Dengue can be prevented by putting kerosene oil over the surface of collected water in containers	84 (40.4%)	112 (53.9%)	8 (3.8%)	4 (1.9%)

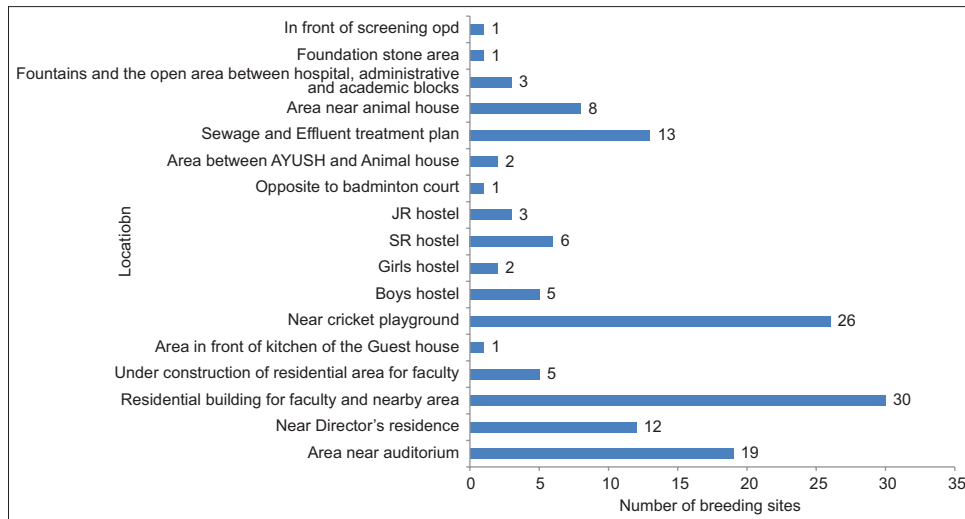


Figure 2: Different areas with mosquito breeding sites. (JR-Junior resident, SR-Senior Resident)

Variables	Number	Percentage
Frequency of replacement of stored water		
Every day	127	61.1
Weekly	47	22.6
Every fortnight	13	6.3
Monthly	8	3.8
Whenever seen	13	6.3
Frequency of fumigation		
Fortnightly	57	27.4
During rainy season	57	27.4
Sometimes	76	36.5
Never	17	8.2
Don't know	1	0.5

	Practice		Test of significance
	Inadequate (n=112)	Adequate (n=96)	
Knowledge			
Sufficient (n=116)	71	45	Chi-square=5.718, df=1, P=0.017
Insufficient (n=92)	41	51	

proportion (70.2%) of male was higher than female (29.8) and most of them belonged to the age group of 31–45 years. Majority (95.2%) of the respondents found to be literate. Almost similar to this, in a study 84.6% of respondents belonged to the age group of 26–40 years and proportion of literacy was 90%.<sup>[18]</sup>

In the current study, majority (63.6%) of the respondents were aware about the mode of spread of dengue and 61% respondents were aware about correct breeding site of mosquito which is less than the knowledge of the study participants of contemporary studies. In contrast, in a study, a higher proportion of

participants (86.3%) said that the disease spread via mosquito and 73% respondents were aware of one of the correct breeding sites of mosquito.<sup>[13]</sup> In another study, 82.4% respondents were aware about spread of dengue and 79.8% knew about breeding site.<sup>[18]</sup> This highlights the existing higher proportion of knowledge concerning the awareness about mode of spread and breeding habits of Aedes mosquitoes than the present study. Its urgent need to trained and increase awareness among the frontline workers regarding dengue prevention in this present study.

Knowledge about daytime mosquito bite (57.2%) and rainy season (72.6%) as the most common mosquito breeding season found in the present study which is similar to the findings in the recent study conducted in Rohtak, Haryana.<sup>[14]</sup>

In this study, it was found regarding the disease prevention, approximately 70% of the respondents reported wearing full sleeves and use of repellents are the most common protective measures. This result was also in accordance with the findings of the study done in rural central India, in western Rajasthan and Delhi slums.<sup>[15-17]</sup>

A study 61.8% of participants could enumerate one symptom of dengue as fever and 11.2% enumerated three symptoms as fever, headache and bleeding.<sup>[18]</sup> In contrast in the present study, the knowledge regarding symptoms was lower, especially the dengue-specific symptoms of low platelets (24.5%) which may lead to bleeding. Presumably, 54.3% of the participants in this study said fever with headache are the typical symptoms of dengue because they might have experienced the disease or witnessed a case in a hospital or the community.

It was observed in the present study that approximately 50% of the participants strongly agreed that dengue is a fatal disease and is managed by hospitalization and infusion of platelets. The majority (66.8%) of participants strongly agreed that cleaning of clogged drainage in and around the residence will help in

**Table 6: Binary logistic regression for association of socio-demographic characteristics with knowledge and practice regarding dengue prevention and control (n=208)**

Characteristics of respondent	No. of respondents (Percentage) (n=208)	Knowledge		Practice	
		Crude odds ratio (95% CI)	P	Crude odds ratio (95% CI)	P
Male	146 (70.2)	Reference		Reference	
Female	62 (29.8)	4.219 (2.011-8.851)	<0.001	1.774 (0.873-3.607)	0.113
18-30	44 (21.2)	reference		Reference	
31-45	148 (71.2)	1.156 (0.531-2.516)	0.716	0.866 (0.413-1.815)	0.703
46-60	16 (7.6)	4.864 (1.321-17.917)	0.017	1.705 (.501-5.808)	0.393
Illiterate	10 (4.8)	Reference		Reference	
Primary	17 (8.2)	1.828 (.323-10.356)	0.495	2.335 (0.425-12.821)	0.329
Lower Secondary	39 (18.8)	1.227 (0.264-5.702)	0.794	0.902 (0.197-4.137)	0.894
Higher Secondary	105 (50.4)	1.381 (0.304-6.269)	0.676	2.447 (0.546-10.962)	0.242
Diploma, Graduation or above	37 (17.8)	1.382 (0.282-6.761)	0.690	2.978 (0.624-14.222)	0.171
Housekeeping	34 (16.2)	Reference		Reference	
Security	164 (78.8)	1.079 (0.427-2.727)	0.873	0.441 (0.176-1.100)	0.079
Technical/Engineering staff	10 (4.8)	3.355 (.672-16.738)	0.140	0.534 (0.113-2.533)	0.430

prevention and control of dengue. Almost similar findings were observed in a study.<sup>[19]</sup>

In this study, it was reported that majority (61.1%) of the respondents replace stored water from various containers on daily basis to prevent dengue infection. Similar to this in a study, it was found that around 73.2% participants have the habit of checking stored water container.<sup>[20]</sup> Asking this question to participants only does matter to understand the knowledge of larva development of *Aedes aegypti* in a stored water. Seven plus one initiative enforces the community participation and intensive mobilization in order to bring the practices for dengue prevention to their conscious level. Frontline workers are the workforce who routinely inspect, clean and take appropriate action to maintain the sanitation of entire institutional premises, and they need to be imparted intensive training and awareness for dengue prevention and control. This model is based on to sensitise the grassroot workers to bring changes in their KAPs.

Seven plus one initiative enforces the practices for dengue prevention with community participation. This initiative is destined to fill the know-to-do gap, i.e., practice-based learning.

The current study also revealed the significant association between knowledge and practice regarding the prevention of dengue in the community endorsed the concept of this initiative. Seven plus one concept was based on the community participation and encouraging learning by doing the process which brings community's behavioural change from precontemplation stage to make them prepare for the action.

Various studies have reported significant correlation between knowledge and practice which strengthen the findings of our study.<sup>[21,22]</sup>

In this study, the knowledge regarding dengue prevention was observed to be higher among female participants and participants belong to higher age group which is almost similar to the

findings of a study conducted in Rajasthan.<sup>[23]</sup> Adequate practices regarding dengue prevention were also observed among females, higher age groups and educated participants. Similar findings were observed in a study.<sup>[24,25]</sup>

The increased knowledge and practice among the female as compared to male participants could be due to the active participation of female during the door-to-door activities of seven plus initiative in the community as majority of the female usually present in the home and engaged in the domestic work while male is not present in their home.

### Limitations

The study was focused on teaching hospital frontline workers. Participants could not be assessed post-intervention of seven plus initiative due to time constraints. This seven plus one programme is a routine program which usually implemented during rainy season in every year from July to October. This study was restricted among frontline workers of a teaching institution only difficult to generalize in wider part of the community. Chances of recall bias may also be reported while assessing the knowledge among workers.

Notwithstanding these constraints, the findings of this investigation are expected to make a significant contribution to enhancing awareness, comprehension and the prevention of dengue among frontline personnel in various institutions.

### Conclusion

Seven plus one model encourages the awareness and advocacy at all level of healthcare delivery system, and it also enforces this programme at grassroot level functionaries. This is witnessed with enhanced knowledge and practices among frontline workers. At the end of the seven plus one dengue control initiative, majority of participants have positive attitude towards the dengue control and elimination through their active participation. This model envisages with the decentralization of program with

bottom up approach which contributes in reducing the overall burden in public healthcare system with minimize cost. This evidence-based seven plus one model may be helpful for the policymaker to implement the awareness and advocacy for dengue at community level with strategic phases. The National Vector Borne Disease Control Programme has already been envisioned with dengue prevention and control at various steps of implementation in healthcare delivery system in India. However, robust community-based decentralized program like seven plus one initiative need to be intervened to prevent and eliminate dengue transmission with the help of community-based participatory research programs. This conclusion is based on the effectiveness of this model in a community of a teaching institution; furthermore study will be required to substantiate the findings and strength of this model.

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### Conflicts of interest

There are no conflicts of interest.

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