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Social dynamics of dengue preventive Behavior: insight from peri-urban communities, using the Health Belief Modal

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ABSTRACT

Dengue is a prominent public health issue and serves as a hurdle in achieving the 3rd sustainable development goal i.e. health for all. In recent years, Pakistan also has witnessed a significant outbreak of dengue fever, marked by a substantial increase in cases and fatalities. In the absence of an effective vaccine and specific treatment, preventive behavior at individual, household and community level has great importance. The transmission of dengue is influenced by a variety of factors such as environmental, social, economic, demographic, uncontrolled population growth and urbanization. The main objective of the study is to investigate the role of social dynamics in dengue preventive behavior of the respondents. This study utilized a modified version of the Health Belief Model (HBM) to analyze how perceived susceptibility, perceived severity, health motivation, perceived benefits and perceived barriers along with other social dynamics influence dengue preventive behavior**.** Data were collected from 387 randomly selected survey participants in five high-risk peri urban communities of District Faisalabad. Results show that socioeconomic indicators, such as income and education, emerge as significant determinants of dengue preventive behavior, with higher income and education levels positively associated with greater dengue preventive behavior. Financial concerns and poor environmental conditions were major perceived barriers. The study's outcome sheds light on how awareness levels, perceived susceptibility and severity, health motivation, and perceived benefits greatly influence preventive behaviors towards dengue. A significant proportion of the population was aware of dengue transmission and prevention methods, yet gaps in consistently implementing these behaviors remain. The findings emphasize

the need to strengthen community-based interventions, enhance collective self-efficacy, and align public health strategies with local social contexts for sustainable dengue prevention.

Keywords: Social dynamics, HBM, susceptibility, severity, health motivation, Dengue

INTRODUCTION

In the contemporary global landscape, the protection of public health has become a cornerstone of sustainable development, particularly under Sustainable Development Goal 3 (SDG-3), which aims to ensure good health and well-being for all. As part of the global commitment to the Sustainable Development Goals (SDGs), Pakistan has recognized the importance of improving health outcomes and reducing disease burden (United Nations, 2015). Pakistan is making concerted efforts to align with this goal; however, persistent public health challenges continue to obstruct meaningful progress. Among these challenges, dengue fever has emerged as a significant and recurring health threat that is deeply influenced not just by environmental conditions, but by a complex web of social behaviors, community awareness, and collective practices**.** Achieving the SDG-3, requires not just biomedical solutions but also addressing the social determinants of health, which directly impact how communities respond to disease prevention measures. This target calls for a holistic approach to health, one that considers not only access to healthcare services but also the role of social behaviors, community engagement, and local leadership in shaping health outcomes (Aftab et al., 2020).

Dengue fever (DF) has become a major public health issue affecting the population in more than 128 countries. Worldwide, the reported cases of dengue fever were 5.2 million. The severity of the infection is evident from the fact that 50% of the global population is at risk including 70% of the population of Asia (WHO, 2023). Many people around the world believe that infectious viral diseases are a bigger problem than terrorist especially in poor countries where people have very little or no access to basic health services and a very low income per person (Naqvi *et al.*, 2024). Research has shown that social, economic, and cultural factors are pivotal in shaping health behaviors, including those related to vector control and disease prevention (Mumtaz & Raza, 2020). World Health Organization (WHO) has recorded 7.6 million dengue cases during 1st quarter of the year 2024; of these, 3.4 million have been confirmed; 16,000 have been classified as severe cases; and 3,00 have lost their lives (WHO, 2024).

A significant number of studies have demonstrated that the danger of DF spreading is directly connected to the parameters that are linked with the climate. Such as temperature and rain water (Zhu *et al.*, 2019). The habitat of Aedes aegypti mosquitoes is any location with clean water, such as bathtubs, buckets, flower vases, bird baths, water dispenser reservoirs, and the region beneath refrigerators used for water disposal. Age, sex, and mobility of the host, environmental variables (housing density, mosquito breeding sites, mosquito resting places, mosquito density, larva free rate, rainfall), and behavioral characteristics were some of the etiological factors linked to DHF (Ibrahim, 2017). In the last 20 years, dengue fever, along with dengue hemorrhagic fever and dengue shock syndrome, has emerged as the most widespread viral infection that is transmitted by arthropods around the globe (WHO, 2022). The public health concerns that are

posed by dengue outbreaks are complicated and have widespread repercussions. One element of these issues that is particularly noteworthy is the load that they place on the facilities that are responsible for providing medical care (Jain *et al.*, 2019).

Pakistan is an endemic country with seasonal outbreaks with the four serotypes spreading across the nation, especially in the urban and suburban regions. Dengue fever has become more common in Pakistan and the Punjab province health department recorded 15,185 confirmed cases across 36 districts in 2023 (NIH, 2023). With rising mortality and morbidity, dengue virus infection is becoming a global health concern (Gubler, 2005). To control the spread of dengue, the main strategy is vector control, of which public participation is very necessary. Mass media and teaching strategies notwithstanding, community involvement is much below expected. Both rural and urban regions have seen the appearance of silent circulation of the dengue virus and a vector (Kaushik et al., 2019).

The effectiveness of public health campaigns may be constrained or enhanced depending on factors such as family dynamics, social cohesion, and trust in local authorities (Yousaf e al., 2018). Furthermore, community participation and leadership at the local level are critical for ensuring that preventive messages are not only received but acted upon. The main preventive strategy is recommended as the most effective method for preventing and controlling dengue fever. This strategy involves the use of insect repellent, mosquito bed nets, mosquito coils, protective clothing, and the systematic elimination of sources of stagnant water in order to inhibit mosquito breeding (Wong *et al.*, 2024).

Social dynamics affecting dengue preventive behavior

Dengue is a prominent public health issue and serves as a hurdle in achieving the 3rd sustainable development goal i.e. health for all. The transmission of dengue is influenced by a variety of factors such as environmental, social, economic, demographic, uncontrolled population growth and urbanization. Numerous social aspects impact dengue prevention by influencing people's views and actions about preventative measures. According to research, people's readiness to adopt preventative behaviors is significantly influenced by their Knowledge, Attitudes, and Practices (KAP) (Alobuia *et al.*, 2015). Because socioeconomic status influences access to resources for mosquito control, sanitation, and healthcare, lower-income groups are more at risk (Vanlerberghe *et al.*, 2017). Age, education, and employment are examples of demographic characteristics that affect people's knowledge of and participation in preventative interventions (Aung *et al.*, 2020). Furthermore, the success of control initiatives might be influenced by the availability of preventative measures, such as repellents and nets coated with insecticides (Wagman *et al.*, 2015). Another important factor in dengue prevention is health motivation, which is influenced by perceived advantages and obstacles (Carpenter, 2010). Moreover, peer and media impact shape collective responses to dengue epidemics by raising knowledge of and socially reinforcing preventative behaviors (Mahmud & Tabassum, 2021). Designing successful public health initiatives to stop dengue spread requires understanding these social factors.

Inequalities in socioeconomic status have a substantial influence on dengue, which has a disproportionately negative impact on countries with low and intermediate incomes. This burden throws extra demand on healthcare systems that are already in a vulnerable position, further increasing health inequities that were previously there (Nikookar *et al.*, 2019). Social dynamics influencing dengue preventive behavior include demographic factors, community engagement, socio-economic conditions, and access to information. Demographic variables such as education, gender age, and income significantly affect individuals' knowledge, attitudes, and practices regarding dengue prevention. while lower socio-economic status often leads to inadequate preventive measures due to limited resources and knowledge (Fatima *et al.*, 2022). The dengue hemorrhagic fever can either directly and indirectly influence human life and significantly influences the social and economic conditions as well as the people of the afflicted area (Zahir *et al.*, 2016). Households with lower incomes, jobless individuals, and unskilled workers engaged in more dengue preventative efforts. Consequently, families with moderate to high-income earners, mostly residing in metropolitan locales, together with skilled laborers, should be the primary focus of proactive dengue preventive and control initiatives.

The Health Belief Model argued that an increased perception of sensitivity to dengue correlates with enhanced dengue preventative activities. Given that perceived susceptibility affects preventive measures, education must explicitly address vulnerability to dengue. Communities with little mosquito presence or low density were less inclined to engage in dengue preventative measures (Wong et al.,2015).

In the absence of an effective vaccine and specific treatment, preventive behavior at individual, household and community level has great importance. The government organizations and researchers worldwide are working determinedly to address the challenges of dengue fever. The need for sociological research on the social dynamics affecting dengue preventive behavior is both timely and critical, particularly in the context of rapidly urbanizing and densely populated regions prone to mosquito-borne diseases. While medical and entomological studies have extensively addressed the biological and environmental aspects of dengue, there remains a significant gap in understanding how social structures, cultural beliefs, risk perceptions, and community engagement influence preventive behaviors. Such research can unveil how socioeconomic disparities, gender roles, communication networks, and trust in public health systems shape people's responses to dengue awareness and control campaigns. By exploring these social dimensions through a sociological lens, the study can contribute to more culturally sensitive, community-driven, and sustainable interventions, ultimately enhancing public health outcomes and policy effectiveness.

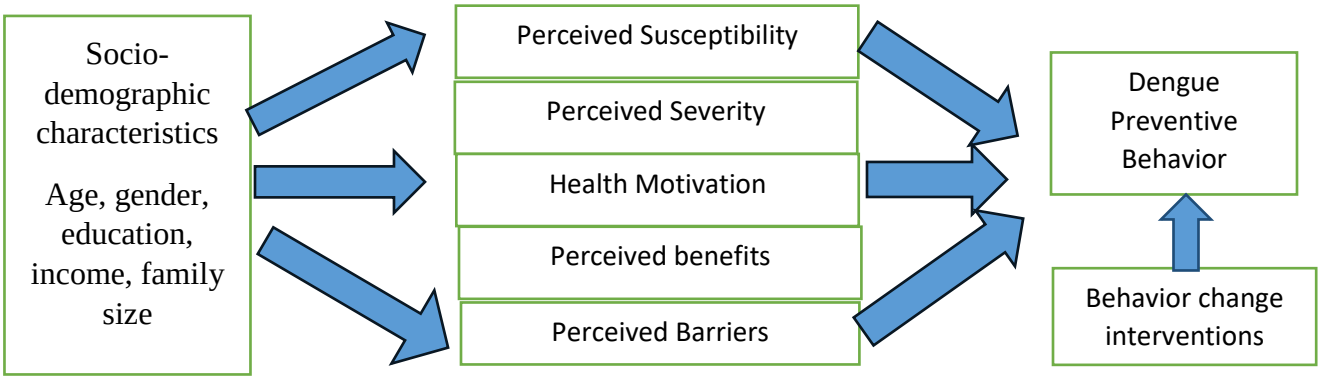
In this context, the current study aims to investigate the role of social dynamics including; perceived susceptibility, perceived severity, health motivation, peer influence and media in dengue preventive behavior of the respondents by using Health Belief Model. Examining the social dynamics that influence dengue prevention behavior is critical to improve public health outcomes. By adopting a sociological lens to analyze dengue preventive behavior, the research offers a novel contribution to the interdisciplinary understanding of health behavior beyond biomedical explanations. It provides insights into the social barriers that hinder the adoption of

preventive practices. Identifying these factors will help design targeted awareness campaigns and community engagement strategies that are culturally appropriate and socially inclusive. Ultimately, the findings of this research will support the development of evidence-based and community-centered dengue prevention programs which can be replicated in other regions facing similar socio-epidemiological challenges.

Health Belief Model:

Health Belief Model is a social psychological framework that was first created in the 1950s by social psychologist Irwin M. Rosenstock, who worked for the US Public Health Service. Beeker then refined it in 1974. HBM model is used to comprehend and forecast behaviors associated to health and to explain health-related activities, especially the utilization of health services. It implies that a person's willingness to take action to improve their health depends on their views about health issues, perceived advantages of action, perceived obstacles to action, signals to action, and self-efficacy. According to the concept, people are more likely to engage in health-preventive measures if they believe they are susceptible to health problems, the situation is severe, acting will be beneficial, and they believe they are capable of achieving. Previous studies showed that many researchers (Thompson and Caltabiano, 2013; Gafar and Shah, 2017; Yari *et al.*, 2024; Narendran *et al.*, 2024; Govindasamy *et al.*, 2024) used the Health Belief Model (HBM) to encourage preventative measures against dengue disease.

The Health Belief Model (HBM) provides a robust theoretical base for researching the social dynamics influencing dengue preventive behavior because it systematically links individual health behaviors to broader social influences (Thompson and Caltabiano, 2013; Gafar and Shah, 2017). The HBM's constructs, such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy, offer a structured approach to understanding how personal and social factors converge to shape preventive actions. In dengue related research, an individual's perceived risk of contracting dengue can be significantly influenced by community norms and peer behaviors, while the perceived benefits and barriers to preventive measures can be shaped by public health campaigns and social support networks. Additionally, cues to action, such as community-led clean-up drives or media alerts, can act as critical motivators for behavior change within social contexts. After reviewing the relevant literature, a modified version of the health belief model used as a conceptual framework for the current study.



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Source: A modified version of Health Belief Model (Rosenstock, 1988), keeping in view the research objectives

Methodology

A methodology explains how a researcher plans to conduct the study in order to provide accurate, trustworthy findings that meet their goals and objectives. It includes what information they plan to get, where they will get it, and how it will be gathered and examined (Saunders et al., 2019).

In Faisalabad, a mix of rural and urban environments, socioeconomic disparities, cultural norms, and local governance structures can all influence the adoption of preventive behaviors. The study was conducted in district Faisalabad of Punjab province. A multistage sampling technique was used to select the study area and the study participants. At the first stage, one tehsil out of 6 tehsils (Tehsil Saddar) was selected randomly. On the basis of information provided by District Health Office, Faisalabad, five high-risk union councils were selected purposively at second stage. The selected communities include; UC #182 (Chak #2, Raam Deawali), UC # 189 (Chak #199, Gat Wala), UC # 185 (Chak #117, Dhanola), UC # 186 (Chak #195, Jandanwala) and UC #180 (Chak # 6, Panj Graien). High-risk communities are most suitable for this study because they have direct exposure to dengue outbreaks, making their knowledge, attitudes, and behaviors highly relevant for analysis.
A sample of 387 respondents were interviewed in a face-to-face survey which were selected by applying Taro Yamane formula (Yamane, 1967). $n = N/(1+N(e)^2$

From the selected respondents, data were collected through structured interviews to gather information on their awareness, practices, and perceptions regarding dengue prevention. For data collection a structed interview schedule was used as a tool covering social dynamics and subcomponents of the Health Belief Model (HBM) i.e. perceived susceptibility, perceived severity, health motivation, perceived barriers and dengue preventive behavior.

RESULTS AND DISCUSSION

The research studied and evaluated the social dynamics affecting dengue preventive behavior in District Faisalabad, through a sociological lens. This section consists of the description and analysis of collected data according to the study objectives and is structured to discuss the results obtained through face to face survey.

Table 1: Socio-demographic characteristics of the participants

n = 387

Socio-demographic indicators	**Categories**	***f***	**%**

Gender	Male	321	82.9
	Female	66	17.1
Age (in years)	Up to 30	70	18.1
	31-45	84	21.7
	46-60	173	44.7
	>60	60	15.5
Family type	Nuclear	198	51.2
	Joint	142	36.7
	Extended	47	12.1
Family size	Up to 4	81	20.9
	5-8	230	59.4
	9 or above	76	19.6
Educational level	Illiterate	56	14.5
	Primary	49	12.7
	Middle-Matric	132	34.1
	Intermediate	36	9.3
	Graduation	94	24.3
	Post-graduation	20	5.2
Occupation	Farmer	57	14.7
	Govt. Job	84	21.7
	Private job	100	25.8
	Skilled labor	79	20.4
	Business	62	16.0
	Others	5	1.3
Monthly income (PKR)	Up to 20000	28	7.2
	20001-40000	111	28.7
	40001-60000	105	27.1
	60001-80000	62	16.0
	80001-100000	60	15.5
	>100000	21	5.4

Table 4.1 shows that a large part (82.9%) of the selected population consisted of males and only 17.1 percent were females. 18.1 percent of the respondents had up to 30 years of age and around 22 percent had 31-45 years of age. Around one-fifth (20.9%) of the respondents had up to 4

family members. However, most families (59.4%) had 5-8 members while 19.6 percent of the respondents had 9 or above family members. 14.5 percent of the respondents were illiterate and 12.7 percent were primary passed and (34.1%) respondents had middle-matric level education. almost 15% of the respondents were farmers, and 21.7% were doing government jobs. Nearly one quarter (25.8%) of the respondents were doing private jobs and 20.4 percent were skilled labour. About 16.0 percent were businessmen and 1.3 percent belonged to any other occupation. only 7.2 percent of the participants earned up to Rs. 20000. However, a major part was earned Rs. 20001-40000 (28.7%) and Rs. 40001-60000 (27.1%) monthly. About 16.0 percent of the respondents earned Rs. 60001-80000, 15.5 percent earned 80001-100000 and remaining 5.4 percent earned above Rs. 100000 monthly.

Table 2: Pearson Correlation Coefficient values indicating the correlation between predictor (background and intervening) and responder (dengue preventative behavior) factors

Independent variables	Pearson correlation coefficients	p-value
Gender	-.143**	.005
Age	-.591**	.000
Family type	-.053	.295
Family size	-.053	.300
Education	.315**	.000
Income	.361**	.000
Susceptibility	.428**	.000
Severity	.317**	.000
Health Motivation	.405**	.000
Perceived Benefits	.141**	.005
Knowledge and awareness	.678**	.000
Peer influence	.809**	.000
Role of media	.824**	.000

Dependent variable: Dengue preventive behavior

Table 2 represents the results of correlation statistics between various independent variables (social dynamics) and the dependent variable (dengue preventive behavior). The study's findings show that gender shows a negative and significant correlation (r = -.143**) with dengue

preventive behavior. Age also displays a strong negative and significant correlation (*r* = -.591**) with preventive behavior, indicating that the likelihood of engaging in dengue preventive behavior decreases as age increases. Family type and family size have insignificant negative correlations (-.053) with preventive behavior and are not statistically significant. These results are consistent with other studies that indicate demographic variables are important in determining dengue prevention practices. The research by Chaudhry *et al.* (2022) revealed that female respondents had better dengue prevention practices than men, indicating gender-based variations in health-related behaviors. This finding is consistent with the negative link between gender and dengue preventative behavior. Similarly, Bakhsh *et al.* (2018) found that younger people were more likely than older populations to use adaptive dengue prevention techniques, which is consistent with the substantial negative association between age and dengue preventive behavior.

Education (*r* = .315**), income (*r* =.361**), susceptibility (*r* = .428**), health motivation (*r* = .405), knowledge and awareness (.678**), role of media (.809**) and peer influence (.824**) display strong positive correlations with dengue preventive behavior, suggesting that higher levels of education, income, perceived susceptibility, motivation, knowledge, role of media and peer influence are associated with better preventive practices. Similarly, the perceived benefits (*r* = .141**) and perceived severity (*r* = .317**) also positively correlate with preventive behavior, emphasizing their value in promoting dengue prevention. The findings of the study, taken as a whole, highlight the significant impact that socioeconomic and psychological variables have in affecting dengue prevention behaviors.

These results align with other studies that highlight how socioeconomic and psychological variables influence behaviors linked to health. Syed *et al.* (2010) and Hossain *et al.* (2021) both indicated that people with higher education levels show more awareness and involvement in preventative measures, which is consistent with the positive link between education and dengue preventive behavior. Similarly, Ahmed *et al.* (2023) found that financial restrictions restrict access to preventative resources, highlighting the significance of economic stability in facilitating good health behaviors and supporting the large positive link between income and dengue prevention. Furthermore, Nguyen *et al.* (2021) and Lim *et al.* (2021) found that people who believe they are at higher risk or who are motivated by health concerns are more likely to take preventative measures. This is consistent with the strong positive correlation between perceived susceptibility and health motivation with regard to dengue prevention.

Multiple linear regression

As mentioned earlier, the regression coefficient is used to establish the relative importance of each independent variable in explaining the dependent variable. The regression coefficient values given in Table 3.

Table 3: Results of regression analysis

Variables	Unstandardized Coefficients	Std. Error	Standardized Coefficients	Sig.

	B		Beta	
(Constant)	1.834	.302		.000**
Gender	-.261	.080	-.128	.001**
Age	-.307	.035	-.382	.000**
Family type	.052	.048	.047	.275^{NS}
Family size	.034	.053	.028	.530^{NS}
Education	.087	.021	.156	.000**
Income	.122	.023	.205	.000**
Susceptibility	.169	.047	.150	.000**
Severity	-.001	.047	-.001	.981^{NS}
Health Motivation	.187	.045	.181	.000**
Perceived Barriers	.111	.053	.097	.038*
Perceived Benefits	-.049	.046	-.046	.281^{NS}

Dependent Variable: Dengue preventive behavior
R^2 = 0.515 Adjusted R^2 = 0.501 F-value = 36.22 P-value = .000

Using regression analysis, the study established the antecedents of dengue preventive behavior. The overall model is significant, F (36.22, *p* = .000) supporting that the variables included significantly predict dengue preventive behavior. The coefficient of determination (R^2 = 0.515) and the adjusted R^2 value 0.509 indicate that the model has 51.5 per cent R-square determination of the dengue preventive behavior, which is quite significant in behavioral studies.

Among the variables, age (β = -0.382, P = .000) and income (β = 0.205, P = .000) emerge as strong predictors of dengue preventive behavior. Age is negatively associated with preventive behavior, suggesting that younger individuals are more likely to engage in such behaviors. In contrast, income is positively associated, indicating that respondents with higher income levels are more likely to adopt preventive measures. Additionally, education (β = 0.156, P = .000), health motivation (β = 0.181, P = .000), and susceptibility (β = 0.150, P = .000) significantly and positively influence dengue preventive behavior, underscoring the importance of awareness, motivation, and perceived risk in encouraging preventive actions. The perceived barriers also show a modest positive effect (β = 0.097, P = .038).

On the other hand, gender (β = -0.128, P = .001) shows a significant negative association, indicating that males might be less likely to engage in dengue-preventive behaviors than females. However, family size**,** family type**,** severity and perceived benefits are not significant predictors of this model. These findings highlight the need for targeted interventions focusing on substantial predictors like age, income, education, and health motivation to design effective dengue prevention strategies.

Based on the overall results, the key factors influencing dengue preventive behavior provide valuable insights for public health initiatives. The model explains a substantial 51.5% of the variance in preventive behavior, with significant predictors including age, income, education, health motivation, and perceived susceptibility. Young people with greater educational attainment, higher incomes and stronger health motivation are more likely to adopt preventive measures. The effectiveness of behavior change interventions also plays a significant role. However, family size, family type, perceived severity and benefits were insignificant predictors.

These findings emphasize the importance of designing targeted interventions that enhance health motivation, highlight susceptibility, and leverage behavior change strategies to encourage widespread adoption of dengue preventive measures, particularly among vulnerable populations.

These findings align with earlier research that emphasizes the importance of socioeconomic, psychological, and demographic factors in shaping health-related behaviors. The significance of education, financial resources, and health motivation in dengue prevention aligns with findings by Syed *et al.* (2010) and Hossain *et al.* (2021), indicating that individuals with more financial stability and higher educational attainment are more likely to adopt preventive measures. Moreover, the findings of Nguyen *et al.* (2021), which indicate that individuals who perceive a heightened risk of infection are more inclined to implement preventive measures, aligning with the significance of perceived susceptibility as a principal predictor of dengue prevention. The study results substantiate those of Lim *et al.* (2021) and Thompson & Caltabiano (2013), who identified that behavior modification treatments are crucial in transforming health-related activities. The findings of Ahmed *et al.* (2023) suggest that structural and social factors may not directly influence preventive activity, along with the insignificance of family-related variables and perceived severity.

Conclusion

The study examined the social dynamics affecting dengue preventive behavior in district Faisalabad. The study's outcome health factors, such as perceived severity and susceptibility, play a critical role in shaping dengue preventive behavior, with respondents recognizing the financial burdens associated with dengue fever. Health motivation and proactive behavior like seeking health protection information, social media and encouraging community participation reflect a growing commitment to prevention. These findings highlight the need for targeted awareness campaigns that leverage peer and media influence, promote health motivation, and address demographic disparities to improve dengue prevention efforts in the region. In conclusion, the study highlights the pivotal role of social factors, community perceptions, and stakeholder engagement in shaping dengue preventive behaviors. Strengthening community-based initiatives, improving awareness, and fostering collective responsibility are essential to enhance sustainable dengue prevention in high-risk areas of Pakistan.

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