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A Comprehensive Statistical Analysis of Symptoms and Impact of Dengue Fever: A Case Study at University of Peshawar

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***Abstract*:** This study conducted a comprehensive statistical analysis of the symptoms and impact of dengue fever, incorporating additional factors such as prevention awareness, disease control, aftereffects, disease stages, serotypes, recovery, and treatment. Data were gathered through questionnaires from 400 students across various departments at Peshawar University, representing both urban and rural areas. The data were processed using SPSS (Version 20) and analyzed using methods like odds ratio, chi-square, pie charts, and bar charts to examine the different symptoms and impacts of dengue fever in this study the findings revealed that approximately one-third of the respondents aged 18-30 had been affected by dengue fever. The results indicate a significant association between these two variables. Furthermore, the odds ratio of 0.5 suggests that respondents aged 18 to 25 are half as likely to isolate during dengue compared to those aged 26 to 35. The study identified common symptoms such as headache, flu-like symptoms, rash, joint and muscle pain, loss of appetite, abdominal pain, and bleeding from the gums. A majority (68.25%) considered dengue a serious illness, and 63.3% perceived it as more prevalent in urban areas. Additionally, the research indicated that a significant number of respondents were skeptical about the long-term effects of dengue, such as hair loss and alopecia, despite existing evidence suggesting these outcomes this study underscores the importance of understanding the prevalence and implications of dengue fever and emphasizes the need for heightened awareness and effective preventive measures.

Keywords: Dengue Fever, Symptoms of Dengue, Odds Ratio, Chi-Square Test and Preventive Measures for Dengue.

1. Introduction

A major threat to public health in many tropical and subtropical areas of the world is the mosquito-borne dengue virus. Dengue, which is mostly spread by the Aedes aegypti mosquito, can cause severe flu-like symptoms and, in severe situations, can develop into potentially fatal diseases like dengue hemorrhagic fever and dengue shock syndrome. With an estimated 390 million infections per year, the virus has emerged as one of the vector-borne diseases with the fastest global expansion. In order to lessen the burden of dengue on afflicted populations, effective prevention, early diagnosis, and comprehensive vector control techniques are critically needed. This is highlighted by the lack of particular antiviral

medicines and the widespread occurrence of mosquito vectors. Dengue fever, also called breakbone fever, is a viral illness transmitted to humans through the bite of an infected female Aedes mosquito, particularly Aedes aegypti, often known as the yellow fever mosquito. This mosquito species is also capable of transmitting several other viral infections, including Zika virus, chikungunya virus, and yellow fever, all of which can be spread to humans (Narvaez, F. et al (2011). The dengue virus belongs to the Flaviviridae family, which comprises about 53 distinct viruses. It is classified into four serotypes: DENV-1, DENV-2, DENV-3, and DENV-4. Any one of these four serotypes, alone or in combination, can cause infection. But compared to the other serotypes, DENV-2 is thought to be the most harmful because of its increased virulence and ease of transmission (Buddhari, D., et al (2014). The three stages of dengue fever progression are typically the febrile, critical, and recovery stages. The symptoms of the febrile stage include high fever, facial redness, skin flushing, body aches, muscular soreness, headaches, joint pain, and light sensitivity. The febrile stage lasts between two and seven days. During this time, nausea, vomiting, and an appetite loss are also typical. In addition, some people may get red eyes, a swollen mouth, and a sore throat. There could be hepatic enlargement and tenderness. The patient may find it difficult to carry out everyday activities like going to work or school as a result of these symptoms. To properly treat the disease, it's critical to keep a careful eye on symptoms and recognize warning signals that the condition may be getting worse. For those living in dengue-endemic areas between the ages of 9 and 45, some governments have approved dengue vaccination programs. Controlling the Aedes aegypti mosquito population is still essential, nevertheless, in order to stop dengue from spreading. Wearing long sleeves, using insect repellent both inside and outside, and making sure window screens are in place can all assist with this disease (Idris, F. et al (2021). A female mosquito contracts a virus during her blood meal when she feeds on a host that is presently infected. This usually occurs during the acute febrile phase of the illness in the host, which is marked by elevated blood viral concentrations (viraemia). The virus initially infects and multiplies in the mosquito's midgut cells after ingestion. The virus then spreads to other tissues as a result. The virus must get past a number of obstacles in order to spread from the midgut to other tissues, including the salivary glands and hemolymph, the mosquito's equivalent of blood. Guzman, M. G., et al (2016).

2. Literature Review

Bhatt, P., et al (2021) The intricate interaction of the virus, host genetics, and host immune response drives the pathophysiology of dengue virus infection. Disease susceptibility is influenced by a number of host variables, including as autoimmunity, memory cross-reactive T cells, anti-DENV NS1 antibodies, antibody-dependent enhancement (ADE), and genetic differences. It is thought that the NS1 protein and anti-DENV NS1 antibodies are important factors in the development of severe dengue.

Hasan, S., et al (2016) An RNA virus belonging to the Flaviviridae family is the source of dengue, an acute viral disease spread by Aedes mosquitoes. Dengue fever can cause anything from a mild fever to serious side effects like shock and hemorrhagic fever. Severe fever, myalgia, rash, hemorrhagic episodes, muscle and joint pain, and circulatory shock are typical symptoms. While oral symptoms are uncommon in dengue infections, they can occur in some instances where mouth symptoms are the only sign of infection. Reducing death depends on early and correct diagnosis. Although dengue fever infections usually go away on their own, dengue has become a serious public health concern in tropical and subtropical areas. An extensive review of dengue virus infections is given in this page, including with information on the many clinical symptoms, diagnostic techniques, differential diagnosis.

Messina, J. P., et al (2017). Four different serotypes of the dengue virus (DENV) have been discovered since the virus was originally isolated in 1943. International travel and urbanization are two major factors that have contributed to the global dengue outbreak. In order to develop and implement vaccines, it is essential to monitor the distribution of particular DENV types in order to comprehend patterns of dengue hyperendemicity and illness severity. Prior research has looked at the regional or local dissemination of

different DENV types or the phylogeographic links among different types. These maps show how the serotypes have spread throughout the world, how disease hyperendemicity is increasing, and how dengue is becoming a more significant global health concern. Mulligan, K., (2015) In order to eradicate dengue fever, policy initiatives frequently focus on improving social and environmental circumstances that are linked to poverty. Although it has long been believed that poverty influences the risk of dengue, there is conflicting empirical data to support this theory. According to our data, there is no discernible correlation between dengue rates and other measures of poverty like income, education, living circumstances, and crowding. While some research revealed positive associations, other investigations produced negative or null results. In particular, studies on access to water and sanitation have primarily found no correlation. The examination of these links is made more difficult by the small number of studies and the variety of poverty indicators utilized. At this time, there is not enough data to draw a firm conclusion on.
Shepard, D. S., et al (2013). Economic and disease burden of dengue. Dengue represents a significant economic and disease burden in Southeast Asia (SEA). Accurately quantifying this burden is essential for setting policy priorities and developing effective disease-control strategies. We assessed the economic and disease burden of dengue across 12 SEA countries: Bhutan, Brunei, Cambodia, East Timor, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam. We gathered reported cases from various sources, including surveillance data, the World Health Organization (WHO),. Unit costs per dengue episode were obtained through a systematic review, and missing data were estimated using linear regression. Costs related to prevention, vector control, and long-term sequelae were excluded. Over the decade from 2001 to 2010, we estimated an annual average of 2.9 million dengue episodes and 5,906 deaths. Dengue imposes a significant economic and disease burden in SEA, with a DALY rate per million inhabitants higher than that of 17 other conditions, including Japanese encephalitis, upper respiratory infections, and hepatitis B. This highlights the need for targeted policy and intervention strategies to address the impact of dengue in the region.

2.1 Research Question

The research question of this study is: "What are the symptoms and impacts of dengue fever among university students, and how do factors like prevention awareness, disease control, and perceptions of the disease vary between urban and rural populations?"

2.2 Objectives of the Study

1. To identify and analyze the prevalence of dengue fever among students aged 18-30 at University of Peshawar.
2. To examine the common symptoms and impacts of dengue fever among the affected students.
3. To assess the level of awareness regarding dengue prevention, control measures, and treatment among the students.
4. To evaluate the effectiveness of current preventive measures and suggest improvements for better disease control within the university population.
5. To explore the differences in dengue fever prevalence, symptoms, and impacts between students from urban and rural backgrounds

2.3 Significance of the Study

This study is significant as it provides a detailed analysis of the symptoms and impact of dengue fever among university students, highlighting the varying levels of awareness and misconceptions surrounding the disease. By incorporating diverse factors such as prevention awareness, disease control, aftereffects, and treatment, the research offers a comprehensive understanding of dengue's impact on young adults in both urban and rural settings. The finding that younger respondents are less likely to practice isolation during the disease suggests a need for targeted awareness campaigns for this demographic. Additionally,

the study addresses the widespread skepticism regarding long-term effects like hair loss and alopecia, despite existing evidence, emphasizing the necessity for improved health education and communication. Ultimately, this research underscores the urgent need for enhanced preventive measures and public health strategies to mitigate the impact of dengue fever in the community.

3. Methods and Materials

3.1 Data Collection

In this study we utilized Primary data collected through a questionnaire. A detailed, point-by-point questionnaire was designed specifically for data collection. Questionnaire contain thirty-seven (37) questions, offering various response options**.**

3.2 Population of the Study

In this study citizens of Peshawar were the study's target Population and University of Peshawar students made up the sample population.

3.3 Sample Size

In order to guarantee adequate representation and dependability in the findings, the sample size for this investigation was determined to be 400 using a formula.

$$n = \frac{N}{[1+N(e)^2]}$$

n = Required sample size
N = Population Size
e = Margin of error (desired level of precision, e.g., 0.05 for ±5%)
Information was collected from the respondents using the questionnaire

3.4 Sampling Method

In this study we used a simple random sampling technique to choose its respondents. A total of four hundred participants were chosen at random from university of Peshawar.

3.5 Sampling Design

Statistical programs for social sciences (SPSS 26) were used to code, tabulate, and analyze the questionnaire responses.

3.6 Statistical Methods for Data Analysis

Numerous statistical techniques, such the odds ratio and the chi-square test of independence, are employed for the statistical examination of the data. Additionally employed were descriptive statistics, such as multiple and component bar charts, pie charts, frequency and percentage distributions, and basic bar charts were used for this study.

3.7 Pie Chart

A pie chart, also known as a circle chart, is a circular graphic divided into sectors to represent numerical data. Each sector illustrates a portion of the whole, with the entire chart totaling 100%. Pie charts are effective for showing data composition and can replace bar graphs, line plots, or histograms. To calculate the degrees for each segment, use the formula:

Given Data / Total Value of Data) × 360°.

To calculate the percentage of each segment using degrees in a pie chart, we can follow these steps: First, measure the angle of each slice on the chart. Next, divide each angle by 360°. Lastly, multiply the resultant value by 100. This formula can be expressed as:

(Frequency) / (Total Frequency) × 100

3.8 Bar Chart

A bar chart, or bar graph, visually represents categorical data using rectangular bars, with their lengths or heights corresponding to the values they represent. These bars can be displayed vertically (column chart) or horizontally. Bar charts allow for easy comparison between categories, with one axis representing the categories and the other showing the measured values. Clustered bars may also be used to represent multiple variables and their values within the same chart.

1.9 Chi Square

The chi-squared test is used to determine if there is a significant association between two categorical variables by comparing observed and expected frequencies under the assumption of independence. A large test statistic suggests the variables are not independent, indicating a significant relationship. Commonly used in fields like social sciences, biology, and market research, the chi-squared test assumes independent observations and evaluates whether the observed frequencies differ from expected ones if the null hypothesis (no association) is true. It is applied both for goodness-of-fit tests (one variable) and for testing the independence between two categorical variables. The formula for the chi-square (χ^2) statistic is used to test the independence between two categorical variables or to compare observed and expected frequencies. The formula is:

$$\chi 2 = \sum (O_i - E_i)^2 / E_i$$

Where,

$\chi 2$ = Chi-square statistic, O_i = Observed frequency for the i-th category, E_i = Expected frequency for the i-th category, $\sum$ = Sum over all categories

This formula calculates the chi-square statistic by comparing observed and expected frequencies, squared, and normalized by the expected values. The result tells you how far the observed data are from what would be expected if there were no relationship between the variables.

3.10 Odds Ratio

An odds ratio (OR) measures the association between an exposure and an outcome by comparing the odds of the outcome occurring with the exposure versus without it. In a 2x2 table with cells a, b, c, and d. The formula for odds ratio (OR) is typically used to compare the odds of an event occurring in one group to the odds of it occurring in another group. The formula is.

$$\textbf{Odds Ratio} = \frac{A \times D}{B \times C}$$

Where,

A = Number of cases where the event occurred in Group 1 (exposed group)

B = Number of cases where the event did not occur in Group 1 (exposed group)

C = Number of cases where the event occurred in Group 2 (non-exposed group)

D = Number of cases where the event did not occur in Group 2 (non-exposed group). In this study, the exposed group consists of individuals affected by dengue fever, while the non-exposed group includes individuals who are not affected by dengue fever.

4. Result and Discussion

Table 4.1: Age of the Respondents

Age	Frequency	Percent	Valid Percent	Cumulative Percent
18-25	353	88.3	88.3	88.3

26-35	47	11.8	11.8	100
Total	400	100	100	

Figure 4.1 illustrates the age distribution of the respondents, highlighting that the largest segment falls within the 18 to 35 age range. The youngest respondent is 18 years old, whilthe oldest is 35 years old. Pie chart show that age distribution of between age groups

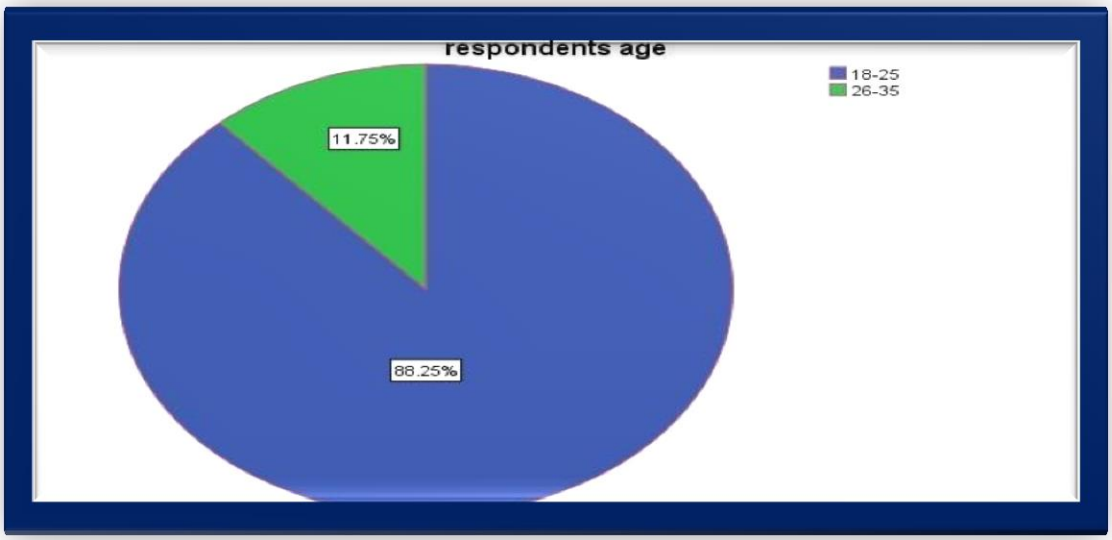

Figure 4.2: Dengue effective

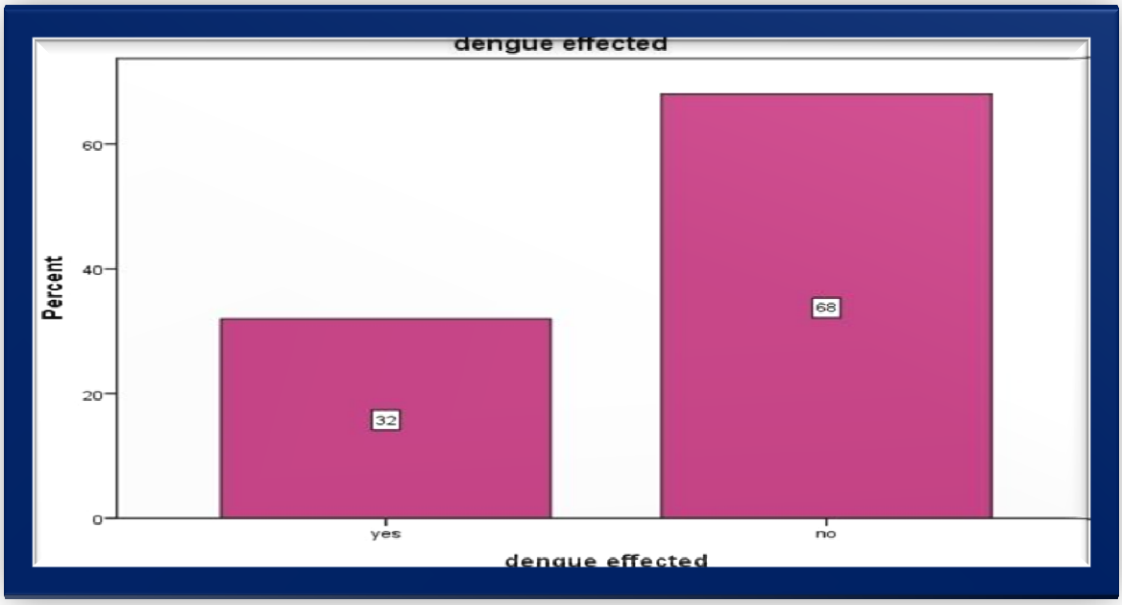

Figure 4.2 displays the percentage of respondents affected by dengue fever. According to the data, 32% of respondents reported being affected by the illness, while 66% indicated that they were not affected.

Figure 4.3 Figure 4.5 provides an overview of the recovery times for respondents who experienced dengue fever. A significant portion, specifically 54.75%, indicated that they were unsure about how long it took for them to recover. This uncertainty may stem from various factors, such as varying

symptoms, different healthcare experiences, or a lack of awareness regarding the typical duration of the illness. In contrast, 36.50% of the respondents reported that their recovery took longer than a week. This suggests that a considerable number of individuals experienced a prolonged illness, which could be indicative of the severity of their symptoms or potential complications associated with dengue fever. On the other hand, 8.75% of respondents indicated that they recovered in less than a week. This group likely experienced milder symptoms or more effective treatment, allowing for a quicker recovery.

Figure 4.3: Recovery Time from the Dengue

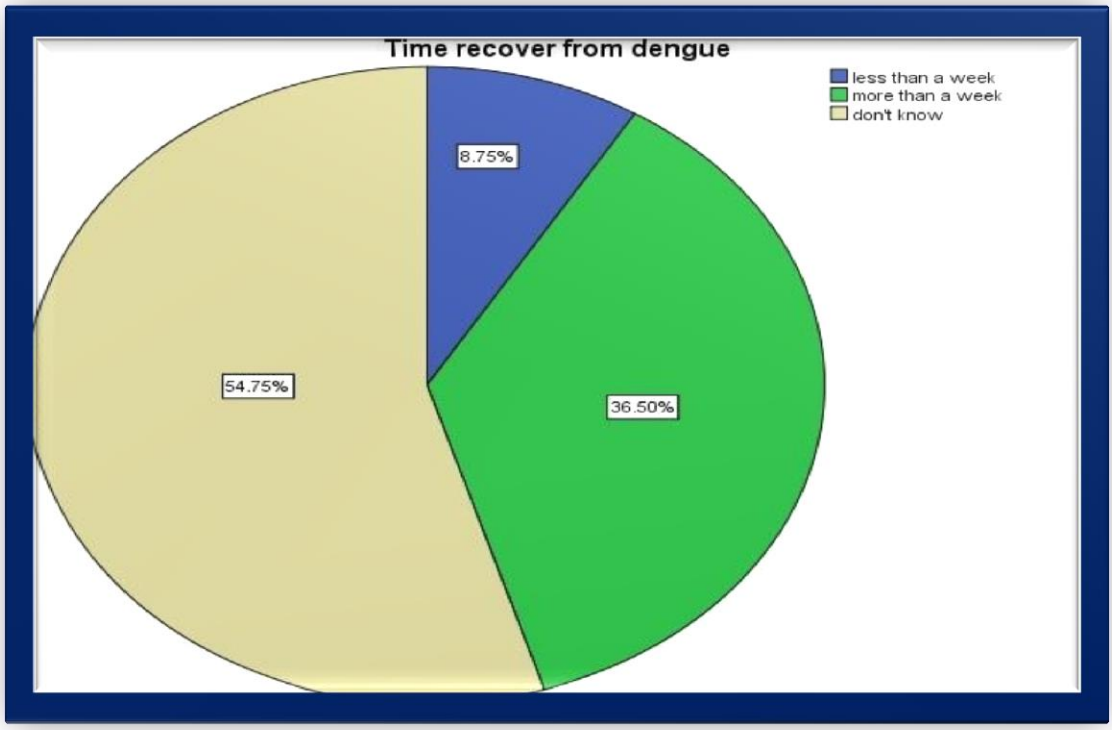

Table 4.2: Effected from dengue more than once

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	106	26.5	26.5	26.5
No	294	73.5	73.5	100
Total	400	100		

The table above presents the percentage of respondents who have experienced dengue fever more than once in their lifetime. According to the data, 73.5% of respondents have not been affected by dengue more than once, while 26.5% reported having had dengue fever multiple times.

Table 4.3: Times Dengue Can Happen

	Frequency	Percent	Valid Percent	Cumulative Percent
Once	78	19.5	19.5	19.5
Twice	74	18.5	18.5	38.0

Thrice	48	12.0	12.0	50.0
Don't know	200	50.0	50.0	100
Total	400	100.0	100.0	

The table indicates respondents' beliefs about the frequency of dengue infections in an individual. Notably, 50% of the participants were unsure about the matter. Among those who provided answers, 19.5% believe that a person can only contract dengue once, while 18.5% think it can occur twice. The remaining 12% of respondents believe that a person may experience dengue three times.

Table 4.4: Felt Muscles and joint pain During Disease

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Yes	192	48.0	48.0	48.0
No	208	5205	52.0	100
Total	400	100.0	100.0	

The table above illustrates the symptoms of joint and muscle pain experienced by respondents during dengue fever. According to the data, 52% of participants reported experiencing joint and muscle pain during their illness, while 48% did not report such symptoms.

Table 4.5: Loss of appetites During Dengue

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Yes	235	58.8	58.8	58.8
No	165	41.3	41.3	100.0
Total	400	100.0	100.0	

The table above displays the occurrence of loss of appetite among respondents during dengue fever. It reveals that 58.8% of participants experienced a loss of appetite, while 41.2% did not report this symptom.

Table 4.6: Stomach pain during Dengue

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Yes	205	51.3	51.3	51.3
No	195	48.8	48.8	100.0
Total	400	100.0	100.0	

The table above illustrates the incidence of stomach pain among patients with dengue fever. It indicates that 51.3% of respondents experienced stomach pain during their illness, while 48.8% did not report having this symptom.

Table 4.7: Distribution of Urban and Rural Dengue cases

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Urban	253	63.3	63.3	63.3
Rural	147	36.8	36.8	100.0
Total	400	100.0	100.0	

The table above indicates that dengue fever is more prevalent in urban areas compared to rural areas. According to the data, 63.3% of respondents believe it is more common in urban settings, while 36.8%

feel it is less common in those areas compared to rural ones.

Table 4.8: Area of the Respondent Cough and shortness Breath

Area of the Respondents	**Cough and shortness Breath**		Total
	Yes	No	
Urban	113	140	253
Rural	89	58	147
Total	202	198	400

Chi-Square=9.380 and P value=0.002

Table 4.9: Odds Ratio

Odds ratio of cough and shortness of breath	Value
(Yes/No)	0.256
Valid No of Cases	400

The table above presents the chi-square association between respondents' areas and the occurrence of cough and shortness of breath during dengue. The results indicate a significant association between these two variables. Additionally, the odds ratio of 0.5 suggests that respondents from urban areas are 50% less likely to experience cough and shortness of breath compared to those from rural areas.

Table 4.10: Area of respondent * Participation in awareness campaigns

Area of the Respondents	Participation in awareness campaigns		Total
	Yes	No	
Urban	109	144	253
Rural	80	67	147
Total	189	211	400

Chi-Square=4.738 and P value=0.029

Table 4.10.1: Odds Ratio

Odds ratio Participation in awareness campaigns (Yes/No)	Value
	0.634
Valid No of Cases	400

The table above illustrates the chi-square and odds ratio association between respondents' areas and their participation in awareness campaigns. The p-value indicates a significant association between these two variables. Additionally, the odds ratio of 0.628 suggests that individuals from rural areas are less likely to participate in awareness campaigns compared to those from urban areas.

Table 4.10.2: Respondent Age Isolation

Age of Respondents	**Isolation**		Total
	Yes	No	
18-25	157	196	353
26-35	27	20	47
	184	216	400

Chi-Square=2.738 and P value=0.094

Table 4.10.3: Odds Ratio

Odds Ratio for respondents age (18-25 / 26-35)	Value
	0.500
Valid No of Cases	400

The table above depicts the chi-square association between respondents' age and isolation during dengue. The results indicate a significant association between these two variables. Furthermore, the odds ratio of 0.5 suggests that respondents aged 18 to 25 are half as likely to isolate during dengue compared to those aged 26 to 35. This study aimed to investigate dengue fever, focusing on its symptoms, effects, and prevention strategies. Conducted in Peshawar, Khyber Pakhtunkhwa, Pakistan, the research surveyed 400 respondents. Key findings include. The majority of dengue cases were reported among individuals aged 18 to 30, with a significant portion from urban areas (63.25%). 66% of respondents had not been affected by dengue, while 32% reported being infected. Recovery times varied, with 36.5% taking over a week to recover, and 59% requiring hospitalization. Common symptoms included headache, rash, joint pain, and gastrointestinal issues. A majority (68.25%) considered dengue a serious illness, and 63.3% perceived it as more prevalent in urban areas. Many respondents believed that measures like window screens and insecticides could help prevent dengue, but over half did not participate in awareness campaigns.

5. Conclusion

The study conducted in Peshawar, Khyber Pakhtunkhwa, Pakistan, offered valuable insights into various dimensions of dengue fever and its impact across different demographics. Most respondents affected by dengue were aged between 18 and 30, with a higher prevalence noted in urban areas compared to rural ones. Approximately one-third of the respondents reported being infected with dengue, with many taking over a week to recover; hospitalization was necessary for a significant portion of these individuals. The study also examined the breeding locations of dengue mosquitoes, which were found in dirty, clean, and hot water sources. Timing of mosquito bites varied, with most respondents indicating that mosquitoes were most active at night, followed by the afternoon and daytime. Notably, many participants reported having experienced dengue multiple times, suggesting the likelihood of recurrent infections. Common symptoms identified included headache, flu-like symptoms, rash, joint and muscle pain, loss of appetite, abdominal pain, and gum bleeding. The majority of respondents viewed dengue as a serious illness, and perceptions of its prevalence were notably higher in urban settings, highlighting the need for focused prevention efforts in densely populated areas. Interestingly, many respondents expressed skepticism about the long-term effects of dengue, such as hair loss and alopecia, despite evidence to the contrary. In terms of prevention, a substantial number believed that measures like window screens, covering storage, and using insecticides could effectively reduce dengue risk. However, participation in awareness campaigns was relatively low, indicating a need for enhanced educational efforts to raise awareness about preventive strategies. In summary, this study underscores the importance of understanding the prevalence, symptoms, and perceptions of dengue fever to develop effective prevention and control measures, emphasizing the need for targeted awareness initiatives. The analysis also revealed significant associations between various factors, such as location, age, and symptom prevalence, underscoring the importance of targeted prevention and awareness efforts in managing dengue effectively.

5.1 Limitations of the Study

There were several limitations to the study. First, time constraints significantly impacted the research process, leading to a smaller sample size and a more restricted research area than initially planned. This may limit the generalizability of the findings, as the study only covered a specific population within a limited timeframe. Furthermore, the shortened sample size might not fully capture the diverse experiences of individuals affected by dengue fever, especially in different geographical or socio-economic settings. These limitations could affect the overall comprehensiveness and depth of the research.

5.2 Recommendations

Based on the findings of this study on dengue fever in Peshawar, Khyber Pakhtunkhwa, several recommendations are proposed to effectively manage and control the disease. Firstly, targeted awareness campaigns are crucial, especially for younger age groups, as they represent the majority of those affected. These campaigns should be conducted through social media, university seminars, and community workshops to educate young adults on early detection, isolation, and treatment. Given the higher prevalence of dengue in urban areas, preventive measures should be prioritized in densely populated neighborhoods, focusing on disseminating information about reducing mosquito breeding sites and using protective measures. Enhanced prevention measures are also necessary, including intensified vector control programs that regularly eliminate mosquito breeding sites in both urban and rural areas, with community participation encouraged through clean-up drives. Personal protective measures, such as using window screens, mosquito nets, and insect repellents, should be promoted, and educational materials in local languages should be made widely accessible to support these efforts. Improved health education is needed to address common misconceptions about dengue, such as skepticism regarding long-term effects like hair loss. This can be achieved through informative brochures, seminars, and healthcare professional engagement. Training for healthcare providers is also essential to help them recognize the full spectrum of dengue symptoms and manage recurrent infections effectively while educating patients on potential long-term impacts. Furthermore, increasing community involvement is key. Mobilizing communities to participate in dengue prevention initiatives, such as clean-up campaigns and reporting potential breeding sites, is vital. Schools and universities should integrate dengue awareness into their health education curricula to promote preventive behaviors among students and their families. Regular epidemiological studies should be conducted to monitor changes in dengue patterns and the effectiveness of prevention measures, while systematic surveillance of mosquito breeding sites should be implemented to take immediate action. Improved access to healthcare facilities is also recommended, especially in urban areas where hospitalization is often required. Establishing dedicated dengue wards during peak seasons and providing financial assistance for treatment can ensure that all affected individuals, particularly students, receive the necessary medical care. By implementing these recommendations, public health officials, community leaders, and educational institutions can work together to effectively reduce the incidence and impact of dengue fever in the region.

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