Gender Comparison of Cases of Dengue Fever and Dengue Hemorrhagic Fever in Lapu-lapu City, Cebu, Philippines

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Date received: July 21, 2015
Revision accepted: May 26, 2016

Abstract

This paper analyzes the difference on the cases of dengue fever and dengue hemorrhagic fever in Lapu-lapu City, Cebu, with respect to gender. Findings show that there were more males that are admitted for the two fevers. Monthly and yearly analyses of variance (ANOVA) showed significant difference for males for both fevers, while only the monthly data for females showed significance. Further, T-test result showed that there is significant difference for both dengue fever (p=0.010) and dengue hemorrhagic fever (p=0.005) when the genders are compared. Other factors are suggested to be included in the analyses such as age, locality and activities for further studies.

Keywords: dengue fever, dengue hemorrhagic fever, gender, Lapu-lapu City

1. Introduction

Due to the rapid changes of the global landscape, that include urbanization, travel, environment, the tropical regions are now facing a great challenge of emerging infectious disease (Farrar *et al.*, 2007). With more than 50 million infections and more than 500,000 hospitalizations recorded per year, dengue fever and dengue hemorrhagic fever are considered as two of the most important arthropod-borne viral diseases. Both fevers are traced to be caused by four different serotypes of dengue virus. (Guzman *et al.*, 2010) whose common identified vectors are *Aedes* spp.

In the Philippines, the first recorded outbreak of dengue was in 1926. By1954, the first dengue epidemic was reported to have occurred in Manila (Simmons *et al.*, 1931; Ooi and Gubler, 2009). Since then, the disease has

become more and more significant. Every year, the country has seen a steady increase of reported cases primarily attributed to rapid urbanization, degradation of the environment, and poor urban planning, which is primarily caused by increase rate of population (Sia, 2008).

As the increase in population tends to rise specifically in the urban zones, more and more people tend to be at risk of the diseases.

Accordingly, there are more cases of dengue fever than dengue hemorrhagic fever (Humayoun, 2010), of which the reason is still unknown. However in the Philippines, specifically Lapulapu City, comparison on gender admitted with dengue fever and dengue hemorrhagic fever is poorly studied. Hence, this paper will evaluate which of the two genders have higher admission either of the two diseases of the said locale.

2. Methodology

2.1 Data Gathering

After the necessary permits were granted, cases of dengue fever and dengue hemorrhagic fever were obtained from 2 hospitals in Lapu-lapu City, Philippines, namely: Our Lady of the Rule General Hospital and Lapu-lapu City District Hospital. Since the focus is on gender comparison, only gender was included in the study.

2.2 Data Analysis

In Northern Mindanao, it has been observed that dengue fever and dengue hemorrhagic fever has its distinct behavior (Opena and Teves, 2011), hence the two cases were treated differently. Cases were recorded in monthly and yearly basis. The inclusive year is from January 2008 to December 2013.

Analyses of the monthly and yearly data according to gender uses One-way Analyses of Variance (ANOVA), where the confidence level is set at $p=0.05$, while the comparison of the cases between male and female of the two diseases employs T-test. The software MiniTab was used to analyze the data.

3. Results and Discussion

A total of 4371cases were recorded from the two hospitals from 2008-2013, where the majority of the cases (85%) was identified to be dengue fever. Male to female ratio showed that for both type of fever, there has been an excess of males (76%, dengue hemorrhagic fever; 80%, dengue fever).

As reflected in Figure 1, lowest cases of dengue hemorrhagic fever has been recorded in the months of April and May for both sexes. In males, highest recorded cases are recorded in the month of July, then in August and November. However in females, dengue hemorrhagic fever is highest in the months of October, and December respectively.

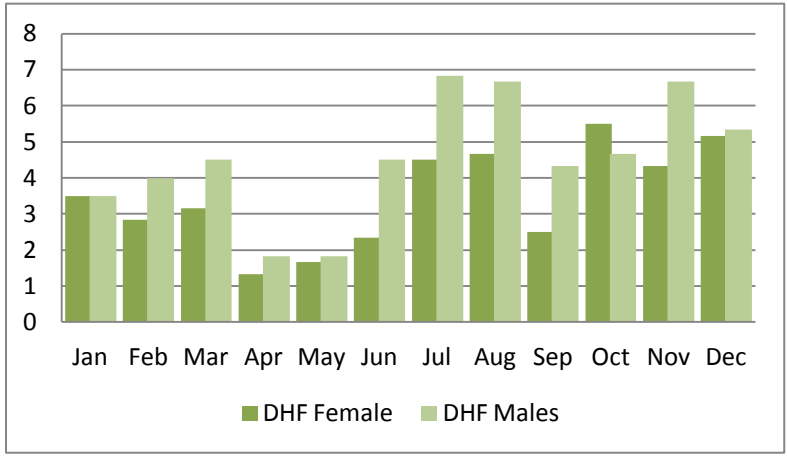

Figure 1. Average dengue hemorrhagic fever cases from 2008-2013

Per observation on the data, more males got the disease, except in the month of October where more females were admitted. Since mosquitoes are olfactory (Vinauger *et al*., 2014), and that they are much attracted to the carbon dioxide emitted by the person (Dekker *et al.*, 2005), males tend to be more attractive to *A. aegypti* since they are more physically active than females in several identified aspects (Azevedo *et al*., 2007).

Contrary to the incidence of dengue hemorrhagic fever, case of dengue fever for males is highest in the month of October. Other months where cases are high are August, November and September where admission does not go below 40 as shown in figure 2.

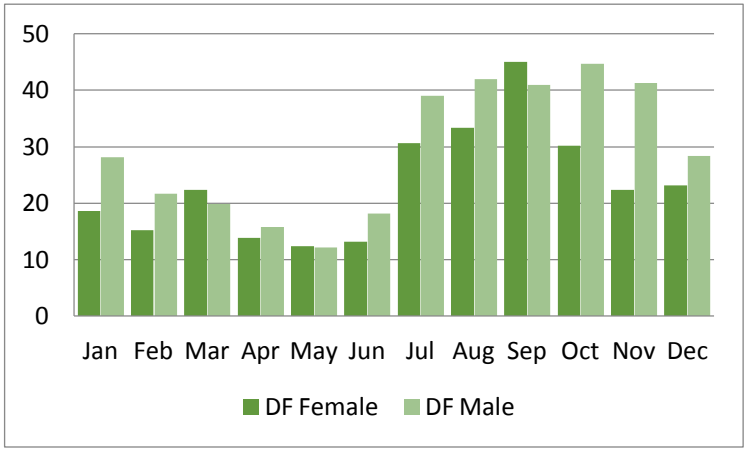

Figure 2. Average dengue fever cases from 2008-2013

By average, fewer females contacted dengue fever, however, for the inclusive years, the gender recorded the highest incidence, specifically in the month of September. The other month where females record higher than males is in March. Further, July to October is the peak season of the said disease for females.

Cases of dengue fever tries to establish a predictable pattern where cases tend to decrease as the dry season approaches. This could be contributed by the effect of the drop of atmospheric factors such as temperature, humidity and rainfall. Those factors were known to have its influence on the breeding and development of *A. aegypti* and the dengue virus (DENV) (Morin *et al.*, 2013; Alshehri, 2013).

Cases of dengue hemorrhagic fever is lowest in the first half of the year, which is similar to that of dengue fever. However, in the second half, trends of peaks of cases are not distinct. Both gender starts to peak in July and that there are more incidence of dengue fever than dengue hemorrhagic fever.

Yearly data shows that more males contacted dengue fever than females as shown in Figure 3. Also noted that cases for males and females tend to go up or down together. For females, the highest recorded cases is during 2010 where it recorded a total of 360. The year 2010 showed the highest recorded cases in males with 455 admissions from the 2 hospitals.

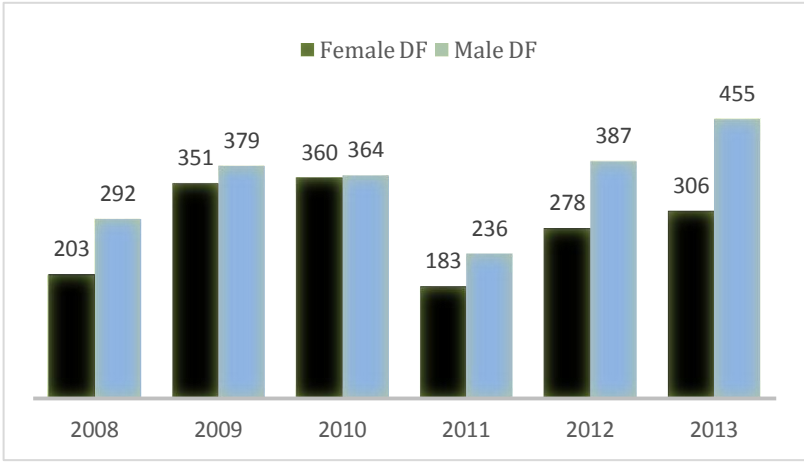

Figure 3. Yearly data of dengue fever in Lapulapu City from 2008-2013

The trend mentioned above may signify that the increase of cases in a particular gender may not guarantee that cases in the other gender will also increase. The year 2011 showed the lowest cases of the fever.

For dengue hemorrhagic fever, 2008 showed the highest (61) and 2011 the lowest (40) cases for males, while for females, 2013 showed the highest (51) and 2011 the lowest (21).

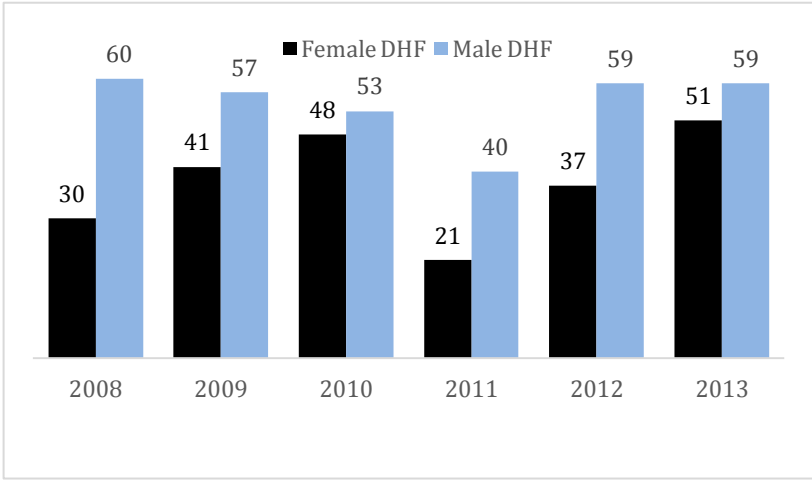

Figure 4. Yearly data of dengue hemorrhagic fever in Lapulapu City from 2008-2013

A consistent trend can be observed in males for dengue hemorrhagic fever. There is a steady increase in 2008 to 2010, then drops in 2011, increasing to 2013. However in females, this trend is not observed (Figure 4). Instead, as the cases in males drop, cases in females increase.

On the other hand, a much more consistent trend between male and female can be observed, where cases tend to increase and decrease together.

More males contacted both diseases than females for the inclusive year. Such finding is consistent with the findings of Anker and Arima (2011). Their study concluded that in various Asian countries, there are more males who got the fever. Additionally, majority of the patients are not younger than 15 years old. This similar result is similar to that of Khan *et al.* (2013).

Pasay *et al*. (2013) reported that in Ozamis City (Misamis Occidental, Philippines), the month of January has the highest cases for the diseases, and their yearly data showed that the year 2010 has the most admission. The finding is highly contrary to the researcher's finding since higher cases are seen between June to November. This will try to suggest that different localities of the same country have different factors that can cause varying behavior of the said diseases.

3.1 Dengue Fever

Analysis of Variance (ANOVA) on the monthly dengue fever cases from 2008-2013 is projected in Table 1A and 1B. For monthly analyses, both gender showed significant difference. This could mean that by average, there could be months where cases are higher than others. In Figures 1 and 2, the drier season exhibits lower cases than the rainy season, a probable reason for its significance.

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Table 1a. ANOVA on monthly dengue fever cases among females from 2008-2013

Source	DF	SS	MS	F	P
Factor	11	6450	586	3.01	0.003
Error	60	11706	195		
Total	71	18156			

Table 1b. ANOVA on monthly dengue fever cases among males from 2008-2013

Source	DF	SS	MS	F	P
Factor	12	21747408	1812284	8112.28	0.000
Error	65	14521	223		
Total	77	21761929			

Table 2a. ANOVA on yearly dengue fever cases among females from 2008-2013

Source	DF	SS	MS	F	P
Factor	5	2288	458	1.90	0.106
Error	66	15868	240		
Total	71	18156			

Table-2B. ANOVA on yearly dengue fever cases among males from 2008-2013

Source	DF	SS	MS	F	P
Factor	6	1.827E+10	3.045E+09	1.5E+06	0.000
Error	77	153487	1993		
Total	83	1.827E+10			

In a related study on dengue cases and monthly rainfall and temperature in Jeddah, Saudi Arabia, Alshehri (2013) noticed that dengue cases is lower during the drier season and tends to increase between May to October and decreases the succeeding months.

Yearly dengue fever cases showed that there is a significant difference ($p=0.000$) in males than females in the 6 year period. This means that males could have varying number of cases of the said period. However for females, no significant difference has been observed. This means that dengue fever cases is more varied in males, where a year could be significantly higher (or lower) in some other years.

3.2 Dengue Hemorrhagic Fever

As mentioned earlier, dengue hemorrhagic fever manifests distinct behavior pathologically than dengue fever. Analyses show that monthly cases for both

males and females significant differences (p=0.000). Hence, both gender showed similar response to disease.

Though there could be some pathologic difference between the two fevers, the highly similar significant differences only signified that there will be months where cases are lower and months where cases are higher. Both cases are lower in the first half of every year, and higher in the second half. And similar to dengue fever, dengue hemorrhagic fever is lowest in the months of April and May.

Considering now the yearly cases, dengue hemorrhagic fever in males showed significant difference than that of the females at p=0.000 and p=0.135, respectively (Tables 4A and 4B). The varying degree of significance may be attributable to the more physical activities engaged by the males which may result to more carbon dioxide emissions compared to females.

Table 3a. ANOVA on monthly dengue hemorrhagic fever cases among females from 2008-2013

Source	DF	SS	MS	F	P
Factor	12	22310245	1859187	3.2E+05	0.000
Error	65	375	6		
Total	77	22310620			

Table 3b. ANOVA on monthly dengue hemorrhagic fever cases among males from 2008-2013

Source	DF	SS	MS	F	P
Factor	12	22285920	1857160	2.2E+05	0.000
Error	65	549	8		
Total	77	22286469			

Table 4a. ANOVA on yearly dengue hemorrhagic fever cases among females from 2008-2013

Source	DF	SS	MS	F	P
Factor	5	56.46	11.29	1.75	0.135
Error	66	425.42	6.45		
Total	71	481.88			

Table 4b. ANOVA on yearly dengue hemorrhagic fever cases among males from 2008-2013

Source	DF	SS	MS	F	P
Factor	6	1.829E+10	3.048E+09	1.8E+06	0.000
Error	77	133025	1728		
Total	83	1.829E+10			

3.3 Gender Difference Analyses

T-test analysis for dengue hemorrhagic fever between males and females showed that there is a significant difference (p=0.005), hence one gender is more prominent in the said disease. As showed earlier, there has been more male cases than females which could be the reason for the observed difference (Table 5).

Similarly, T-test for dengue fever between the genders showed significant difference (p=0.010). In this said disease, males are also much prominent (Table 6).

This finding suggest that closer monitoring among males must be incorporated in every action plan of the health sector against the two diseases, especially among the younger population where the diseases are much prevalent (Pasay *et al.*, 2013). For example, when there are reported cases in a particular area, information drive which mentions on the vulnerability of the male over the female in having the disease can be included.

Table 5. T-test for dengue hemorrhagic fever cases between male and female

	N	Mean	StDev	SE Mean
DHF Females	12	20.75	8.25	2.38
DHF Males	12	27.33	10.08	2.91
Difference	12	-6.58	6.43	1.86

95% CI for mean difference: (-10.67, -2.50)
T-Test of mean difference = 0 (vs not = 0): T-Value = -3.55 P-Value = 0.005

Table 6. T-test for dengue fever cases between male and female

	N	Mean	StDev	SE Mean
DHF Females	12	176.1	70.6	20.4
DHF Males	12	140.1	59.3	17.1
Difference	12	36.0	40.2	11.6

95% CI for mean difference: (10.4, 61.6)
T-Test of mean difference = 0 (vs not = 0): T-Value = 3.10 P-Value = 0.010

4. Conclusions and Recommendation

In this study, both monthly and yearly data for dengue fever and dengue hemorrhagic fever showed that there are more males than females that are admitted for the said diseases. This means that the common dengue vectors (*Aedes agypti* and *Aedes albopictus*) are more attracted to males, most likely because of the physicality of the said gender as showed in the statistical details. Further, the case of Lapulapu City suggest that more cases are recorded in the second half of the year, suggesting that the hotter months could be significant for the development of the said vectors found in the city.

Inclusion of the age bracket and places where the patients live are the highly recommended inclusion for further analysis, where the former can confirm that the younger population is more vulnerable, while the latter could lead to dengue mapping of the said city for a more effective planning and vector control. Further inclusion is the correlation of cases of dengue fever and dengue hemorrhagic fever to local climate variables.

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