

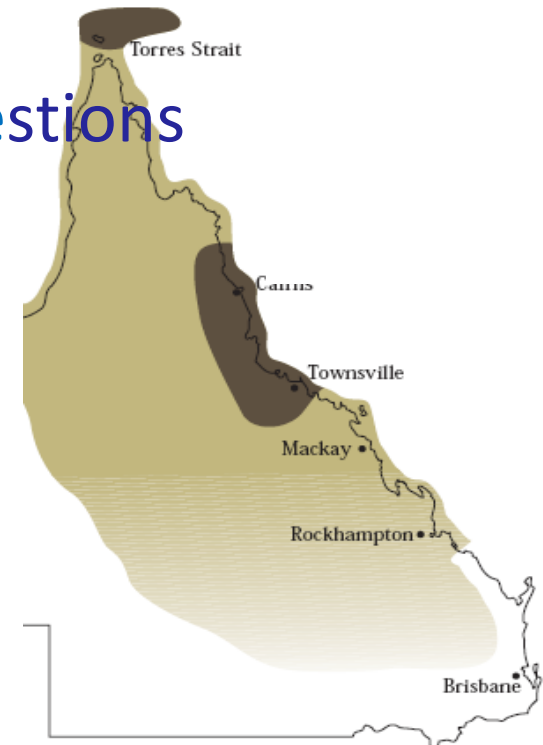
**THE IMPACT OF CLIMATE
FACTORS
ON DENGUE FEVER
IN CAIRNS AND TOWNSVILLE
NORTH QUEENSLAND**



Amalya

Outline

1. Introduction
2. Background & Rationale
3. Aim, Research Question, & Focus Questions
4. Conceptual Framework
5. Findings & Discussions
6. Conclusions & Recommendations





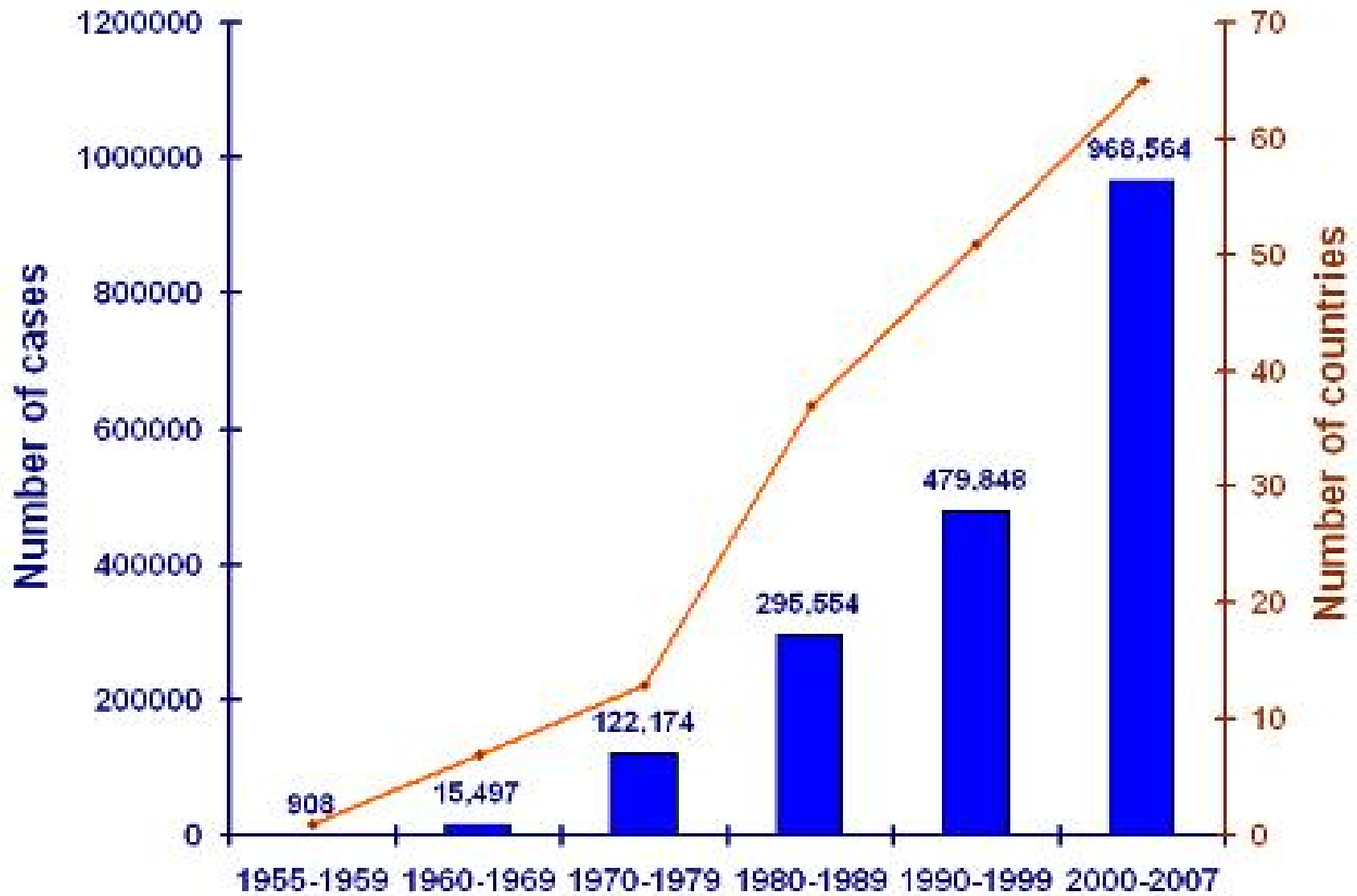
I n t r o d u c t i o n

- Dengue fever is a **mosquito-borne disease** caused by dengue **virus**
- Transmitted by ***Aedes aegypti* mosquito**
 - one of mosquitoes that are **very responsive** to climate (Githeko et.al., 2000)
- Dengue → a **major** international public health **concern** (WHO, 2008)
- 2.5 billion people – two fifths of the world's population – are now **at risk** from dengue (WHO, 2008)
- The disease is spreading to **new areas**
- **West Pacific Region** → the 2nd highest region with dengue cases after SEARO (WHO, 2008)

Average annual number of DF/DHF

cases reported to WHO & average annual number of countries reporting dengue

Chart Title

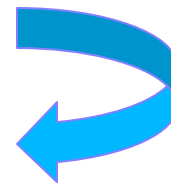




- Areas infested with *Aedes aegypti*
- Areas with *Aedes aegypti* and dengue epidemic activity

I n t r o d u c t i o n

- In Australia, dengue has been reported in the Northern Territory, New South Wales, and QLD; but, in recent decades, it has only been reported in North QLD
- Outbreaks (In 1990 to 2009):
 - CAIRNS → 13 times
 - TOWNSVILLE → 11 times



In **2009**, the **largest dengue epidemic in Australia** in at least 50 years w/ more than 1,000 cases

(www.health.qld.gov.au/dengue/outbreak_update)



Rationale

- ❑ Previous research found **significant relationships** between **climate** (Temp, Humid, Rainfall) & **dengue** (Koopman et. al., 1991; Schultz, 1993)
- ❑ DF mostly occurs in the **tropics & subtropics** (Amarakoon,2007)
- ❑ **Townsville and Cairns** → **tropical & most populated areas** of QLD where *Aedes aegypti* commonly occurs and **outbreaks** more often to occur; contributes to the **increase of the burden** of human disease along with other mosquito-borne diseases in QLD (Queensland Health, 2005, p.14; Queensland Health, 2008; WHO, 1998)
- ❑ **No research covered** this issue (climate & dengue) → Needs to **further explore** to prevent outbreaks



Significance of Research

Provide **baseline data** to improve understanding about the relationship between climate and dengue fever; so that, it can be useful for prevention/control efforts to prepare for future outbreaks by using climate forecasts and also for further research



Aim and Research Question


□ Aim of Research

Knowledge Seeking

To determine the relationships between climate factors and dengue fever in Cairns & Townsville

□ Research Question

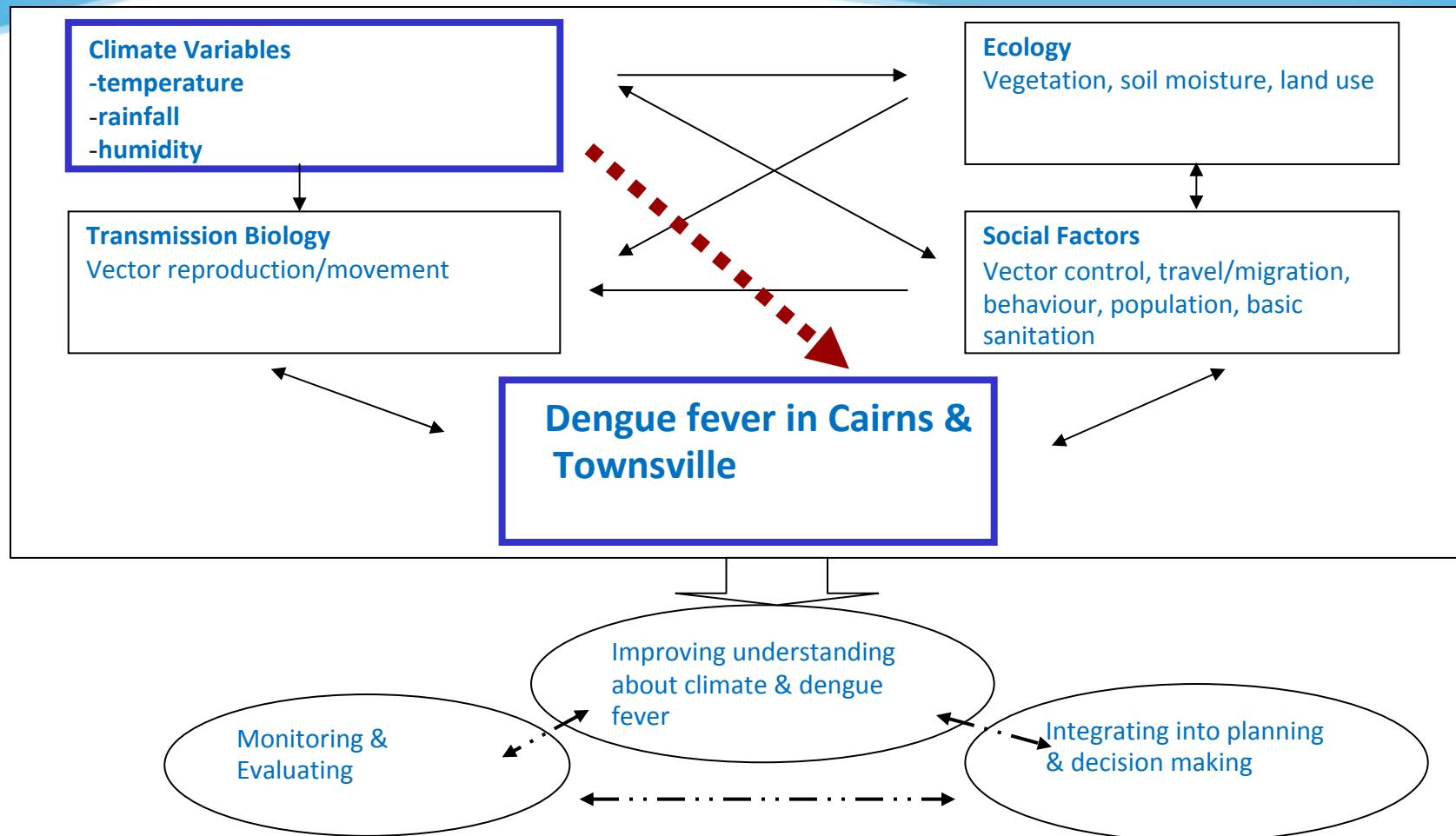
Is there a relationship between climate factors and dengue fever in Cairns & Townsville?



**Focus
Questions**

1. What is the **trend of dengue fever** in Cairns & Townsville?
2. What are the **patterns of climate** variables (temperature, rainfall, and humidity) in Cairns & Townsville?
3. What are the **relationships** between climate variables (temperature, rainfall, and humidity) with dengue fever in Cairns & Townsville?

Conceptual Framework

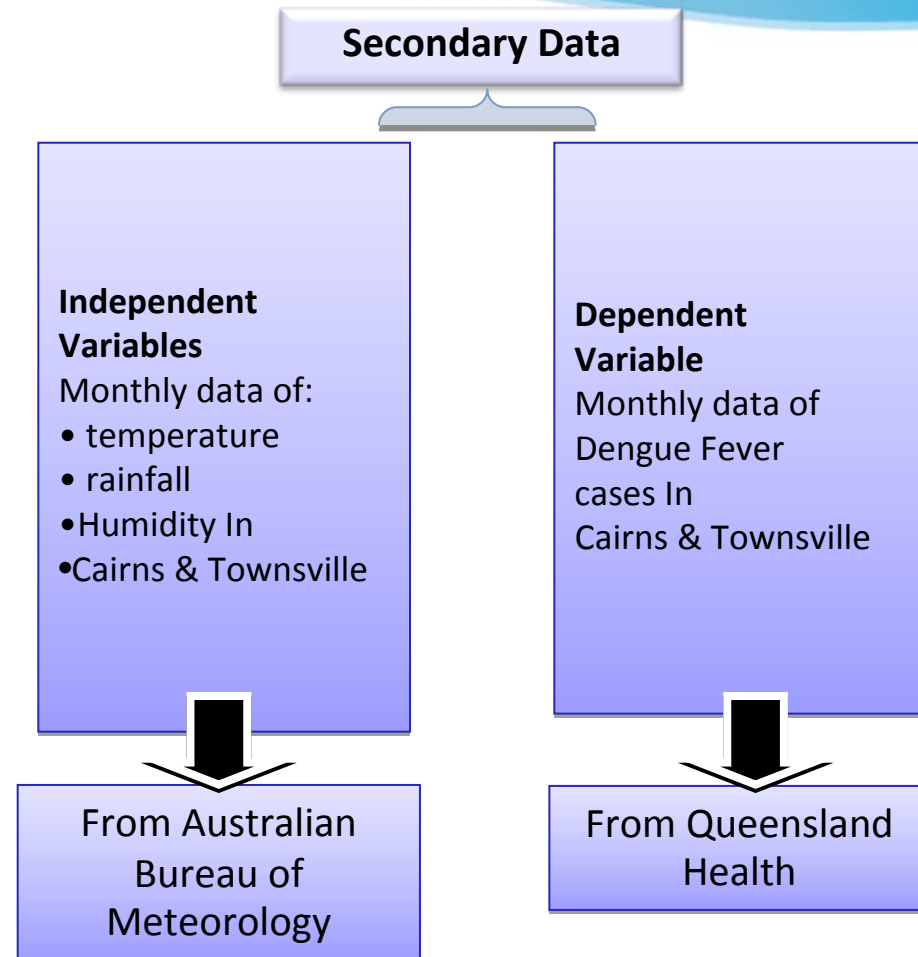


Methodology

- Research method
Quantitative method, Ecological Study
- Source of Data
Secondary Data (18 years data, from 1990-2007)

Data analysis method

- **Univariate analysis**
Frequency distribution
- **Bivariate analysis**
Spearman Correlation
- **Multivariate analysis**
Multiple linear regression

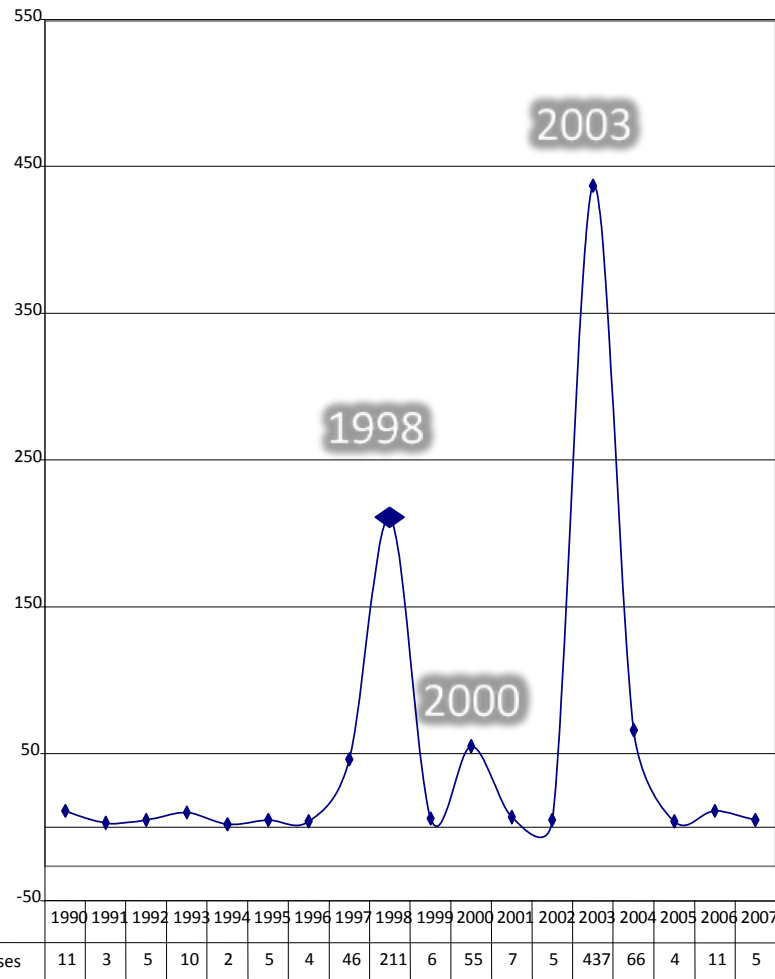




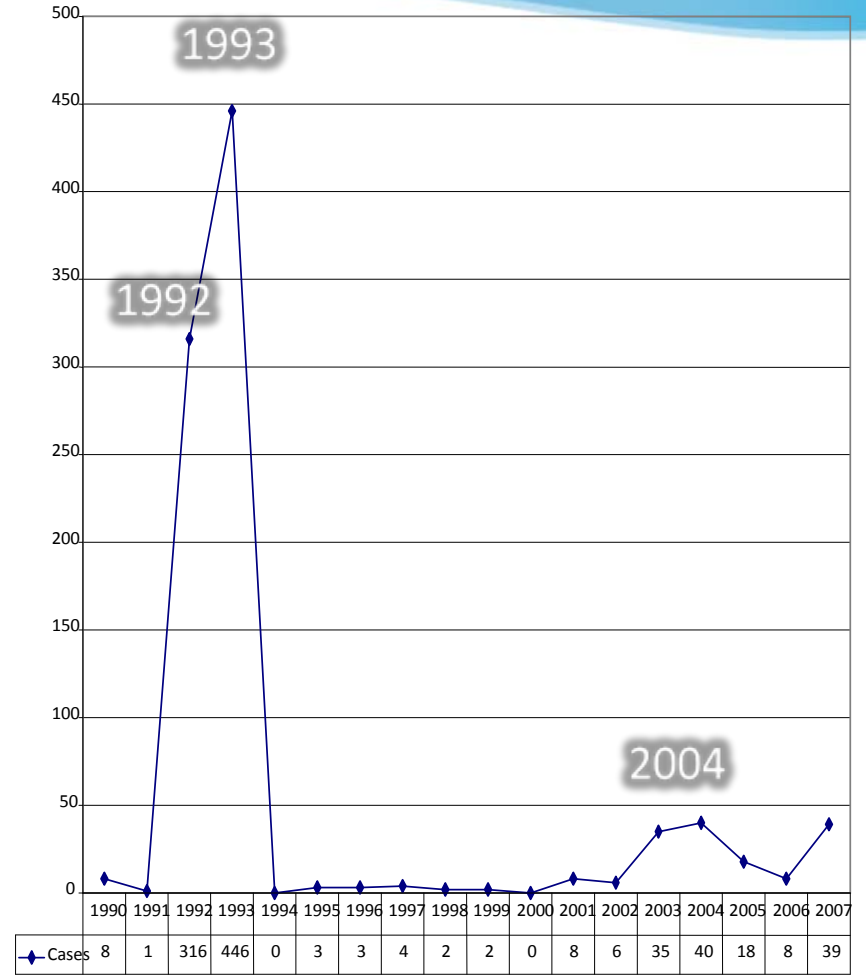
Findings & Discussions

The distribution of dengue fever cases: 1990-2007

Cairns



Townsville



Climate: 1990 - 2007

Climate Variables	CAIRNS	TOWNSVILLE
Average Temperature	17.5-29.9 ^o C	19.65-29.05 ^o C
Relative Humidity	45.5-80.5%	52.5-82%
Rainfall Index	0 - 649.05 mm/month	0 - 1,287 mm/month
Number of Rain Days	0 - 24 days/month	0-29 days/month

Bivariate Analysis Results

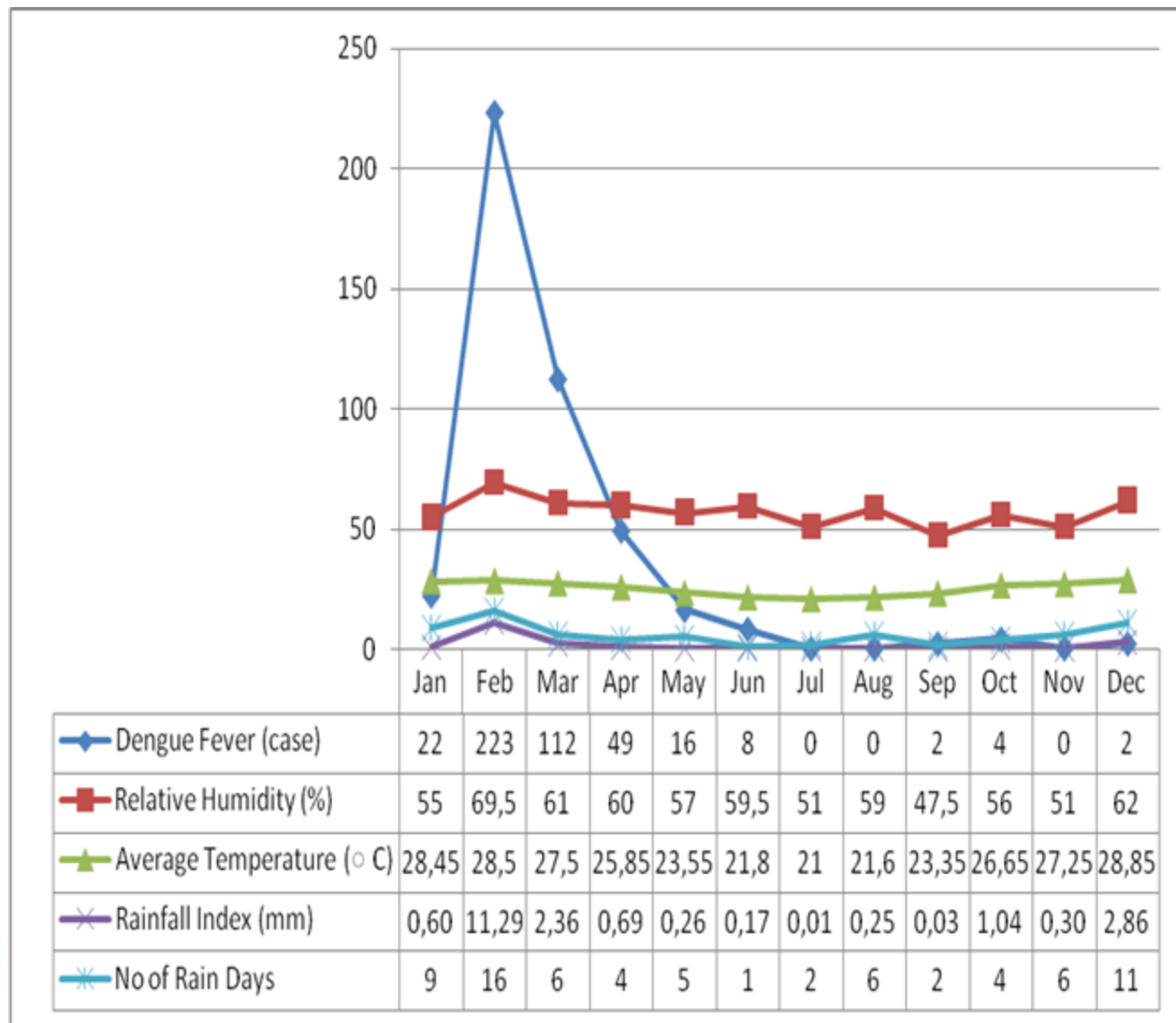
CAIRNS		Dengue Fever Cases
Correlation Coefficient	Relative Humidity	.194 (**)
	Average Temperature	.192 (**)
	Rainfall Index	.232 (**)
	Number of Rain Days	.181 (**)

TOWNSVILLE		Dengue Fever Cases
Correlation Coefficient	Relative Humidity	.268 (**)
	Average Temperature	.122
	Rainfall Index	.208 (**)
	Number of Rain Days	.219 (**)

**Correlation is significant at the 0.01 level (2-tailed)

Analysis on Occasional Outbreaks

CAIRNS
2003



RAINFALL

AVERAGE TEMPERATURE

RELATIVE HUMIDITY

- In Cairns & Townsville

- Range of humidity was ideal for *Ae. aegypti* breeding

- explosive number of DF cases occurred in the years with **high humidity**

- strongly correlated with hatching activities (Rigau Perez et al. as cited in Depradine & Lovell, 2004)

- DF still occurred in **low humidity**

- People stored water in containers → potential breeding sites for *Ae. aegypti* (Koviats...)
- *Ae. aegypti* tends to feed more frequent to avoid dehydration (Mc Michael as cited in Pusparini, 2004)

Multivariate Analysis Results

Cairns

Dengue Fever = - 17.097 + 0.037 Humidity + 0.758 Temperature + 0.834 Rainfall Index – 0.302 No. of Rain Days

Rainfall Index → a significant variable to predict the change of dengue cases

Townsville

Dengue Fever = - 40.186 + 0.689 Relative Humidity – 0.014 Rainfall Index

Relative Humidity → a significant variable to predict the change of dengue cases

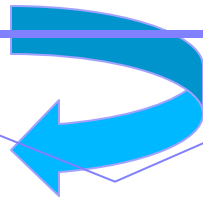
Future Directions

- Climate in Cairns & Townsville → significantly correlated with DF
- Climate change is happening in Queensland → more extreme weather events, e.g. storm surge, cyclone, sea-level rise & flooding



Australian Green House Office (2002); EPA-Queensland Projection

- increase of av. temperature will increase by 0.4°C to 6°C in 2030-2070
- uncertainty rainfall (less or more rainfall)



More frequent dengue fever outbreaks

A decorative blue banner with a wavy bottom edge. On the left side, there are white floral and leaf patterns. In the center, a faint image of a moon is visible. The word "Conclusions" is written in white, bold, sans-serif font on the right side of the banner.

Conclusions



Trend of dengue fever

❑ CAIRNS:

→ cases occurred every year over 18 years which highly increased in summer season

❑ TOWNSVILLE:

→ there were years with zero cases

→ highly increased during summer – mid autumn

Pattern of climate factors

❑ All climate factors (temperature, humidity, rainfall, & rain days) in Townsville were higher than in Cairns

Relationships between dengue fever & climate factors

❑ CAIRNS:


→ DF was significantly correlated with all climate variables; especially rainfall index

❑ TOWNSVILLE:

→ DF was significant w/ humidity, rainfall index, rain days; especially humidity



Recommendations

- 
- ✓ For QUEENSLAND HEALTH:
 - ❑ **Consider climate factors in developing DF Management Plan** for North Queensland → intensify mosquito surveillance and control at the time when the risk of having dengue fever increases (summer & autumn)
 - ❑ **Ongoing public education** → emphasize **on the management of breeding sites** of *Aedes aegypti* → not focus exclusively on increasing knowledge.; but, **stimulating actual behaviour**
 - ❑ **During emergency time** → not only focusing on reducing adult mosquito but also on **source reduction**
 - ❑ **Priority on identifying imported cases**
 - ❑ Promote **education for General Practitioners (Physicians) and medical officers** in recognition, management, and treatment of dengue fever → prevent late notifications due to misclassification of dengue fever cases
 - ❑ Pay more **attention on rain water tank utilisation**
 - ✓ Future research investigating other factors beside climate (non-climatic factors)

Thank You

