

Climate Change and Human Health

(Typhoid cases in Kathmandu, Nepal)

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Climate Change Scenario in Nepal

- Increasing temperature – $0.06\text{ }^{\circ}\text{C}$ per year
- Rain has become less predictable and dependable both in terms of distribution and amount in Nepal
- Glacier retreat – with reduction in area /volume
- Plain areas are experiencing fog and winter are cold



Typhoid fever –effect of climate

- Systemic infection by *Salmonella typhi*
- 3-4 weeks continuous fever - communicable disease
- Enteric fever includes both typhoid and paratyphoid
- Nature of spread -sporadically, epidemically & endemically
- Occurs where water supply and sanitation is substandard

Household Access to Drinking Water Sources

Ecological Region	Total Households	Percent of Total Households					
		Tap/Pipe	Well	Tube Well	Spout Water	Rivers/Stream	Others
Mountain	285,217	72.2	6.2	0.0	17.1	3.4	1.0
Hill	1,950,345	72.2	12.0	2.4	10.1	2.0	1.2
Terai	1,938,895	30.8	6.5	58.6	1.1	0.6	2.5
Nepal	4,174,457	52.9	9.0	28.4	6.4	1.5	1.8

Households' Accessibility to Toilet and Sewerage



Ecological Region	% toilet coverage	% sewerage coverage
Mountain	40.4	1.0
Hill	55.8	18.7
Terai	37.3	7.4
Nepal	46.1	12.1

Water Quality Analysis

Parameter	Water source				WHO GV
	Pr Tap	Pu Tap	Well	S. spout	
pH	6.5-8.2	6.5-7.5	7.5	7.5	6.5-8.5
Iron (mg/l)	ND-0.2	0.2	0.2	0.3	0.3 -3
Chlorine mg/l	ND	ND	ND	ND	0.2
Chloride mg/l	10-30	22-45	26-27	23-45	250
N-NH4 (mg/l)	ND-0.2	0.2	0.2	0.2	0.04-0.4
PO4 – P (mg/l)	0.1	0.1	0.1	0.1	0.4-5.0
Coliform bacteria (source)	+/-	+	+	+	-
Coliform bacteria (consumption point)	+				-
E. coli cfu/100 ml	10-131	3-20	48-200	58	0

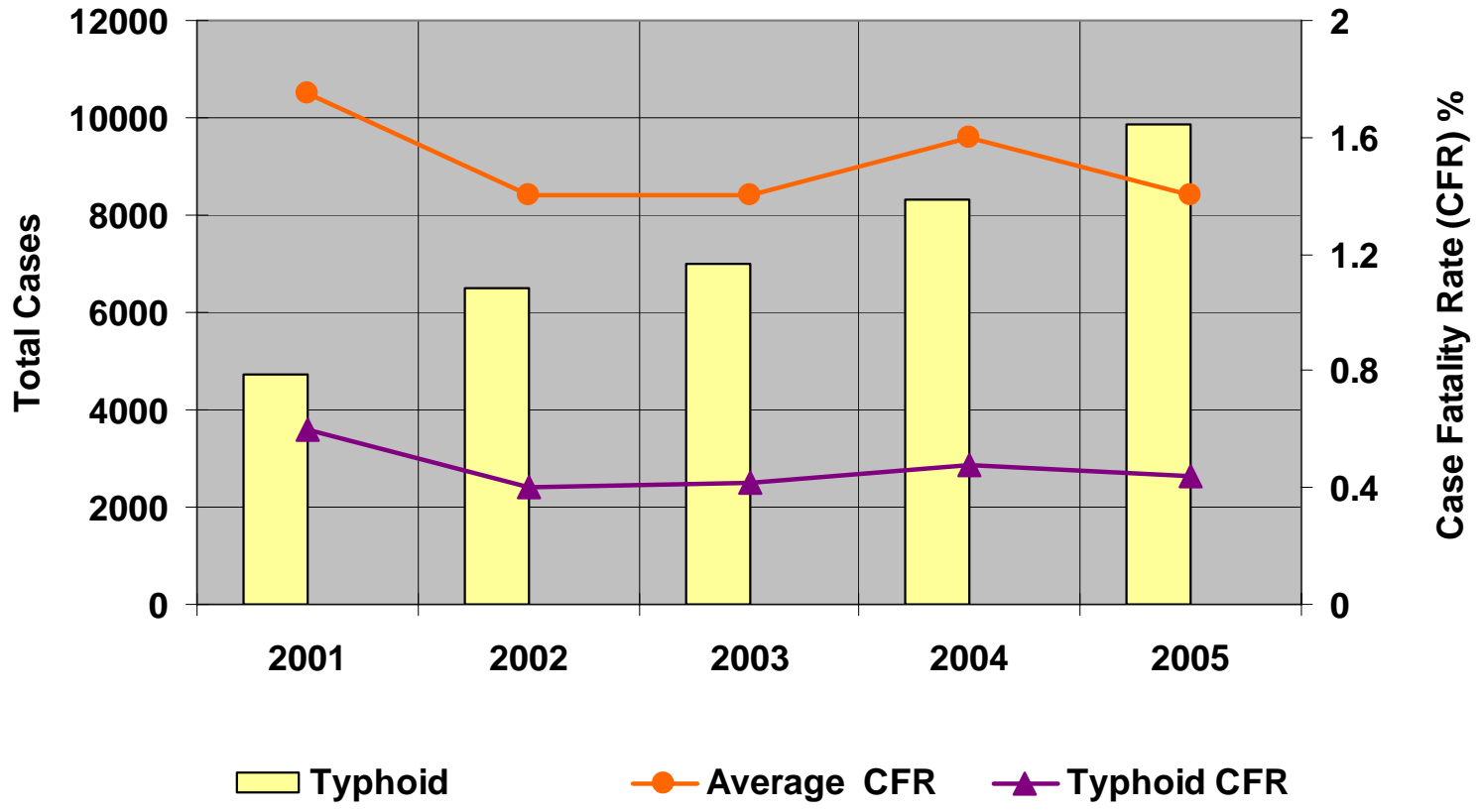
Bacteriological Water Quality of Different Sources Kathmandu valley

Faecal coliform /100 ml	Value as % of Sample Units of 15							
	Dug well	Shallo w well*	Deep well	Spring	Stone spout	Pond	River	Pipe water
0	0	60	80	40	20	0	0	60
1-100	40	30	15	30	40	0	0	20
101-1000	30	5	5	30	40	0	100	20
>1000	30	5	0	0	0	100	0	0

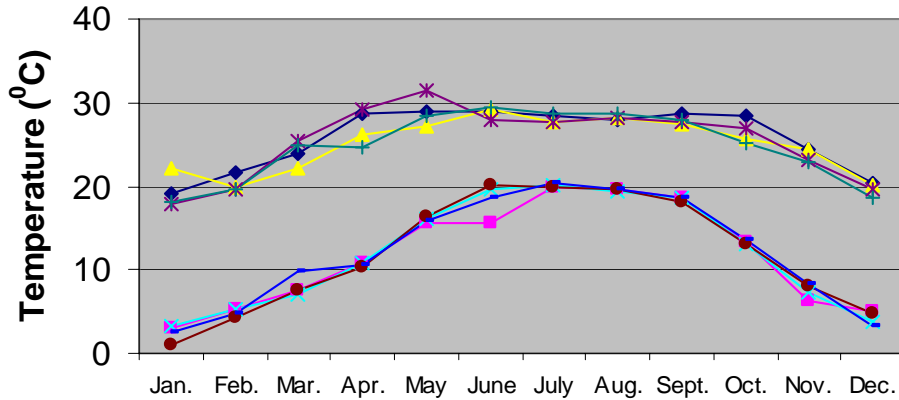
Source: Pradhan (2000); NWSC (2000). *Number Samples = 16.
WHO Guideline value = 0

All the water sources of Kathmandu valley have faecal contamination at various levels

Trend of total inpatient cases of Typhoid disease and comparison of average case fatality rate and Typhoid disease



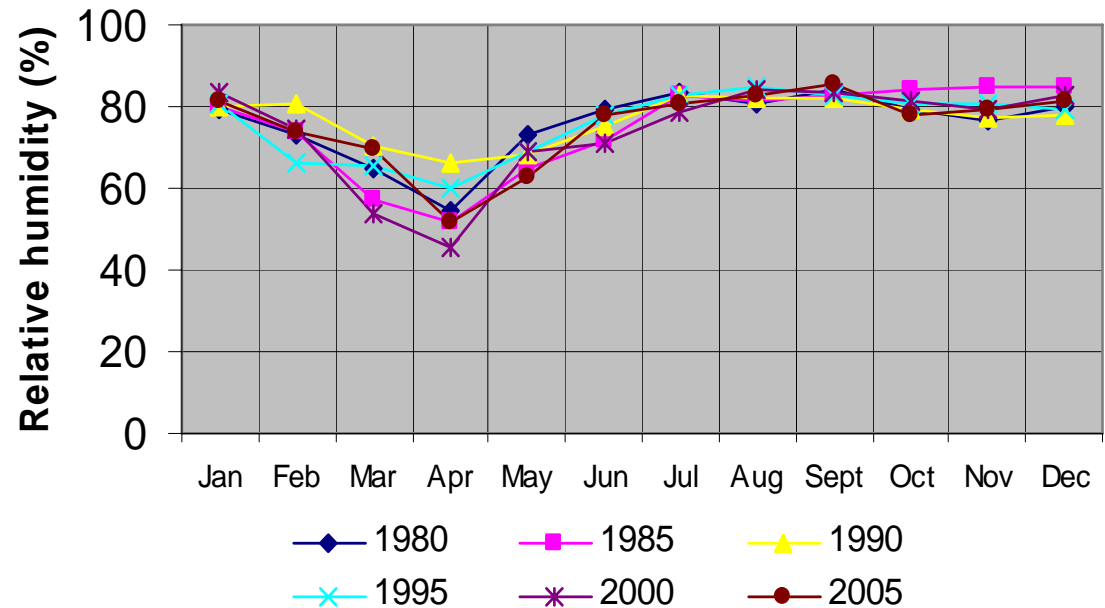
Temperature trend in Kathamndu



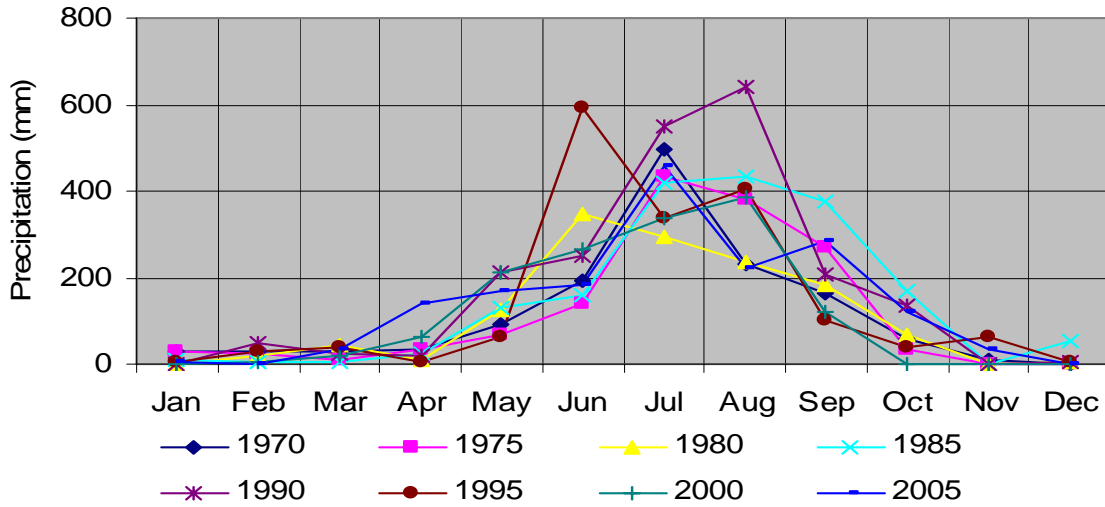
Kathmandu valley

- Winter days less cold
- Frost becoming rare
- Summer warmer

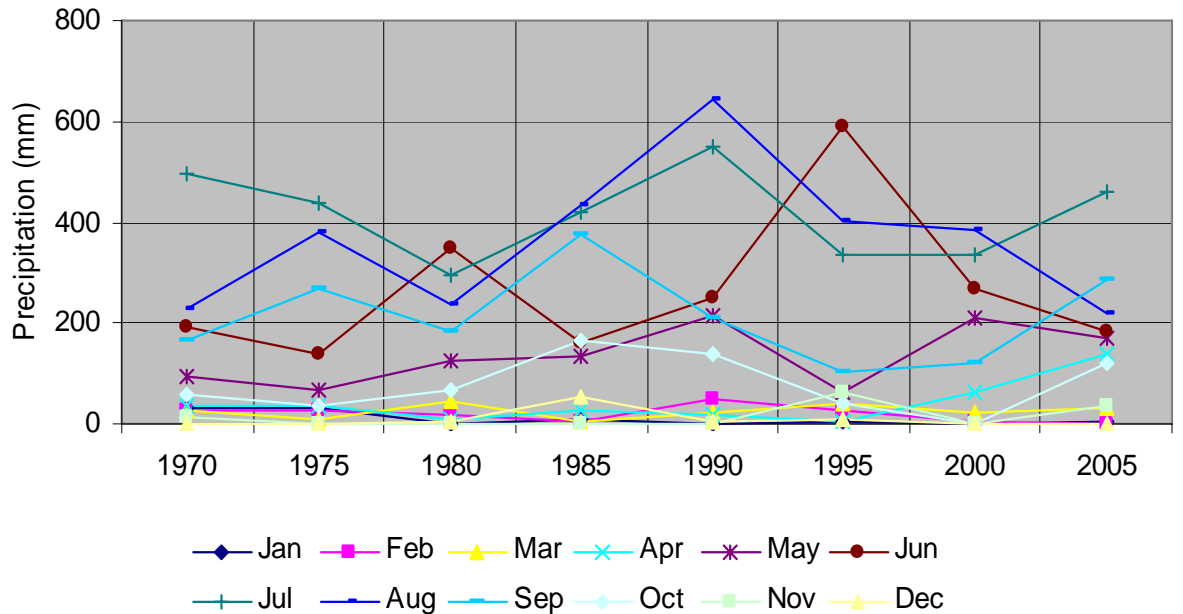
Relative humidity trend in Kathamndu



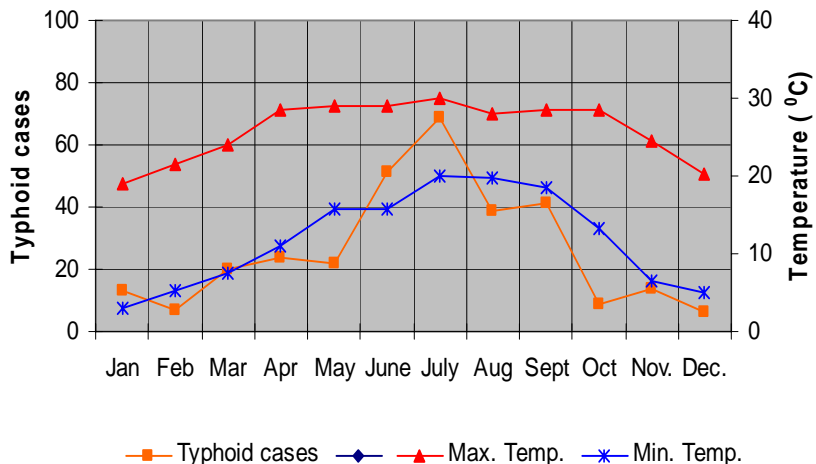
Monthly precipitation change in Kathamndu



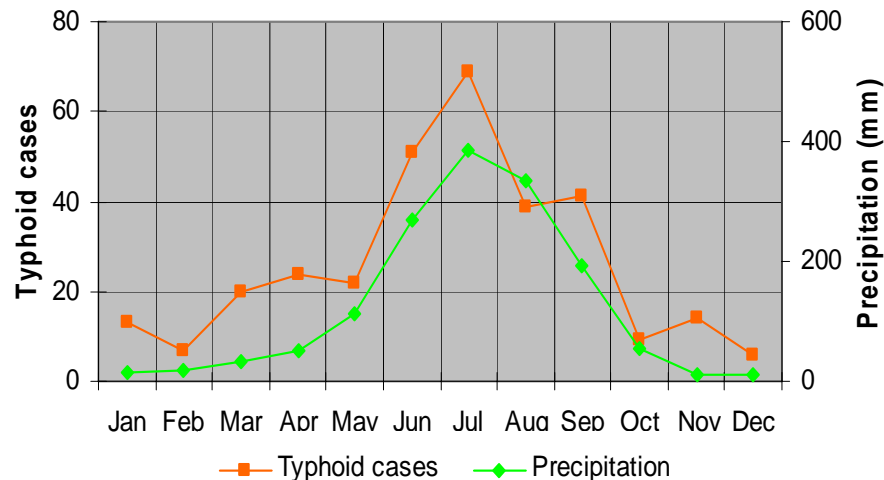
Precipitation trend in Kathamndu



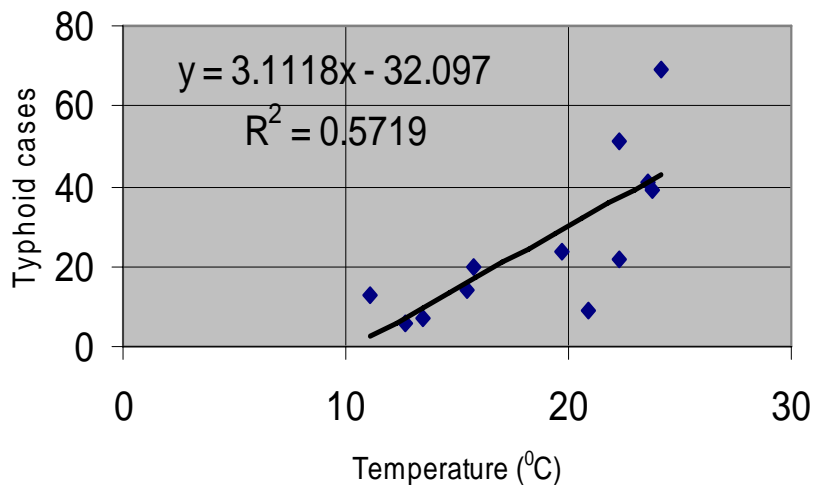
Min and Max Temperature and typhoid cases



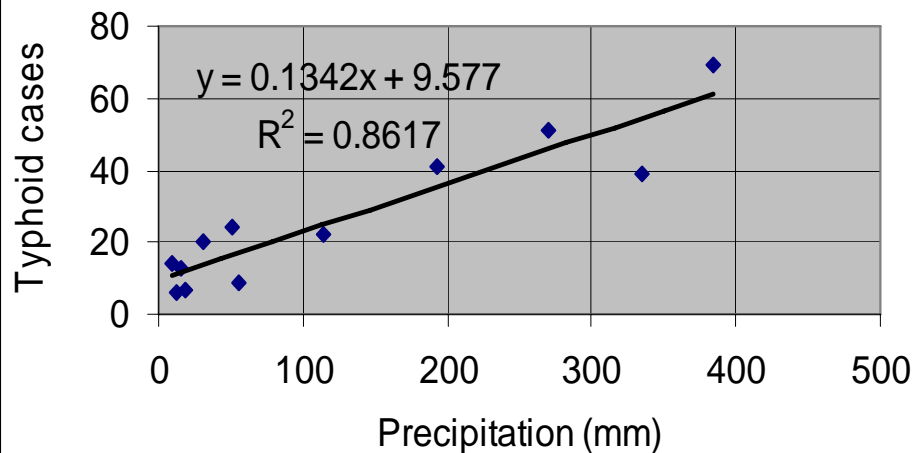
Precipitation and Typhoid cases from Patan hospital



Temperature and Typhoid cases



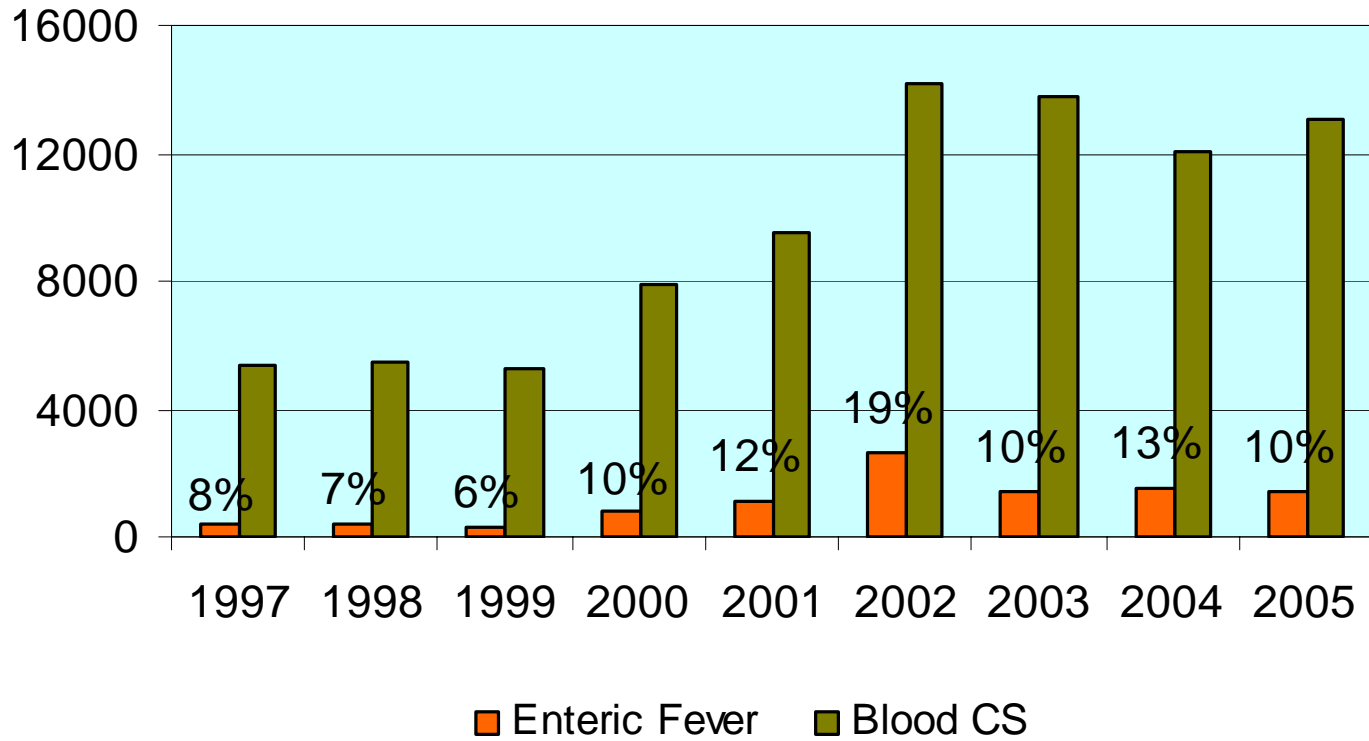
Typhoid cases and precipitation



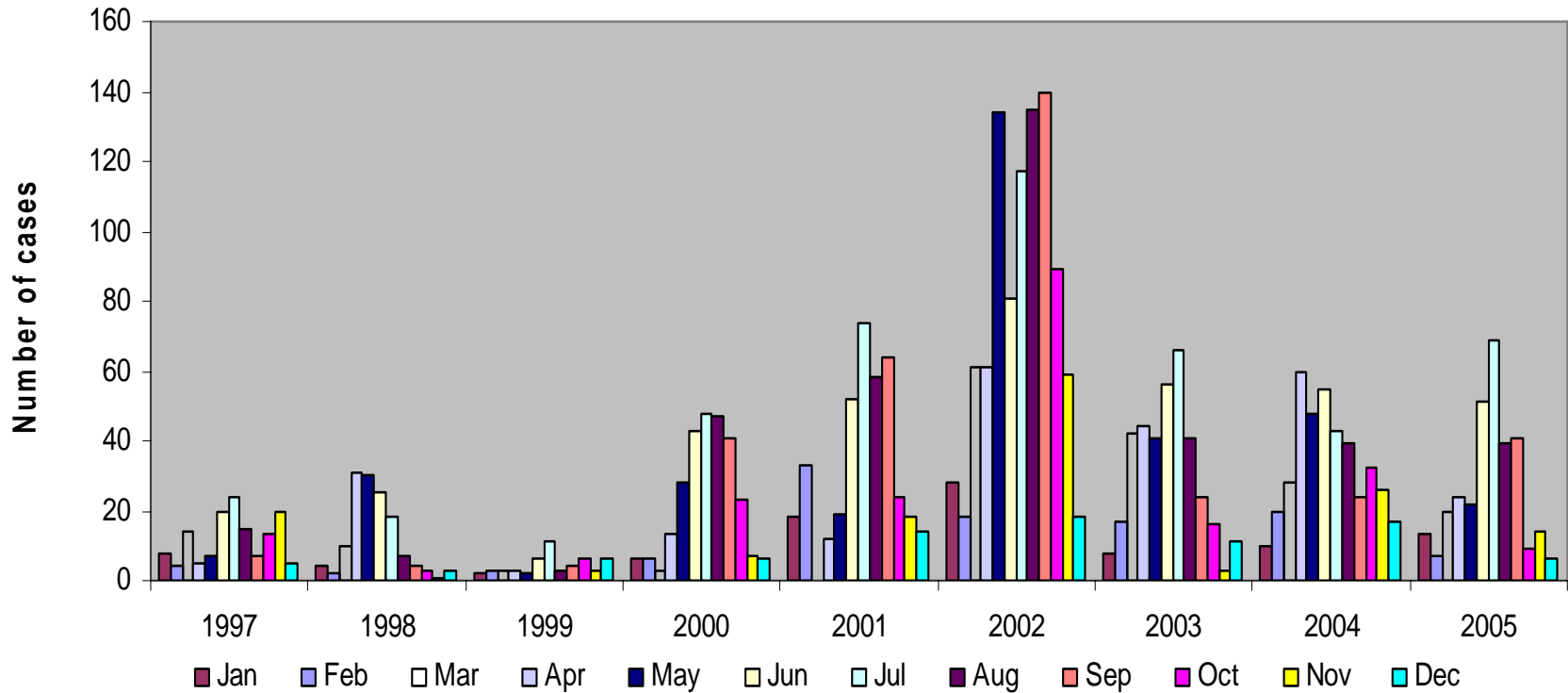
Positive association with temperature, flooding and typhoid case

Blood culture and Typhoid positive cases

Number of blood culture and positive cases



Trend of Typhoid Disease in Patan Hospital



Typhoid cases increased during Winter

Future Concerns

- Undoubtedly, temperature will rise in the coming years (global warming, change in human activities, etc.)
- Changing pattern in the precipitation
- Increase in frequency of drought and floods
- Increase in frequency of vector and water-borne diseases



Future Concerns

- There seems to be a relationship between temperature and precipitation, and vector and water-borne diseases, but their cause and effect relationship requires further studies (to establish relationship)
- Integrated approach for health research and planning (particularly with climatic regions) – health should not be seen in isolation





Thank you