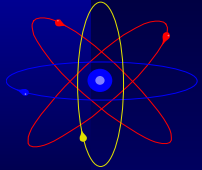


**CHANGING EPIDEMIOLOGICAL PATTERNS
OF *SALMONELLA* serotype ENTERITIDIS
IN BARBADOS:
IMPLICATIONS FOR TOURISM AND TRADE**



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Background

Salmonella serotype Enteritidis (SE)

- Pathogen of global public health concern
- Emerged in 1980's; growing worldwide pandemic
- Leading cause of salmonellosis in most countries
- Poultry and Eggs harbor the organism
- SE contaminates egg contents before the shell is formed
- Intact Shell Eggs : major source of SE
- Raw & Undercooked Egg Dishes : main implicated foods
- Polyclonal: different geographic regions- specific phage type

SE in the Caribbean

- First reported in 1980: Most common *Salmonella* by 1996

Trinidad and Tobago:

- From 1% in 1992 to 69% in 1996
- Since 1995: most prevalent *Salmonella*

Barbados:

- From 3% to 15% from 1990 to 1999
- 2nd most common *Salmonella*, after *S.typhimurium*

Jamaica:

- 11% to 49 % from 1997-1999
- Most common *Salmonella* since 1998

- Multiple hotel outbreaks involving tourists in B'dos & J'ca

SE in Trinidad and Tobago (Indar-Harrinauth et al. 2001)

- Isolation rate/100,000 pop: **0.8** in 1992 to **8.5** in 1996
- Seasonal occurrence: 41% during Dec-Jan.
- Children <10yr: highest rate of infection (25/100,000 pop)
- **Raw & undercooked eggs** : major vehicles of infection
- Main foods: Homemade eggnog, cake batter, ice cream;
raw egg-containing beverages: *reflect cultural customs*
- Refrigerated eggs: protective against SE infection
- PT4 is the dominant SE phage type

Objectives

SE study in Barbados

- determine the occurrence and distribution of SE
- describe the demographic, clinical and socio-cultural features of human SE infections
- define the etiology (cause) of SE infection
- identify the potential sources and risk factors for SE
- recommend appropriate Prevention Measures

Methods

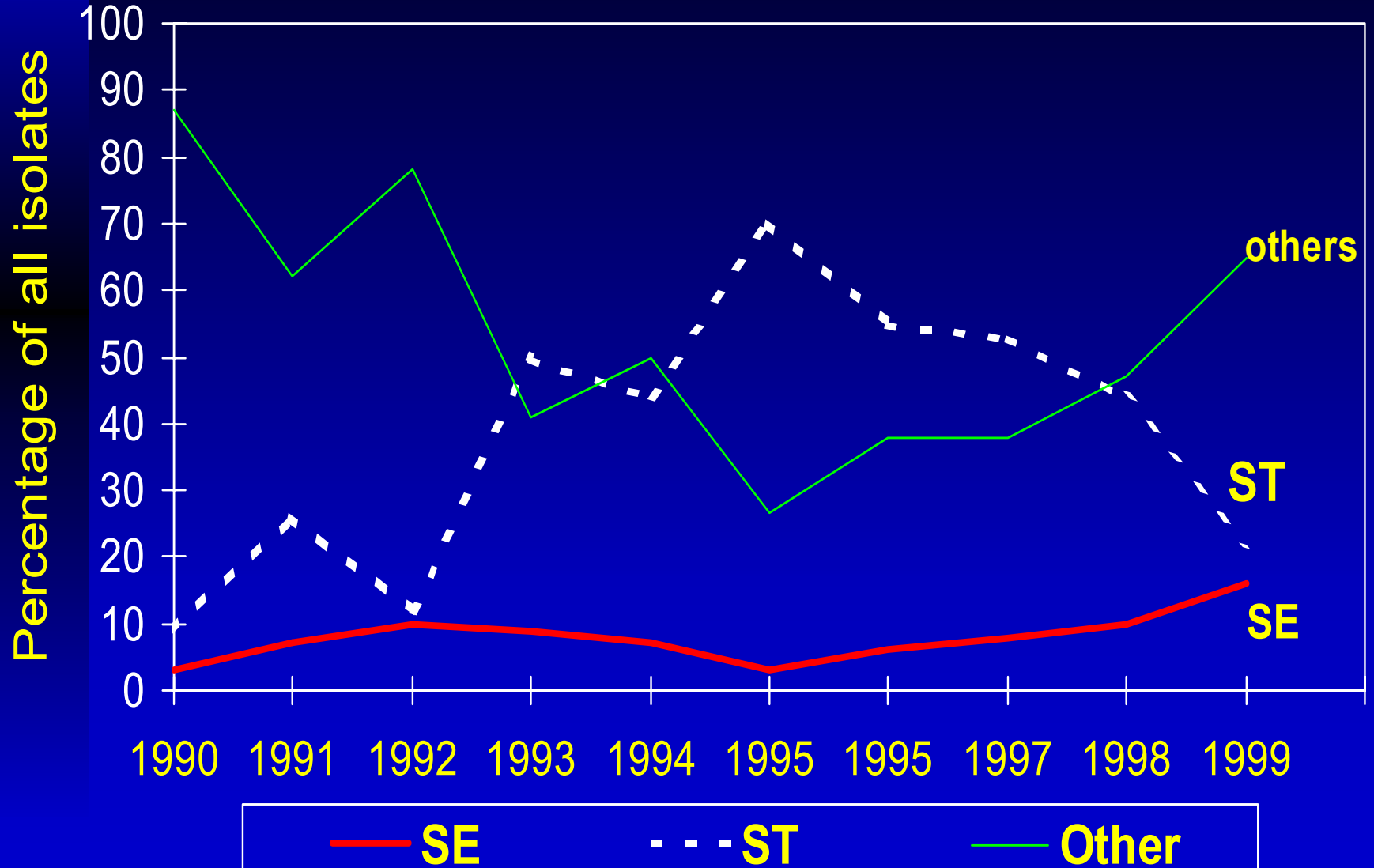
- **Descriptive Epidemiological Studies**
 - **Retrospective** (1996-1998)
 - **Prospective Study** : (Aug '98-Nov 2000)
- **Matched Case Control study** (Feb '99-March 2001)
 - Age -and- neighborhood matched study (2 controls/case)
(age group criteria: <1 , 1- 4, 5-9, 10-19, 20-49,>50)
 - std. questionnaire, face to face interviews
 - signed informed consent
- **Outbreak Investigations**: cohort analysis
- **Statistical Analysis** : Epi- Info 6.04
 - Odds Ratio >1, $p < 0.05$, C.I: >1
- **Serotyping** (Ewing 1986) ; **Phagetyping** (Ward et al.1987)

RESULTS

SE in Barbados

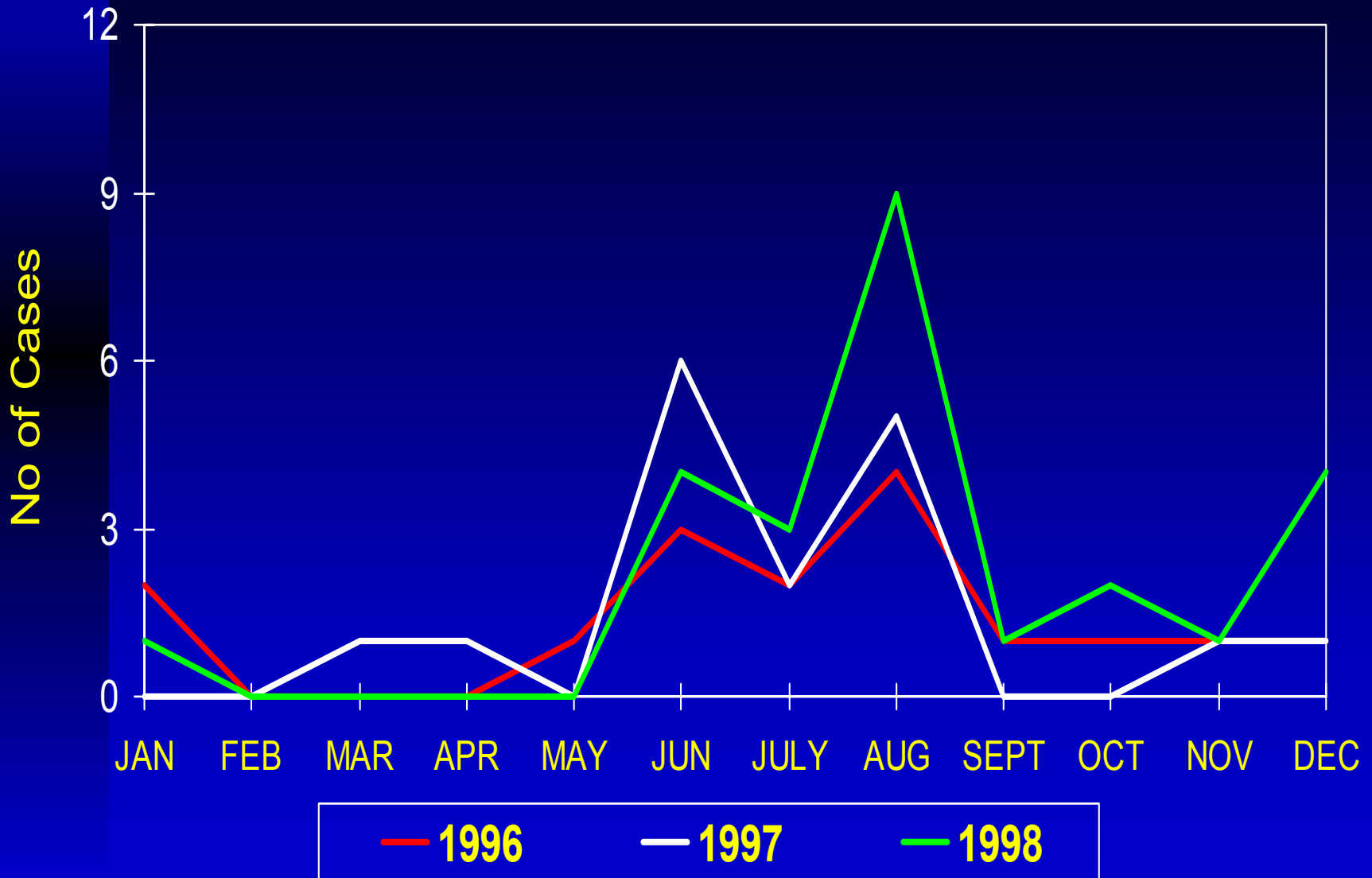
- **10- year Review: 1990 to 1999**
 - Percent increase : 3% to 15%
 - Isolation rate: 1.1 to 10.5 /100,000 pop
- **3-year Review: 1996-1998**
 - SE doubled (6-11%), ST decreased (55-35%)
 - Seasonal variation: 67% in Summer (June-Aug)
 - Children <10yr: 44% of cases ; (39 /100,000 pop)
 - 33% in 20-49 age group; 10% >50 years
 - 61% in 2 parishes (includes main tourist belt)

Salmonella Isolates by Serotype, Barbados, 1990–1999

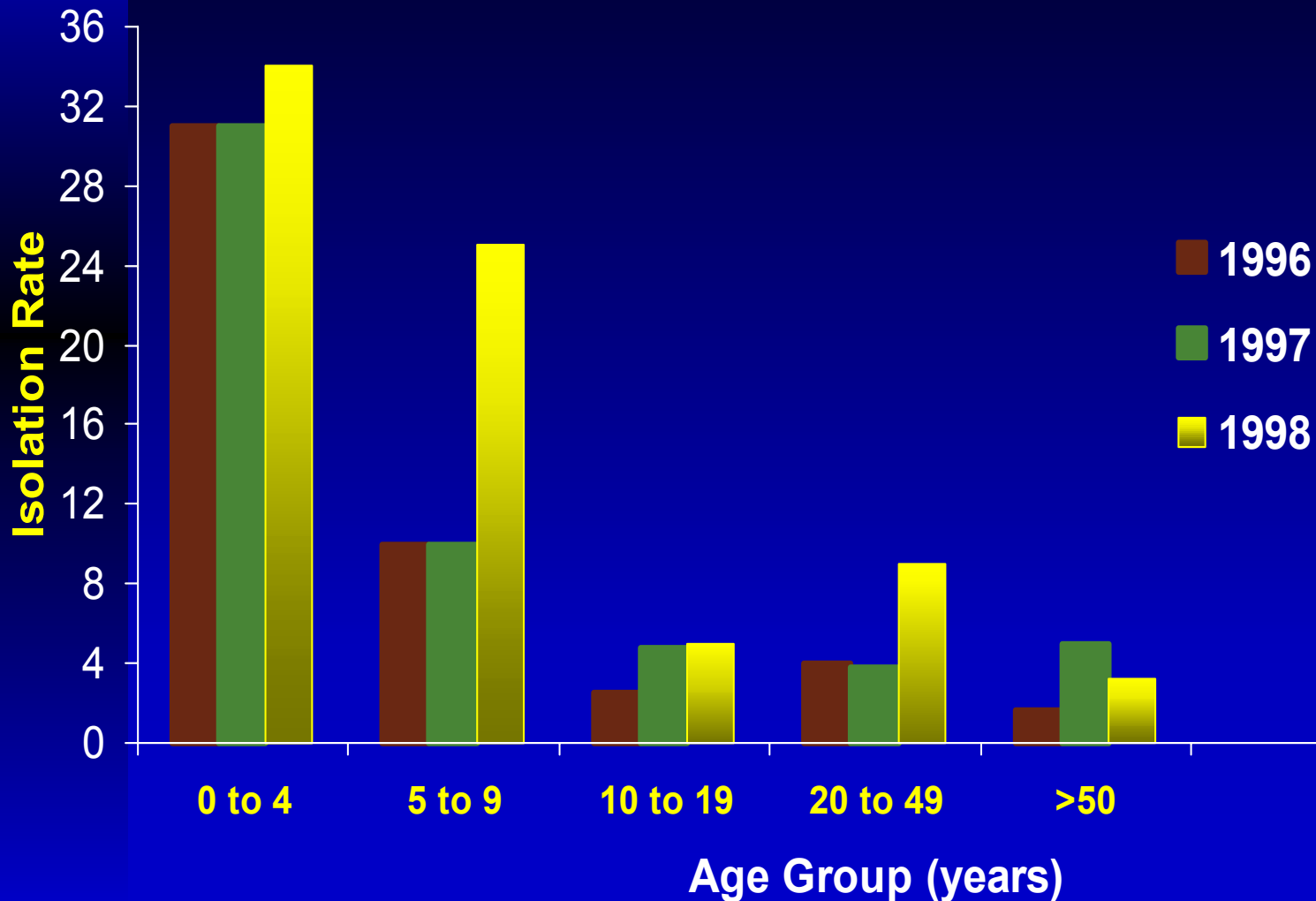


Retrospective Descriptive Study (1996-1998)

SE Isolations by Month, Barbados



SE Incidence by Age Group, Barbados, 1996-1998



Prospective Descriptive study (Aug 98- Nov 2000)

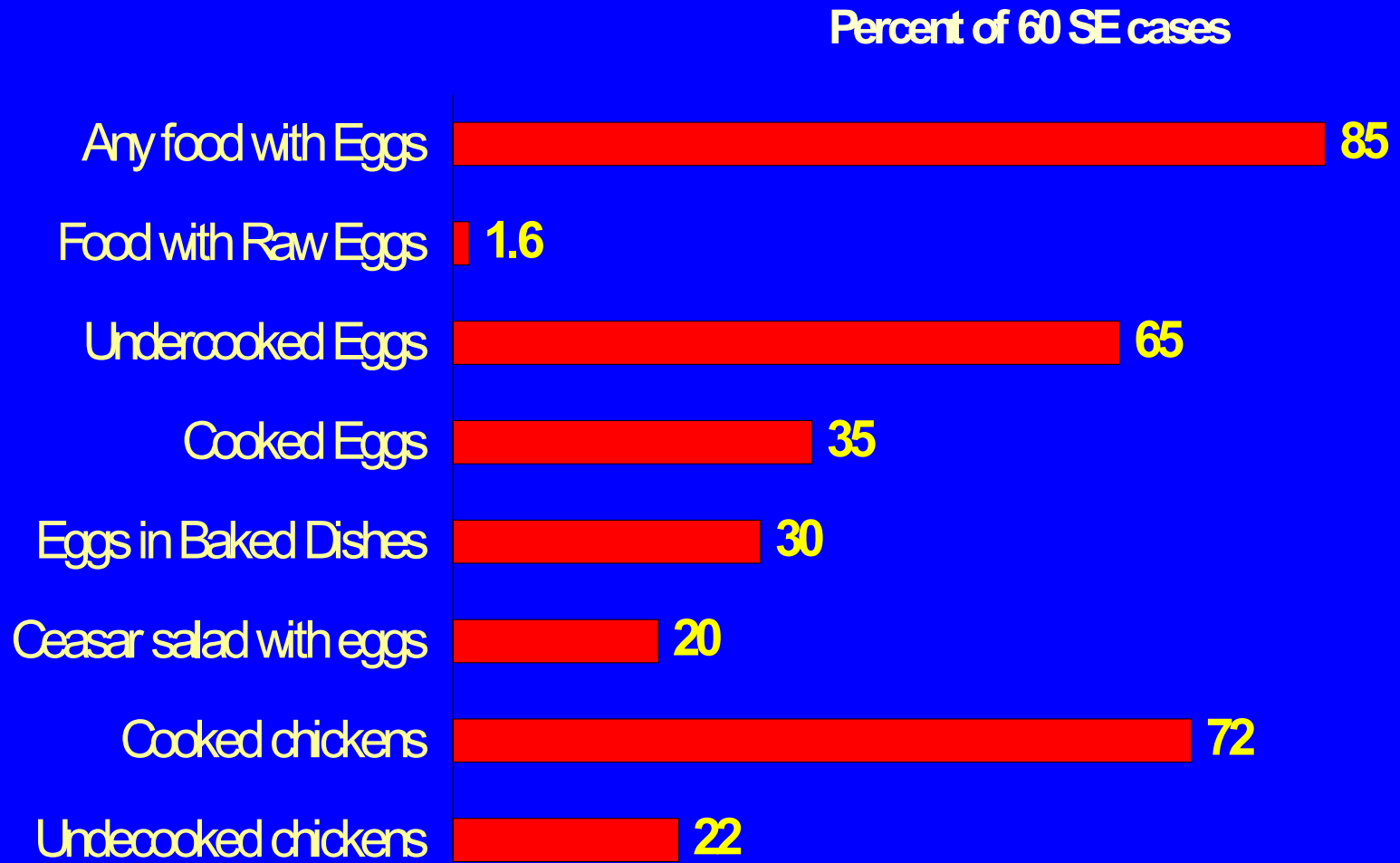
Characteristics of 60 culture confirmed SE cases

Characteristics	Percent of Cases (n=60)
Residents: Visitors	85% : 15%
Children <10 years	49%
Africans: Mixed: Caucasians	85%: 10%:5%
Males :Females	47% : 53%
Ass. with Outbreaks: family: outside	37%: 23%
Hospitalization	32%
Treatment: ORF :IV : Antibiotics	95% : 18 % : 8 %
Underlying Illness	7%
Do not usually Refrigerate eggs home	30%
Do not usually Wash eggs home	71%

Reported Symptoms among 60 confirmed SE cases , Barbados, August 1998-Nov 2000

Symptom	Cases (N = 60)	(%)
Diarrhea	60	(100)
Ab. cramps	53	(88)
Fever	53	(88)
Bloody stool	24	(40)
Vomiting	29	(48)
Nausea	21	(35)
Headache	6	(10)
Chills	5	(8)
Muscle Aches	5	(8)

Foods Consumed by SE cases 3 days before Illness Onset, Barbados, August 1998-Nov 2000



Matched Case Control Study (Feb 99- March 2001)

38 cases: 76 controls

Univariate analysis of selected risk factors for SE infection

Risk Factor	Cases	Controls	mOR	95% CI	p value
Shell Eggs	87%	50%	8.9	2.3-54.	< 0.0001
Undercook Eggs	88%	8%	44.8	7.8-1502	< 0.0001
Soft boiled eggs	51%	5%	31.2	5.2-1103	< 0.0001
Scrambled eggs	21%	2.6%	9.3	1.6-67	0.001
Caesar Salad	16%	1%	7.9	1.4-73	<0.001
Undercook Chicken	39%	3%	8.4	1.8-72	<0.01
Pooling of eggs	24%	5%	3.2	4.5-1101	<0.01

SE Outbreaks (Aug 1998-March 2001)

- 39 SE outbreaks
 - Family: 62%
 - Outside home (restaurants, hotels, fast food): 37%
 - Hotels Outbreaks: 53%
 - Majority: August; main tourist belt region
 - Contributory factors:
 - Poor kitchen and personal hygiene
 - Poor food safety/food handling practices
 - Pooling
 - Cross contamination
 - Lack of knowledge on food safety

SE Outbreaks (Aug 1998-March 2001)

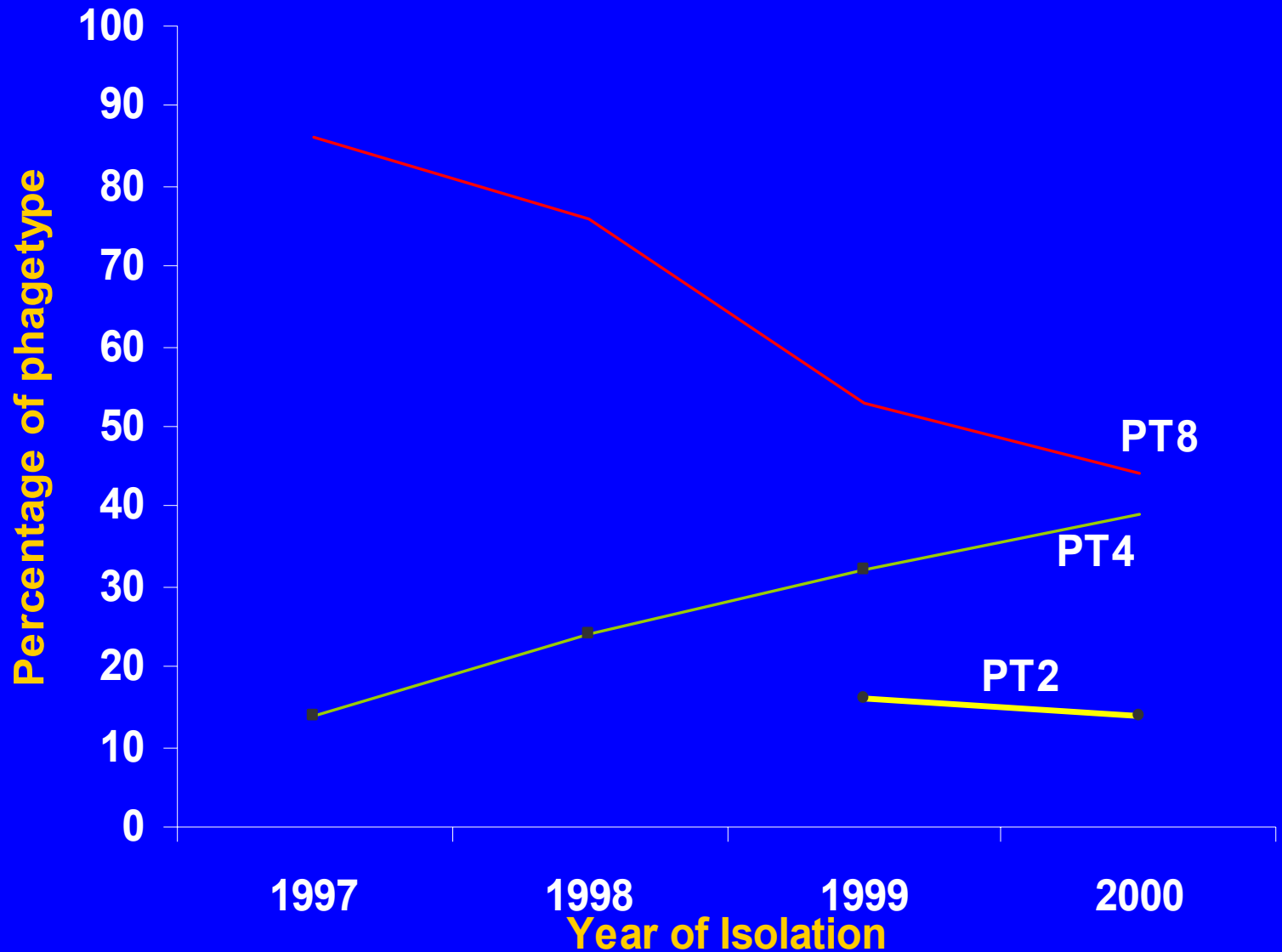
Hotel SE outbreaks

Month	No. ill	Food	PTs
Aug'98	12 (8 visitors)	Caesar Salad(c eggs) Egg-glazed pastries	PT 8
Nov '98	8 (6 visitors)	Scrambled eggs (soft yolk)	PT 8
June '99	5 (4 visitors)	Fried eggs(soft yolk)	PT 4
Aug'99	2 (3 visitors)	U/cooked chicken	PT2
Aug'00	7(3 visitors)	Caesar Salad(c eggs)	PT 8
Jan '01	3(2 visitors)	U/cooked chicken	PT2

Family (home) SE outbreaks

Month	No ill	Food	PTs
Oct'98	4	Soft boiled eggs (pooled)	PT8
Nov'98	2	Raw cake batter	PT 8
Dec'98	8	Soft boiled eggs	PT 4
Feb'99	3	Fried eggs (soft yolk)	PT 8
Mar'99	4	Scrambled eggs	PT 8
April'99	4	Soft boiled eggs (pooled)	PT 8
July '99	5	Undercooked chicken	PT 2
June'00	5	Lasagna (with eggs)	PT4
Sept'00	3	Soft boiled eggs (pooled)	PT8
Nov'00	6	Scrambled eggs	PT8
Jan'01	4	Soft boiled eggs (pooled)	PT8

Phage types of human SE isolates Barbados, 1997-2000



Conclusions

- SE infection in Barbados is associated with
 - undercooked eggs (mOR 8.4, CI 6.8-1937)
 - undercooked chickens (mOR 8.2, CI 1.5-73.6)
 - 1st time undercooked chicken :SE source in C'bean
- Main foods: Soft boiled eggs, scrambled eggs and fried eggs(soft yolk), caesar salad
- PT 8 predominate in Barbados, followed by PT4 and 2
 - first time PT2 identified in C'bean
- SE outbreaks and cases -involved visitors:
 - serious implications for tourism and trade

Epidemiology of SE in Barbados vs Trinidad

- Although both egg associated, different foods
- Different cultural practices
 - Raw egg foods and drinks not common in Bdos
 - Refrigeration
- Chickens not found as A SE source in T &T
- Different seasonal occurrence
- Visitors: 15% cases in Bdos, none in T&T
- Different PTs: different entry source of for SE
- Hotel outbreaks and Tourism
 - use of imported table eggs and chickens

Recommendations

SE in Bdos: Implications for Health, Food Safety, Trade, Tourism

- Farm to Table approach for prevention and control
- Improvement in Surveillance and Response, Outbreak Inv
- Public Health Education: targeted to Specific groups
 - Thorough cooking of all egg-containing dishes
 - Thorough cooking of chicken-containing dishes
 - Avoid pooling of eggs
 - Refrigeration of eggs at home
- Reduction of SE in flocks
 - Hatchery surveillance; environmental testing , traceback
- Regulate importation of table eggs, feeds and chickens
- Virulence studies on SE PTs