

Possible effects of climate change on food & waterborne illness

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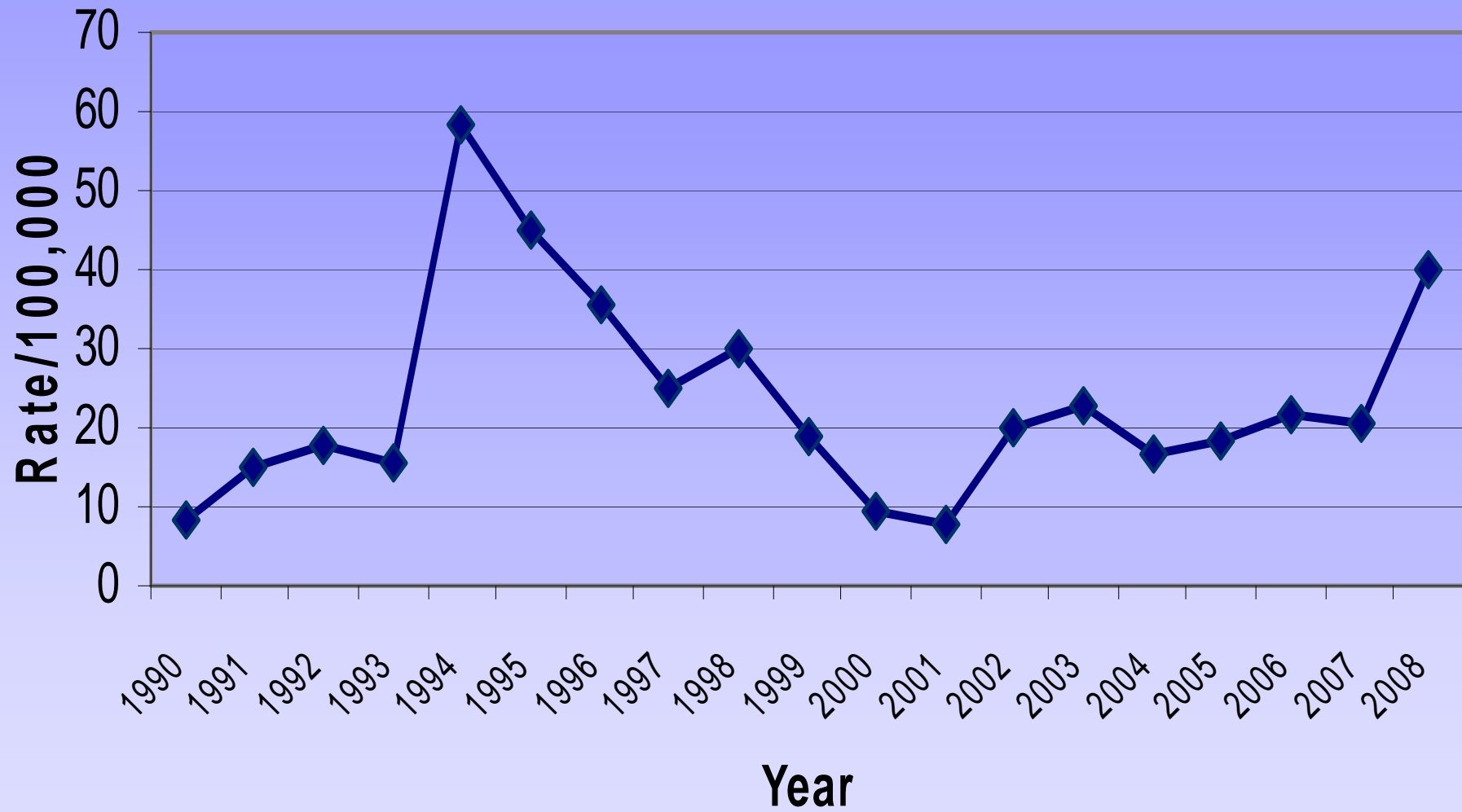
Why is Salmonella Important?

- The 2nd commonest pathogen causing FWD in EU¹
- 71% of all laboratory confirmed OB in EU²
- 160,649 confirmed cases in EU in 2006¹
- Salmonella causes 1.3 million illness & 500 deaths/year in the USA³

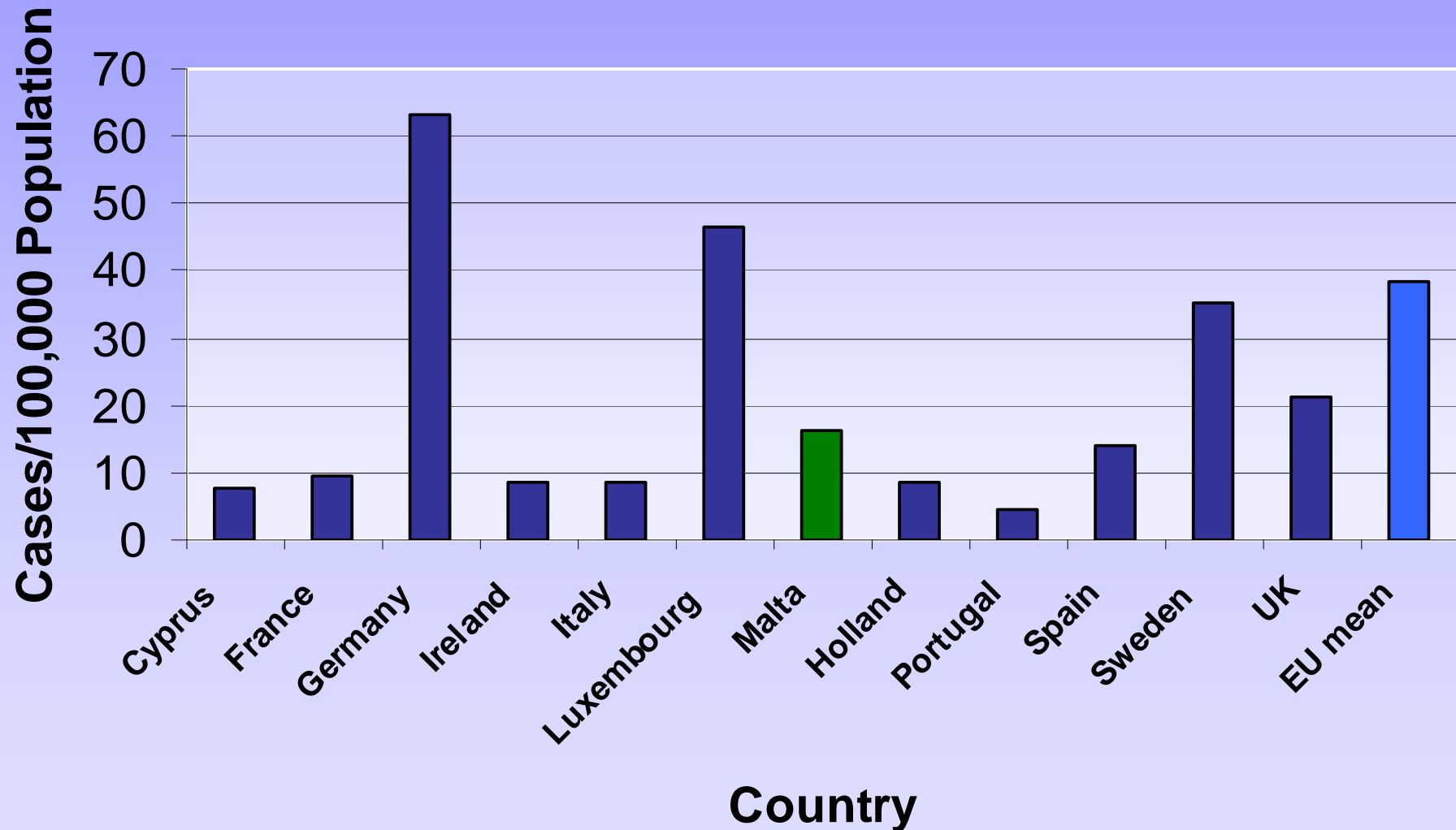
- *S. Enteritidis* & *S. Typhimurium*^{1,2} – predominant serovars causing human infections

- Major sources^{1,7}: *S. Enteritidis* – eggs/poultry meat
S. Typhimurium – pigs, poultry & bovine meat

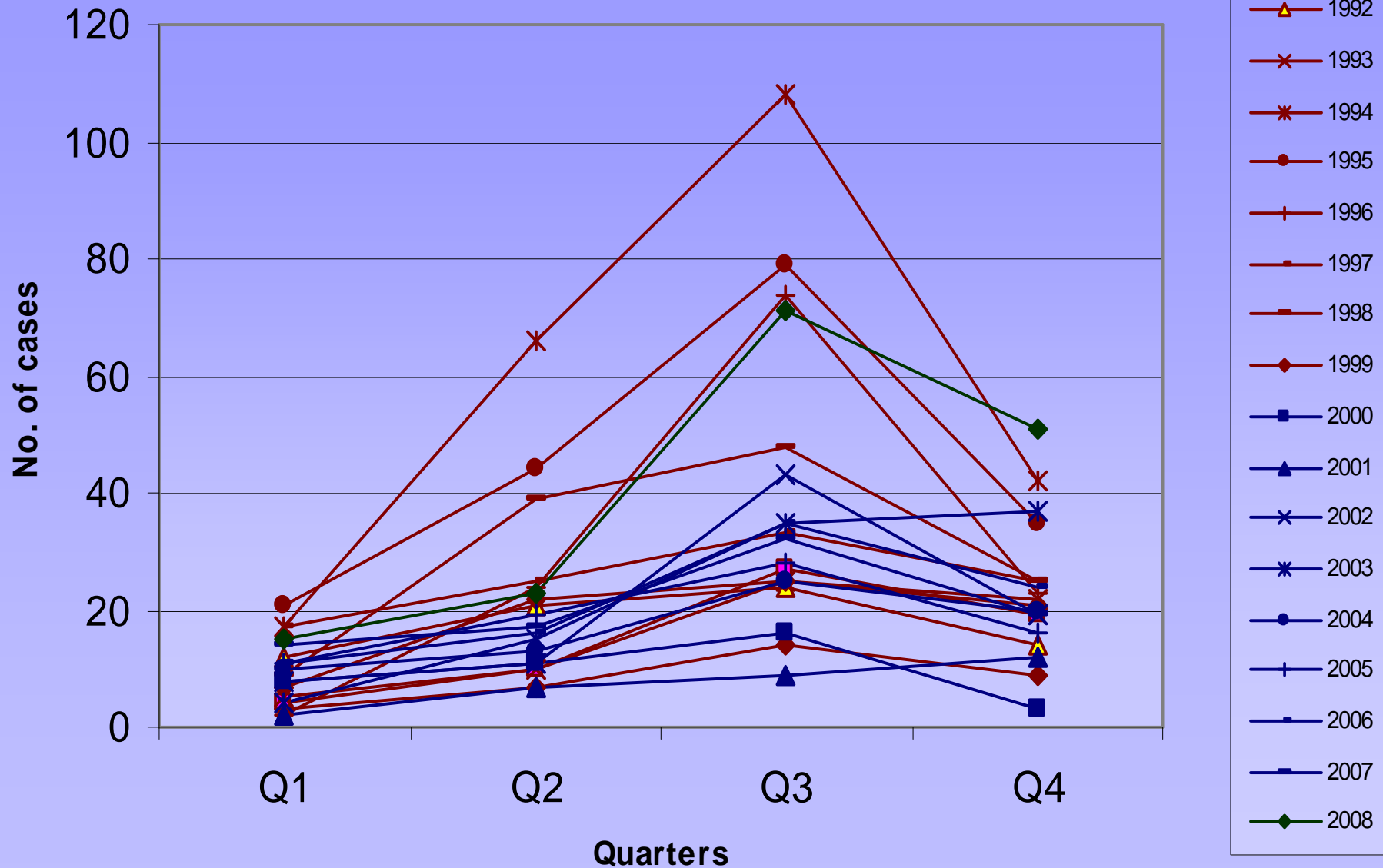
Reported Salmonella Cases in Malta 1990-2008⁹



Reported Salmonellosis Cases in Humans in Some EU Countries 2005^{9,7}



Salmonella/Quarter 1990-2008 in Malta⁹



Salmonella Growth

- Salmonella grows at room temperatures
- Temperature misuse of food is a major risk factor ^{4,5,6}:
 1. Inappropriate storage
 2. Inadequate cooking
 3. Preparation of food too far in advance
- The effect of temperature on growth of salmonella in food is now better understood¹⁰
- Laboratory rate of salmonella growth directly related to temperature range of 7.5 - 48°C (optimum 37°C)¹¹

Foodborne Illness & Temperature^{8,15}

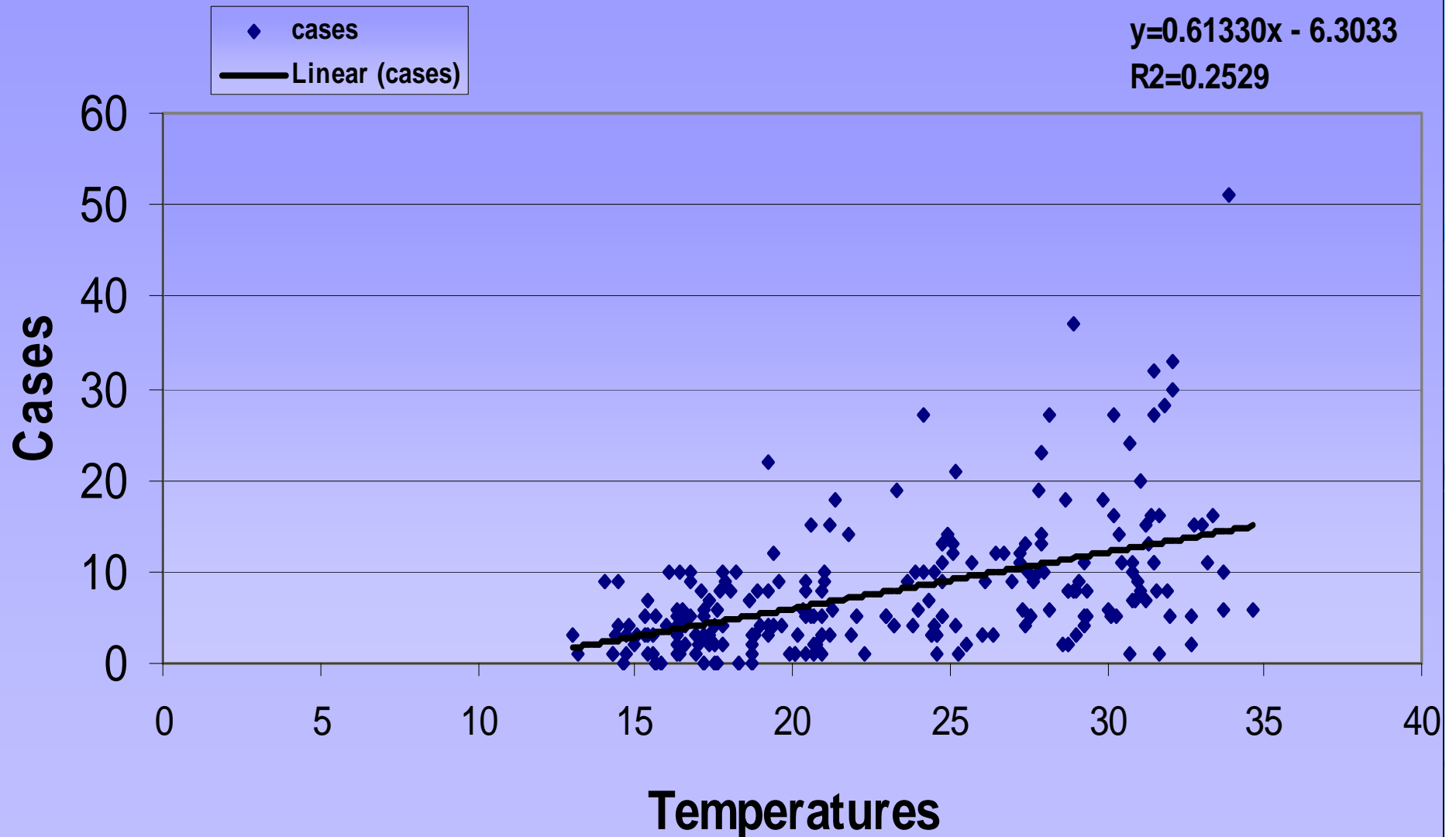
- **Time series analysis in 10 European populations* comparing atmospheric temperatures and number of salmonella**
 - **Clear & linear association between temperature and no. of salmonella cases in most countries**
 - **Threshold ($>7.5^{\circ}\text{C}$) present in some countries studied**
 - **The relationship is linear in most countries**
- **Compared the effect of temperatures in the previous 2 months on disease**
 - **Lag time effect of a rise in ambient temp & onset of disease was max in the first week and diminishes up to 5 weeks (UK)**
- **Temperature influences transmission of infection in about 35% of all cases in most of the studied countries**

* Poland, Scotland, England & Wales, Estonia, The Netherlands, Czech Rep, Spain, Switzerland, Denmark, Slovak Rep

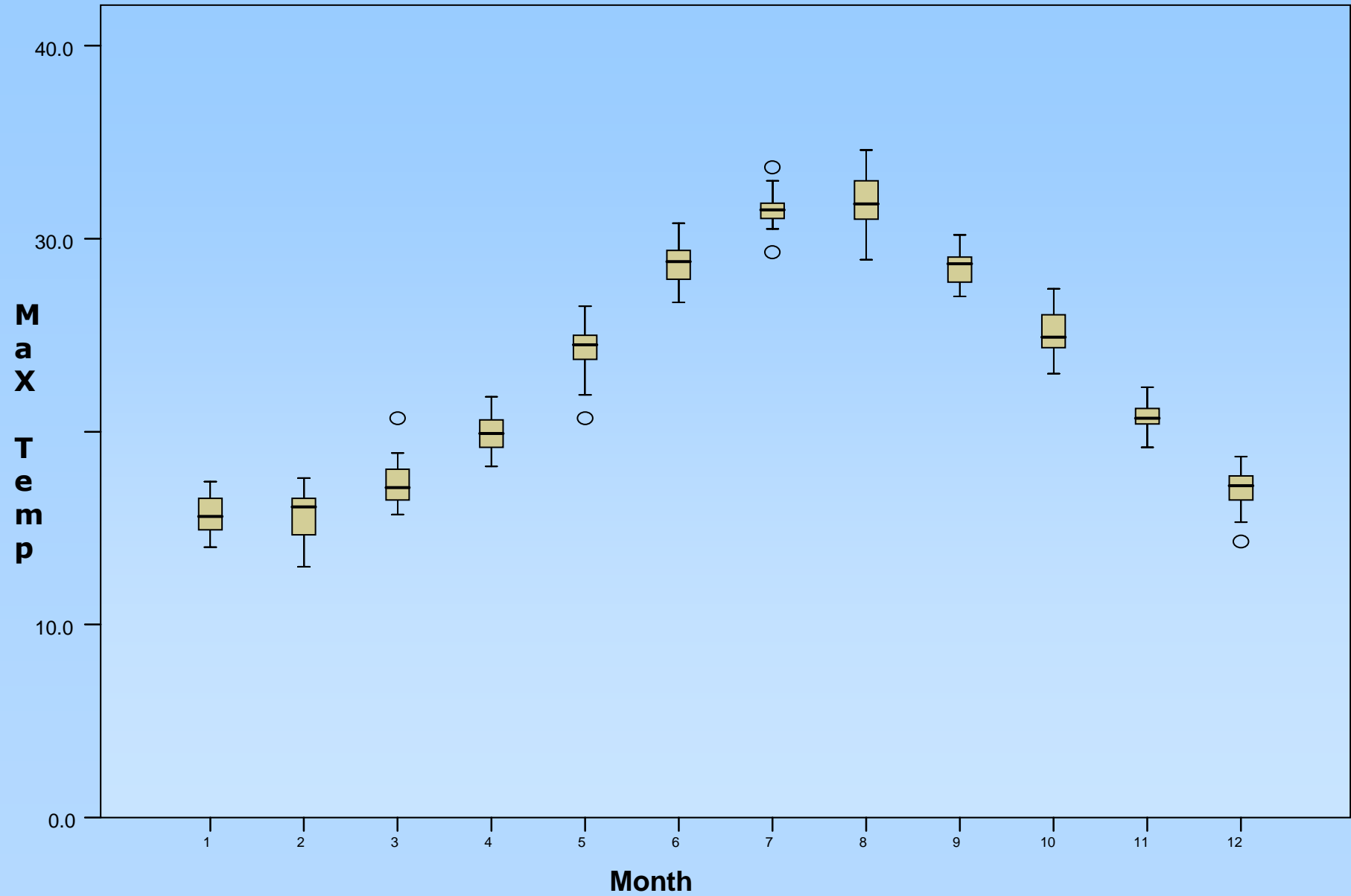
Foodborne Illness & Temperature

- Five Australian city study¹²: a clear linear relationship and lag period of 1 month;
 - No threshold temps were found;
 - 5-10% case rise/ °C rise in ambient temp.
- The Netherlands, 2003 – 50% rise *S. Enteritidis*;
 - 12.6 % rise in cases/°C attributed to temperature effect;
 - Lag time effect largest 1st week before tailing off up to 5 weeks;
 - Rise also noted to be due to increased importation of eggs from other EU countries.
- In contrast the effect of temp. rise on campylobacter transmission is weak¹⁴
- Food poisonings significantly related to ambient temp. above 7.5°C in the same month & previous month ^{16,17}
- Regional studies in UK: no association with relative humidity and amount of rainfall⁸.
- IID in Malta correlated with peak summer temperatures(2005)

Scatter plot of Salmonella Cases and Temperatures 1990 - 2008 in Malta



Salmonella Cases (aggregates 1990-2008) per Month with Maximum Temps.



Association Between Cases & Ambient Temperatures

	Cases		Cases		Cases
Average temp	0.5124	Min temp	0.5238	Max temp	0.5029
Average temp: 1 month lag time	0.4936	Min temp: 1 month lag time	0.4807	Max temp: 1 month lag time	0.5003
Average temp: 2 month lag time	0.3302	Min temp: - 2 month lag time	0.3032	Max temp: 2 months lag time	0.3490

- Pearson's correlation coefficient values. Stat 2 package

Limitations

- Small numbers
- Under-reporting
- Late notifications
- Variations in surveillance over time
- Improved laboratory techniques
- ?Physician heightened awareness on investigations

Conclusions

- Higher & sustained temperatures for longer periods of time are likely to lead to increasing cases of salmonellosis.
- The time lag of 1 -4 weeks of rising salmonella cases suggests that temperatures might be influential earlier in the production phase¹¹!
- New and sustained strategies are needed to combat rising salmonellosis.

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