

Wet Weather Epidemiology Study



Problem Statement

- **Most beach water quality problems in dry weather have been addressed in So Cal**
- **Wet weather is more problematic**
 - **Bacteria exceedences are regional, not local**
 - **Cost of compliance is estimated in the \$billions**
- **Not clear whether there is a health risk**
 - **Epidemiology studies all conducted in the summer**

Our Study Questions

- Is surfing associated with an increased risk of illness?
- Is illness risk greater when surfing following wet weather compared to dry weather?
- What is the association between *Enterococcus* and illness following wet weather events?
- What level of *Enterococcus* corresponds to the same risk of illness as current water quality objectives?

Our Study Answers

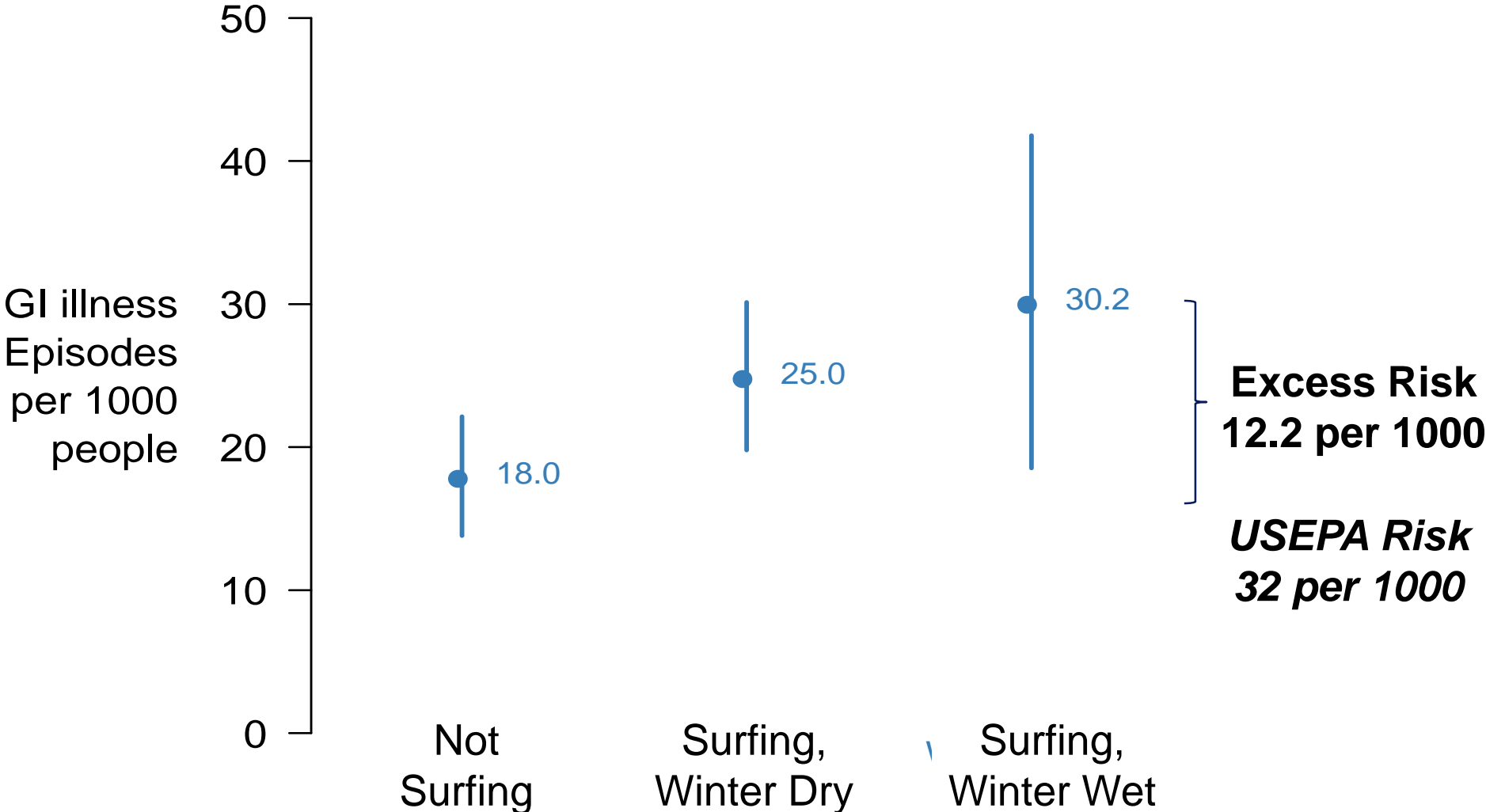
- There is an increased risk of illness associated with surfing
- Illness risk is greater when surfing following wet weather compared to dry weather
- There is an association between *Enterococcus* and illness following wet weather
- The illness risk is lower than *Enterococcus* quality objectives would predict

Study Approach

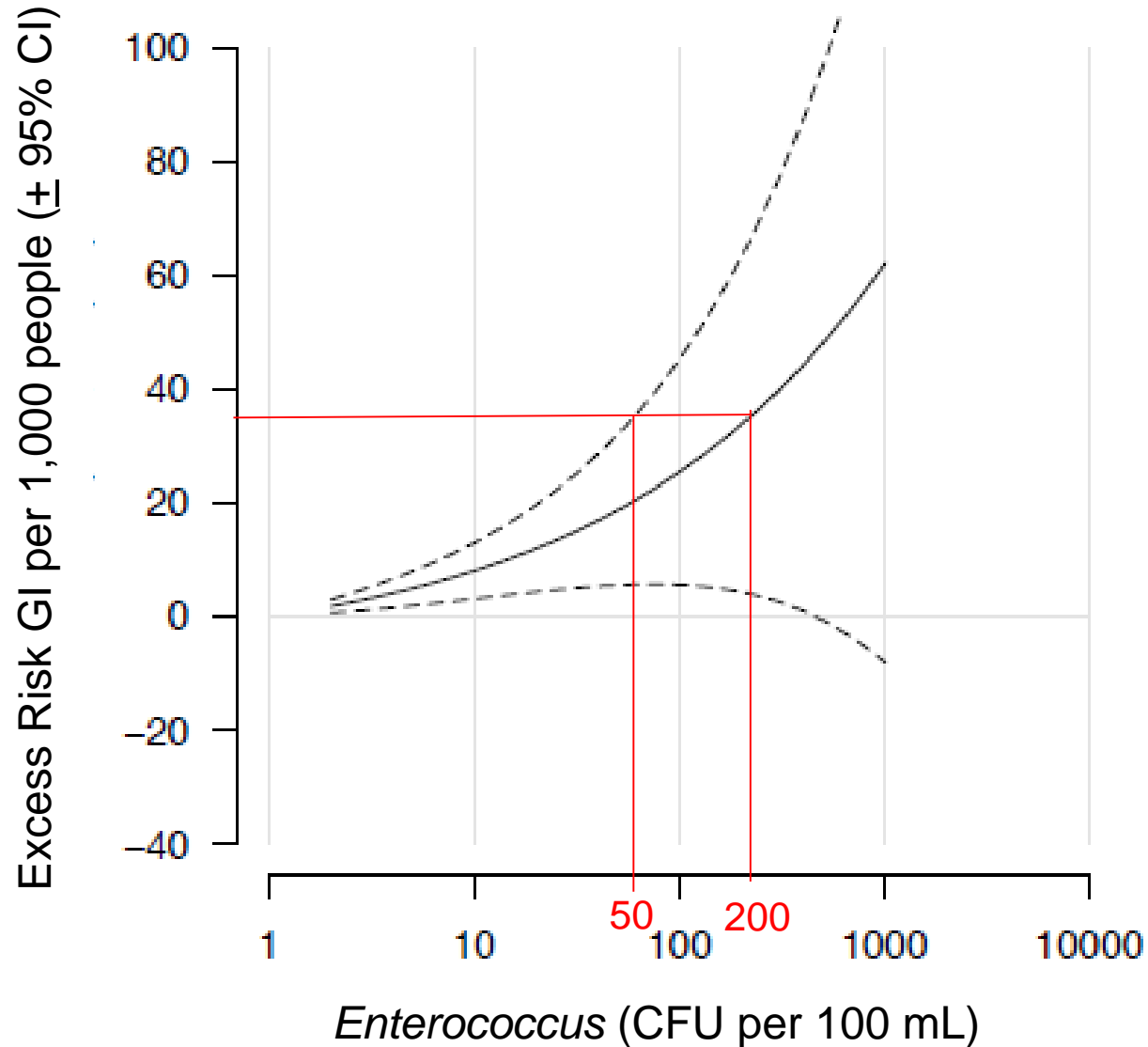
- **Recruited 650 surfers across any San Diego County beach**
 - Daily surfing activity and 12 health symptoms
- **More than 33,000 days of follow-up and 10,000 surf sessions**
 - Compare illness rates when surfing vs. not surfing
 - Compare illness rates surfing in dry vs. wet weather
- ***Enterococcus* relationships at 2 beaches**
 - Ocean Beach and Tourmaline Surfing Park
 - Collect beach water quality daily
 - Collect discharge during storm events



Cumulative Incidence of Gastrointestinal Illness



Gastrointestinal Illness, Wet Weather



Next Steps

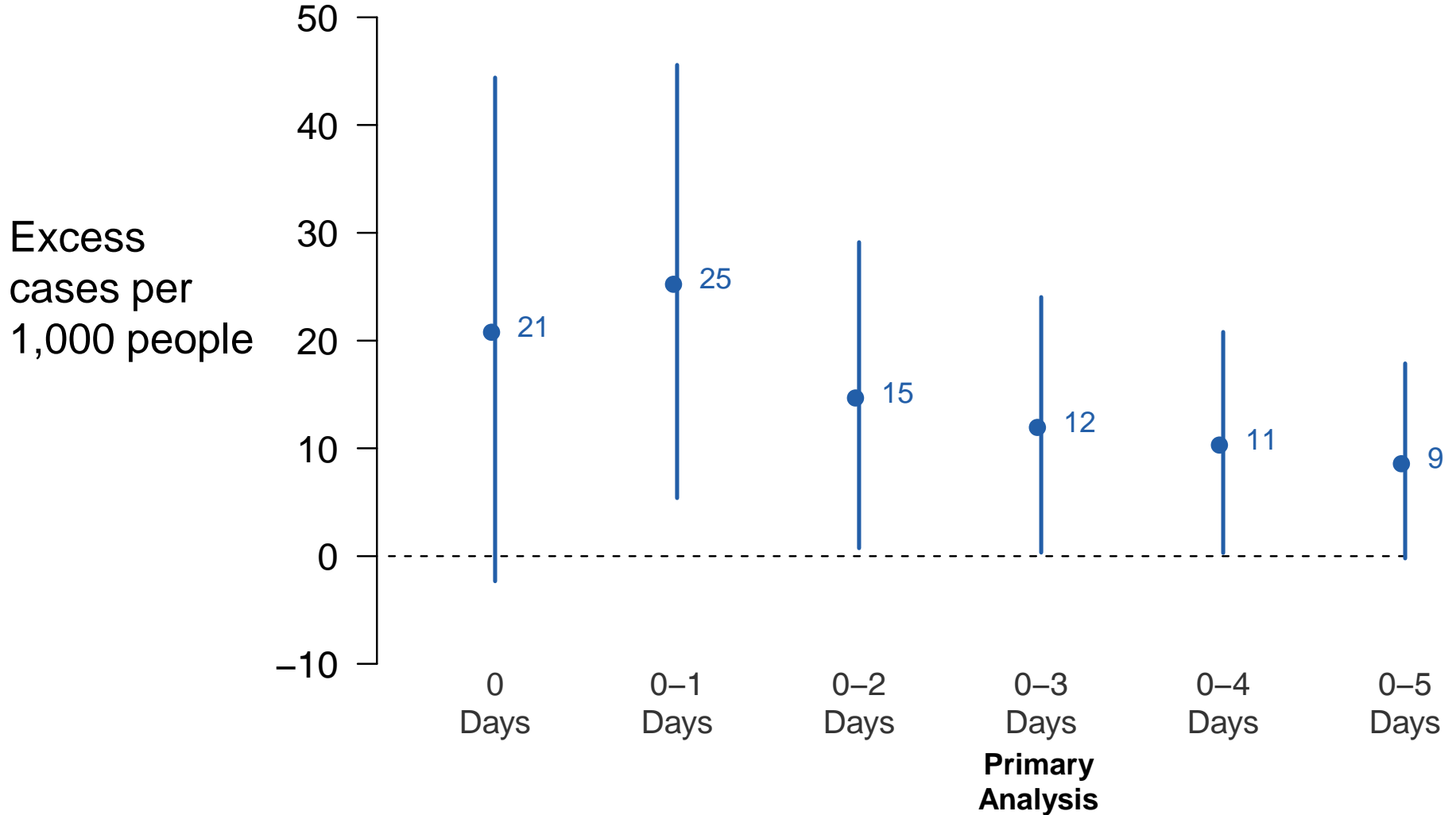
- **Enhanced source identification**
- **Ability to extrapolate**
 - Quantitative Microbial Risk Assessment (QMRA)
- **Economics analysis**
 - Cost benefit scenarios
- **Time-specific thresholds**
 - Wet weather criteria/TMDL targets based on allowable risk

Pathogen and Human Marker Detection Frequency in Storm Runoff Discharges

	Noro-virus	Adeno-virus	Entero-virus	<i>Campylo-bacter</i>	<i>Salmo-nella</i>	Human Marker (HF183)
San Diego River	96%	22%	0%	100%	25%	86%
Tourmaline Creek	72%	9%	0%	45%	9.5%	95%

Excess Risk in Wet Weather vs. Unexposed

Varying Wet Weather Window Definition
Days Since Rain >0.1in / 24hr



GI illness rates By Storm Size

