Health Risk of Bathing in Southern California Coastal Waters

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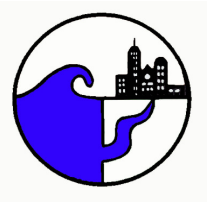
Coastal Water Research Group



Reference:

Brinks, MV, RH Dwight, ND Osgood, GS Kumar, DJ Turbow, M El-Gohary, JS Caplan, JC Semenza; 2008, Health risk of bathing in southern California coastal waters, *Archives of Environmental and Occupational Health*, 63(3):123-135

OBJECTIVE

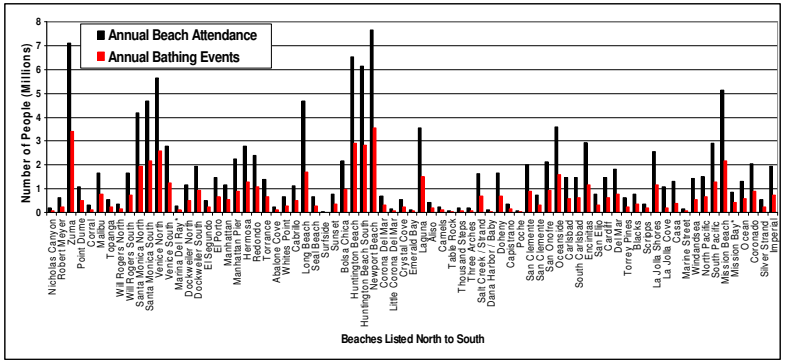
To investigate the number of gastrointestinal and respiratory illness episodes due to contamination among bathers at southern California beaches with a simulation model utilizing water quality, beach attendance, and bathing rate data, along with three published concentration-response relationships.

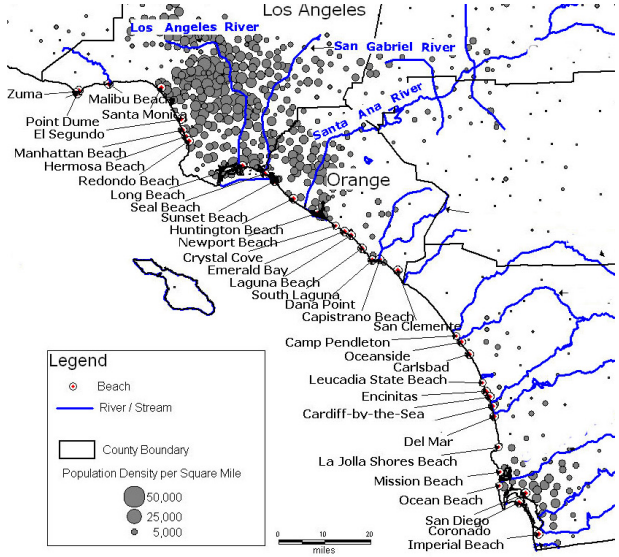
METHODS

Beach Attendance and Bathing Event Data

Citation: Dwight RH, Brinks MV, SharavanaKumar G, Semenza JC, Beach attendance and bathing rates for Southern California beaches, *Ocean and Coastal Management*, 2007, 50:847-858

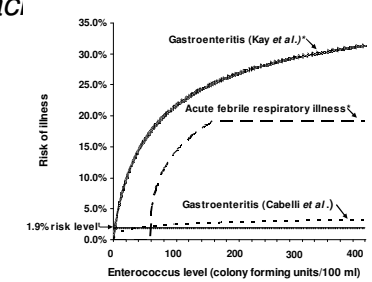
- ***5 years of daily beach attendance data; 3 years of daily exposure rate data***
- *75 beaches investigated*
- *129 million beach visits per year (60% of all beach trips in U.S.)*
  - *Exposure pattern: 45% of visitors engaged in recreational water contact*
  - *Over 56 million swimming events per year at southern California beaches*





Water Quality Data

- ***5 years of Enterococcus data***
- *185 monitoring stations – 67 beach*



Simulation Modeling

- ***EPA Model (Cabelli)***
- ***WHO Model (Kay)***

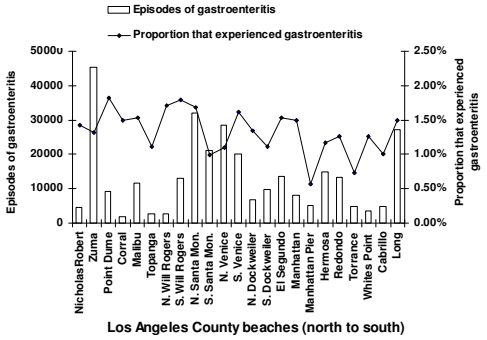
RESULTS

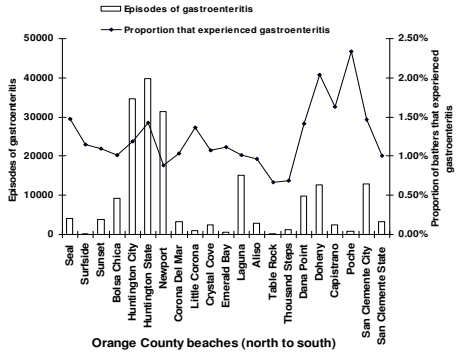
Estimated Number of Illnesses and Disease Incidence Among Beach Bathers in Southern California, 2000-2004

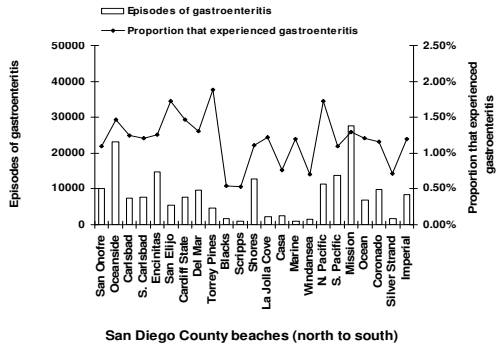
	Concentration - response relationships		
	Gastroenteritis (Cabelli *et al.*)	Gastroenteritis (Kay *et al.*)	Acute Febrile Respiratory Illness
Episodes of illness			
Annual	689,000	4,003,000	693,000
Summer (%)	551,000 (80)	3,060,000 (76)	398,000 (57)
Winter (%)	138,000 (20)	943,000 (24)	295,000 (43)
Annual, when enterococcus level < 35 cfu/100ml (%)*	491,000 (71)	2,434,000 (61)	0 (0)
Disease incidence			
Annual	1.26%	7.30%	1.26%
Summer	1.19%	6.65%	0.86%
Winter	1.55%	10.62%	3.32%

* California marine water contact standards define coastal water enterococcus levels under 35 colony forming units (cfu)/100 ml as associated with an acceptable risk of gastroenteritis for bathers.

Estimated Mean Annual Number of Episodes and Mean Annual Incidence of Gastroenteritis Among Bathers, 2000-2004 Calculated using the California / US EPA model (*Cabelli*)

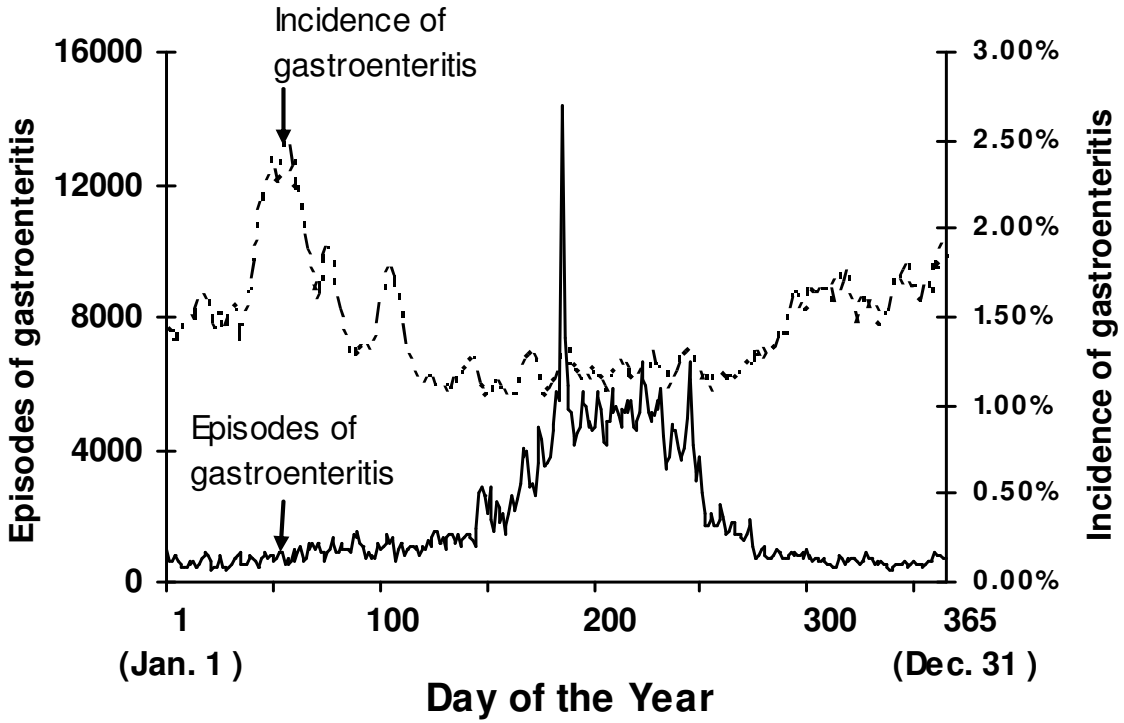






RESULTS

Mean Daily Number of Episodes and Mean Daily Incidence of Gastroenteritis Among Bathers in Southern California, 2000-2004
Calculated using the California / US EPA model (*Cabelli*)



DISCUSSION

Results are conservative

- Narrowly defined severe illness (both require reporting of fever)
- Many illnesses excluded (GI, eye, ear and skin infections)
- "Capped" risk levels
- No adjustment made for children with higher susceptibility
- Attendance data underestimates number of exposures (Dwight, 2007)

Data Validity

- Attendance and Bathing Rate data
  - Long term daily data sets
  - High correlation between stations and within stations over time
- Water Quality data
  - Comprehensive *Enterococcus* set of data
  - Testing is standardized and calibrated

CONCLUSIONS

Large disease burden regardless of model used

- 1-4 million severe GI illnesses per year (HCGI)
- 700,000 respiratory illnesses per year
- Largest single source of waterborne illnesses in the country

Attendance is a driving force in disease burden

- 50% of GI and AFRI illnesses occurred at only 12 beaches
- 80% of illnesses occurred in summer when risk is lowest

Current "acceptable illness rate" allows for a large disease burden

- 71% of illnesses occurred when enterococci levels were below the acceptable risk level.
- If beach waters were at standard: 1.9% x 56 million exposures equals >1 million HCGI episodes.
- The EPA standard was created as a minimum level of water quality with the expectation that local health officials would institute more restrictive standards (Cabelli, 1989).