

# Web-based investigation of water associated illness in marine bathers\*

*\*In press: Environmental Research (2007)*

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**H<sub>2</sub>O Conference 2007**

# Introduction & Problem Statement

- California's coastal waters receive runoff, sewage inputs.
- Marine bathers can get sick from exposure to contaminated seawater (Reviews by Pruss, 1998; Muggleston 2000, others).
- Disease surveillance is not routine activity (Yoder et al., 2004)
- Internet is useful for foodborne illness investigation (Wethington & Bartlett, 2006).

# Project Goal

Assess the utility of web-based survey to collect illness data on surfers/swimmers

# Recreational Health Data

Source: Surfrider Foundation's self-reported illness database (1996-2005)

Information:

- Demographic characteristics
- Beach going day
- Time/location of recreation
- Illness and symptom description
- Physician care

# Water Quality Data

Source: State Water Resources Control Board

Information:

- Beach Mile Day assessment of closures/postings (1999-2005)
- Total Beach Mile Days (BMD's) for coastal counties in California

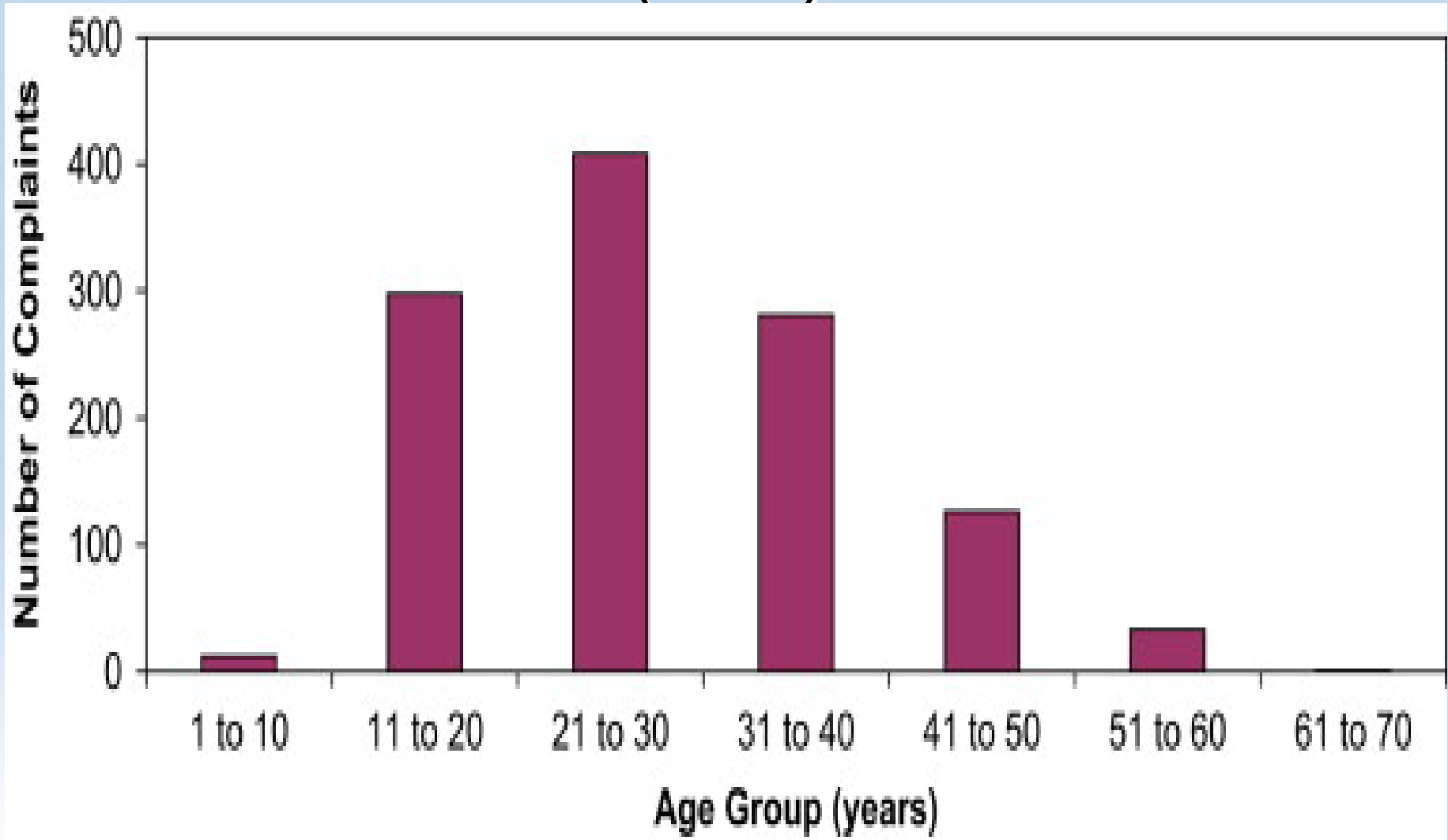
# Subject Recruitment

1. Self-visitation to website (n=1,895)
2. Responses screened to meet inclusion criteria (n=1,190)

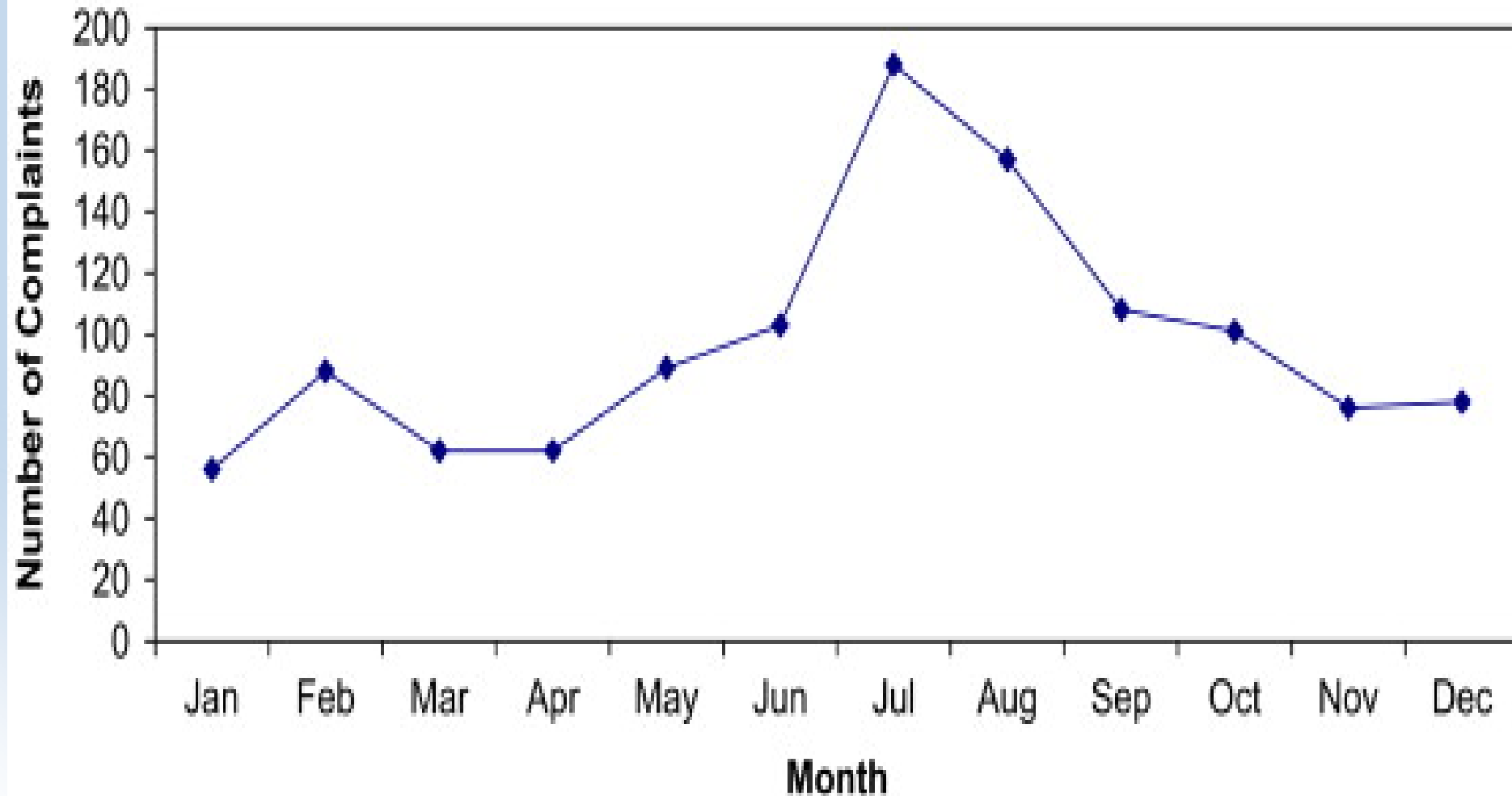
# Data Sorting/Statistical Analysis

1. Categorized responses by location, date, age, symptom type, severity.
2. Data Processing: GIS Maps created to examine spatial distribution of illnesses

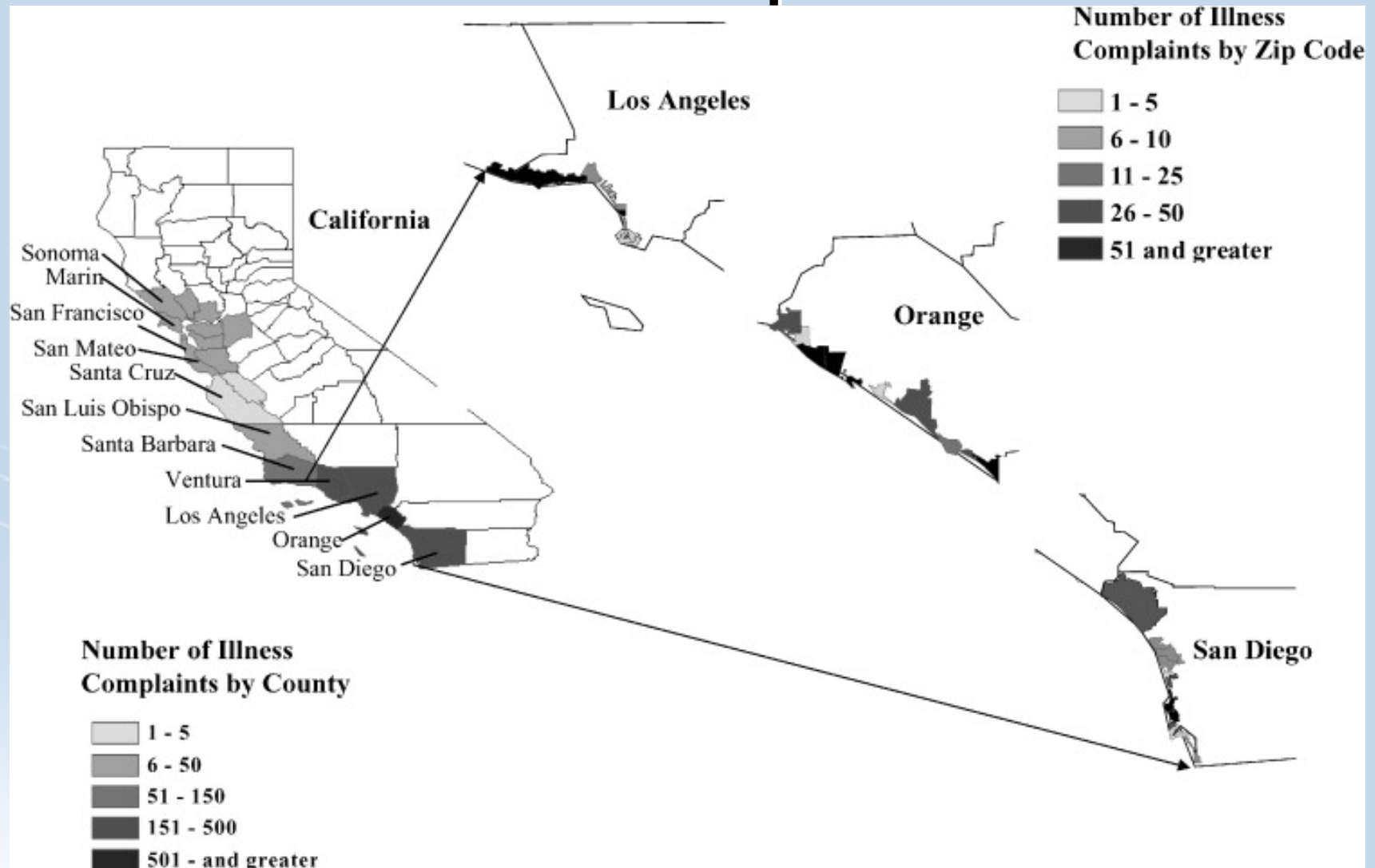
# Age Distribution of Respondents (U.S.)



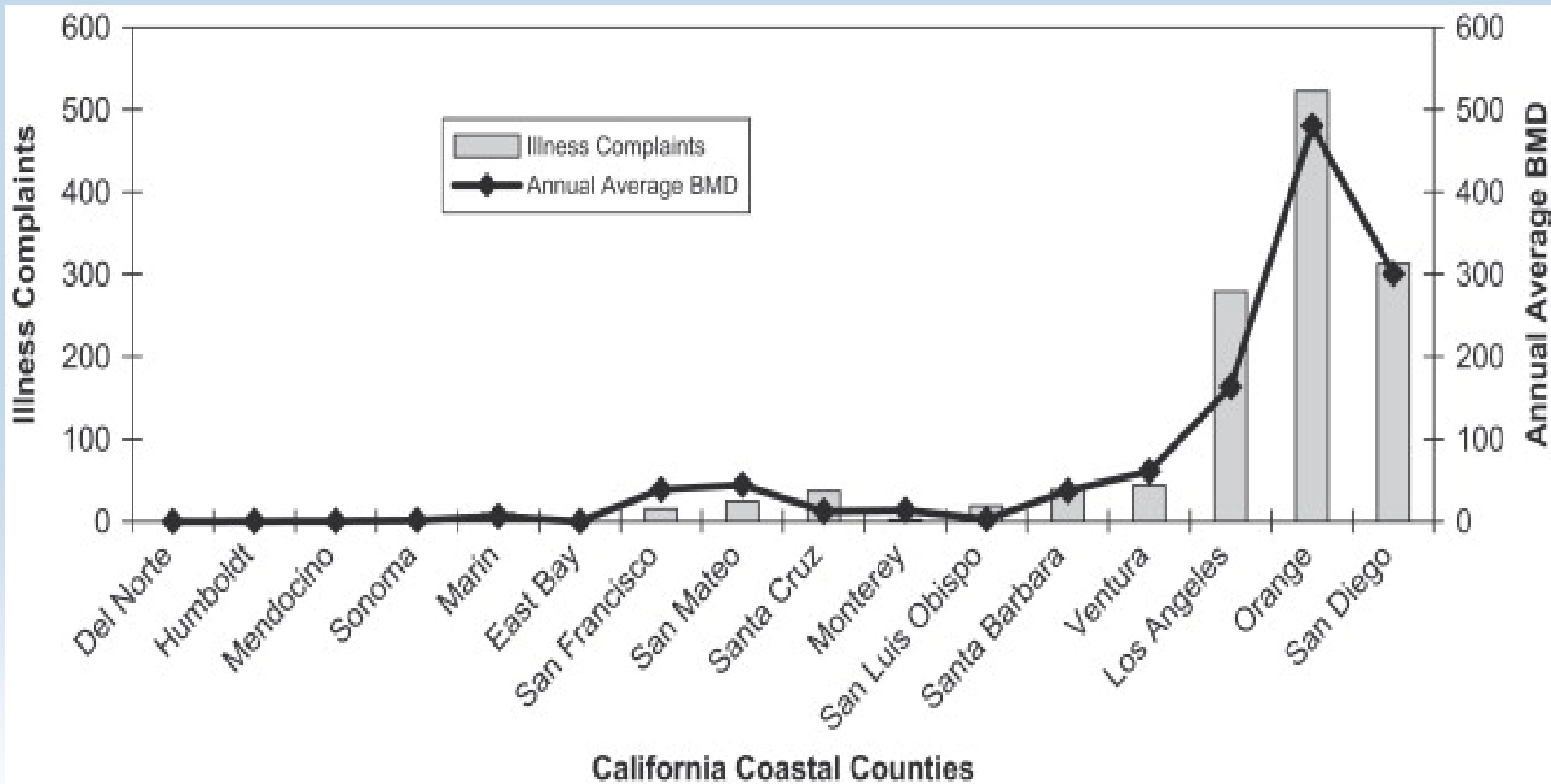
# Number of Illness Complaints by Month (U.S.)



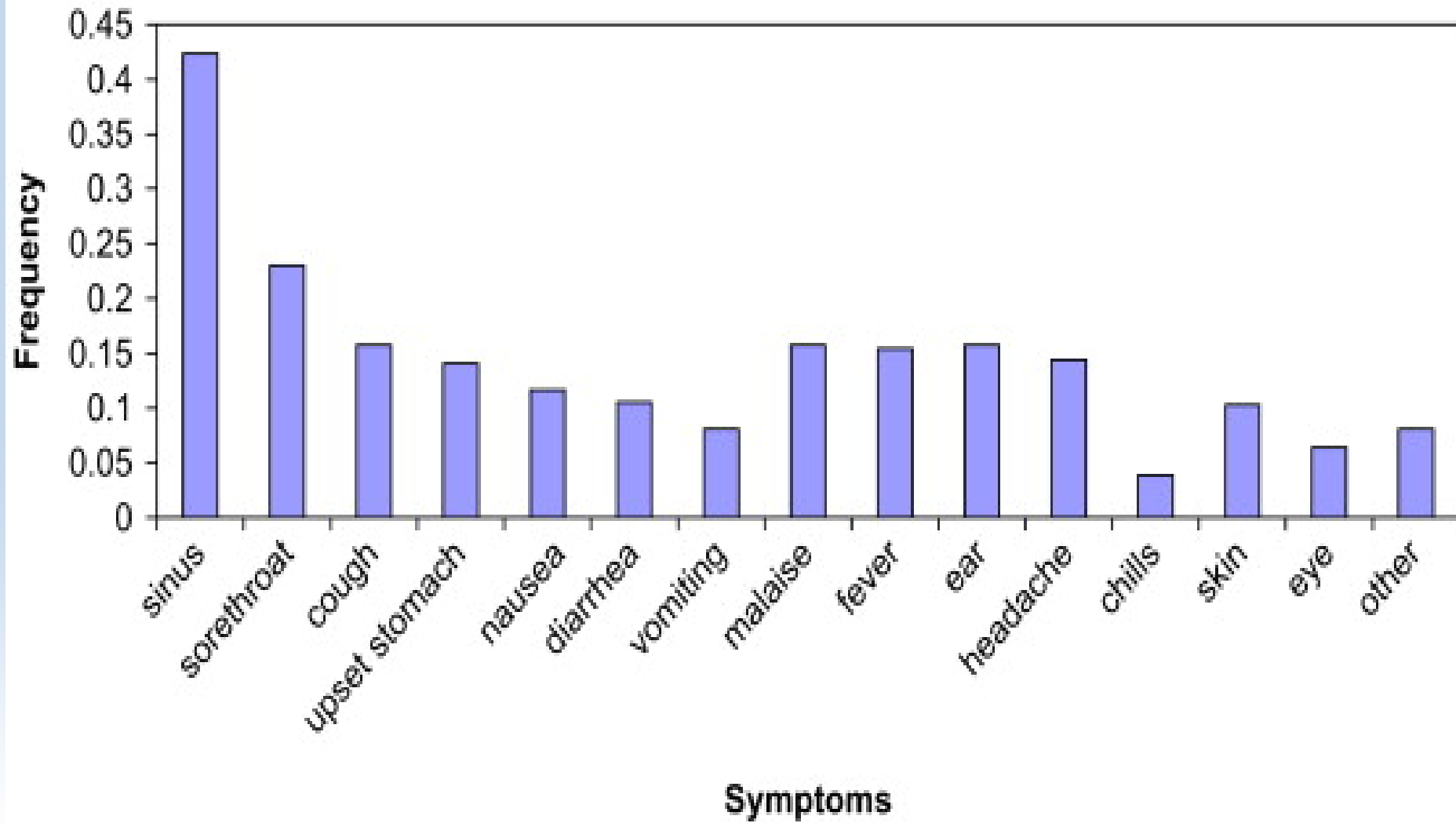
# Geographic Distribution of Illness Reports



# Relationship between coastal water quality impairment and illness complaints (1999-2005)



# Relative proportion of Symptom Types for illness complaints (U.S.)



# Main Findings

1. Seasonal peak in illness complaints during summer beach season (Jun.-Sep.).
2. Coastal water quality impairment higher in Southern California counties compared to Northern California counties over study period.
3. Strong correlation between number of illness complaints and annual advisory BMD's in each county ( $r=0.96$ ,  $p<0.001$ ).

# Main Findings

4. Sinus (e.g. runny nose, congestion) 42%, and gastrointestinal symptoms (e.g. diarrhea, vomiting) 45% were most common complaints.
5. About 1/3 of respondents (35%) saw doctor for ailments.
6. Respondents 35 yrs.+ were more likely than those under 35 to see a doctor  $X^2 (1, N = 1152) = 7.016, p = 0.008$ .
7. Small percentage of respondents (0.8%) hospitalized for symptoms (e.g. seizures, severe skin infections that did not heal).

# Discussion

## Findings consistent with literature

- Illnesses predicted during summer season (models: Turbow et al. 2003; Given et al., 2006)
- High proportion of illnesses from urbanized areas (See Dwight et al., 2004).
- Symptoms: Upper Respiratory, GI common (see Haile et al. 1999; Kay et al., 2004, Fleisher et al., 1993; Fleisher et al., 1996)

# Limitations

1. Possibility of selection bias
2. Illnesses self-reported
3. Surfing/swimming combined
4. True risk, relative risk to non-bathers could not be estimated.

# Conclusions

1. Web-based methods are a rapid, useful to identify time-space clusters of illness.
2. Systematic disease surveillance of marine bathers is needed.
3. Health officials can save time, resources by shifting from mail, fax towards web technologies.
4. Survey can be conducted alongside future site-specific epidemiology studies.

# Acknowledgments

- Special Thanks to Rick Wilson, Chad Nelsen, Mark Babski of Surfrider Foundation, and to Dr. Leslie Henrickson and Dr. Frank Gomez of TUI.

# References

1. Dwight, R.H., Baker, D.B., Semenza, J.C., et al., 2004. Health effects associated with recreational coastal water use: urban versus rural California. *Am. J. Public Health* 94, 565–567.
2. Fleisher, J.M., Jones, F., Kay, D., et al., 1993. Water and non-water related risk factors for gastroenteritis among bathers exposed to sewage-contaminated marine waters. *Int. J. Epidemiol.* 22, 698–708.
3. Fleisher, J.M., Kay, D., Salmon, R.L., et al. 1996. Marine waters contaminated with domestic sewage: nonenteric illnesses associated with bather exposure in the United Kingdom. *Am. J. Public Health* 86, 1228–1234.
4. Given, S., Pendleton, L.H., Boehm, A.B., 2006. Regional public health cost estimates of contaminated coastal waters: a case study of gastroenteritis at Southern California beaches. *Environ. Sci. Technol.* 40, 4851–4858.
5. Haile, R.W., Witte, J.S., Gold, M., et al. 1999. The health effects of swimming in ocean water contaminated by storm drain runoff. *Epidemiology* 10, 355–363.
6. Kay, D., Fleisher, J.M., Salmon, R.L., et al. 1994. Predicting likelihood of gastroenteritis from sea bathing: results from randomised exposure. *Lancet* 344, 905–909.
7. Mugglestone, M.A., 2000. A review of the health effects of sea bathing water. In: Stutt, E.D., Rushton, L. (Eds.), Web Report W2. Institute for Environment and Health, Leicester, UK.
8. Pruss, A., 1998. Review of epidemiological studies on health effects from exposure to recreational water. *Int. J. Epidemiol.* 27, 1–9.
9. Turbow, D.J., Osgood, N., Jiang, S.C., 2003. Evaluation of recreational health risk in coastal waters based on Enterococcus densities and bathing patterns. *Environ. Health Perspect.* 111, 598–603.
10. Yoder, J.S., Blackburn, B.G., Craun, G.F., et al. 2004. Surveillance for waterborne-disease outbreaks associated with recreational water-United States, 2001–2002. *Morbidity Mortality Weekly Rep* 53, 1–22.