Impacts of beach closures on perceptions of swimming-related health risk in Orange County, California

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Abstract

Following a major beach closure due to bacterial contamination, a survey of beachgoers was conducted in Huntington Beach, California in 1999 to assess perceived health risk from swimming. Responses were compared to those of beachgoers at the unaffected Laguna Main Beach. No significant differences were found in risk perception. Respondents were aware of the closures (83%), yet the majority (83%) felt the water was safe for swimming. Proximity of residence to the beach was strongly associated with closure awareness (Spearman’s $\rho = 0.427$, $p < 0.0001$). Although 83% of respondents felt that water quality was important in deciding to go to the beach, only 25% of respondents who did not plan to swim cited pollution or contamination as a reason not to swim. Most respondents (70%) trusted local health agency officials’ decisions about when to open/close beaches. Surveyed beach visitors were likely to bathe (84%) and were not highly concerned with swimming-related health risks.

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1. Introduction

Southern California’s beaches attract over 100 million visitors to the shoreline annually. Huntington Beach, California, located approximately 40 miles south of Los Angeles and 60 miles north of San Diego, is a popular beach for water contact recreation. Portions of Huntington Beach (HB) were closed to swimming for much of the Summer 1999 due to bacterial contamination of unknown origin. Orange County Health Care Agency officials re-opened HB for swimming over Labor Day Weekend (September 3–5) citing a reduction of indicator levels, but attendance was 40% lower than normal. Media coverage of the beach closure reports was extensive.

Our study reports on a survey of beachgoers administered at HB and Laguna Main Beach (LB), a control site that was not impacted by coastal contamination, over Labor Day Weekend (September 3–5) in 1999 (Fig. 1). Our objectives were to determine characteristics of individuals who visit re-opened beaches immediately following closure events. It was hypothesized that such beach visitors either had little awareness of the closures, and that beach closure awareness adversely affects decisions to swim. Beachgoers with high education levels were hypothesized to be more risk averse to swimming than less educated ones, and a strong association was expected between beach closure awareness and risk perception. It was further hypothesized that visitors to the unaffected LB would be less averse to swimming-related health risks.

2. Materials and methods

2.1. Field survey

A 15-item written survey was administered to 248 randomly selected individuals between 10 a.m. and 2 p.m. at HB and LB on September 3–5, 1999. Fourteen of the items were close-ended questions or statements. The results of 204 valid responses are reported here.

The first questionnaire category assessed beachgoer demographics. The second category assessed behavior, i.e. frequency of beach visits, time spent swimming/bathing in the ocean, plan to swim that day (yes/no), and if parents would allow children or grandchildren to
swim. Respondents who had not planned to swim were asked their reason for abstention. The third category measured awareness of the closures in HB, i.e. how many media reports they had seen and where they had seen them. The fourth category measured perceived risk, i.e. the importance of water quality in making a decision to visit the beach, how safe they felt the water was for swimming, and to estimate a person’s risk of becoming ill from swimming in the water. A final item assessed trust in beach closure decisions made by health agency officials. Respondents were asked to describe their level of agreement with the statement, “public health agency officials make proper decisions about when to close beaches.”

2.2. Statistical analysis

Bivariate analyses were performed to determine significant associations between demographic and behavioral characteristics of beachgoers. A logistic regression analysis was performed to identify significant differences in closure awareness level of respondents by beach, controlling for age, education, and gender.

2.3. Media coverage of beach closures

A Lexis–Nexis® search was performed to determine the extent to which the beach closures in HB were discussed in media reports over the three-month period (June 1–September 5, 1999) immediately preceding our investigation.

2.4. Water quality assessment

Water quality was assessed to explore how perceived risk of swimming-related illness related to actual health risk. Recreational health risk from June 2–September 22, 1999 was determined by applying a mathematical relationship between fecal bacterial indicator enterococcus (ENT) density in seawater and highly credible gastrointestinal illness (HCGI) risk in marine recreational bathers (Cabelli et al., 1982). Weekly mean of ENT data provided by the Orange County Sanitation District (OCSD) and Orange County Health Care Agency (OCHCA) at HB and LB were applied to the following equation:

\[ Y = 0.2 + 12.2 \left( \log_{10}X \right) \]

where \( Y \) is the expected attack rate of gastrointestinal illness and \( X \) is the mean enterococcus density in seawater.

Where reported indicator densities were below detectable limits, a value of zero was used to provide conservative estimates of both contamination and illness risk.

3. Results

3.1. Survey data analysis

Survey results showed that respondents at LB were older \((t = -2.97, p < 0.05)\), more educated \((X^2 = 21.57; df = 4, p < 0.01)\), and lived closer to the beach \((X^2 = 16.27, df = 5, p < 0.01)\) than visitors at HB. The mean age of respondents at LB was 36 years (SD = 14.5), compared to 30 years for HB (SD = 11.4). At LB, 85% of respondents had a college-level education or above, compared to 61% of respondents in HB. Approximately 36% of respondents at LB resided more than 40 miles from the beach, compared to 61% of respondents at HB. The gender ratio at both beaches was approximately 3 female to 2 male.

Respondents at LB visited the beach more often during a typical summer \((X^2 = 12.658; df = 5, p < 0.05)\) than those surveyed at HB (Fig. 2). However, they spent significantly less time swimming \((F = 26.873, df = 4, p < 0.0001)\) (Fig. 3). At both beaches, the farther subjects lived from the beach, the less often they visited the beach during a typical summer (Spearman’s \(\rho = -0.385, p < 0.0001\)).

3.2. Media coverage and perceived risk

Between June 1, 1999 and September 5, 1999, more than 70 media reports mentioned the beach closures in HB (Table 1). Most reports (81%) appeared in local newspapers or network television broadcasts. Approximately
83% of total respondents had seen or heard at least one media report of the closures. No significant differences were found in number of media reports seen between two beaches surveyed ($X^2 = 6.58$, df = 6, $p = 0.36$) (Table 2). The regression analysis further confirmed no significant differences in level of beach closure awareness between respondents at the two beaches, controlling for age, education, and gender. At both beaches, distance of residence from the beach was a strong determinant of closure awareness. Respondents who lived farther from the beach were less aware of the beach closures (Spearman’s $\rho = -0.427$, $p < 0.0001$).

Despite differences in demographic profiles at the beaches, no significant differences were found between beaches in perceived level of swimming-related health risk ($X^2 = 0.8165$, df = 4, $p = 0.9362$). Approximately 51% of respondents felt the water was either safe, or very
safe for swimming. Only 5% of respondents felt that the water was not safe at all and 13% were unsure of its safety. When asked to estimate a person’s risk of becoming ill from swimming, 35% reported low, 13% responded extremely low, and only 3% responded “high”.

Of total subjects surveyed, 83% reported that water quality was either important or very important in making a decision on whether or not to attend the beach. Approximately 84% of total respondents planned on swimming. Despite closure awareness and stated importance of water quality in deciding to attend the beach, only 25% of total respondents who had not planned on swimming cited pollution, bacterial contamination, or fear of illness as a reason not to swim (Fig. 4). Of those who did not plan to swim, many respondents cited non-pollution-related concerns.

In response to the question, “How safe do you feel the water is for swimming today?”, the number of media reports seen about the beach closures was significantly associated with perception of water safety (Spearman’s $\rho = -0.177, p = 0.012$). Not surprisingly, perceived water safety was the strongest predictor in perceived illness risk of several factors examined (including age, education, sex, and awareness of the beach closures) (OR = 1.859, 95% CI, $p < 0.01$). Responses to the item “estimate a person’s risk of becoming ill from swimming in the water today” were collapsed from a Likert scale ranging from 0 to 5, into “low” and “high” categories.

Roughly 64% of total respondents with children or grandchildren would allow their children or grandchildren to swim. No significant relationship was found between closure awareness and decision to let children or grandchildren swim.

No significant differences were found in level of trust in public health agency officials’ beach closure decisions. Approximately 92% of respondents at both beaches were in at least partial agreement with the statement that “public agency officials make proper decisions about when to close beaches”. Only 7% of total respondents were in strong disagreement. Trust in agency decisions was not strongly associated with age or education level. Nevertheless, 70% of those in strong agreement with the trust statement had a college-level education or above.

### 3.3. Health risk computation

Between June 1 and September 5, 1999, the weekly mean ENT levels were 17 CFU/100 ml at HB, compared to 6 CFU/100 ml at LB. ENT levels were higher in HB for all weeks with the exception of the first week in August and the first week in September. At LB, ENT levels were below the detection limit for nine of 15 summer weeks.

Fig. 5 shows the computed weekly average HCGI risk at the two beaches based on ENT densities. An average risk level of 1.24% was found at HB, compared to 0.56% at LB. The highest risk (1.9%) was found at HB during week of August 25–31st, which reached the tolerable risk threshold under EPA’s marine water contact guidelines (USEPA, 1986). The tolerable risk threshold was not crossed at LB. However, the HCGI risk in swimmers was higher in LB than HB during the sampling week encompassing Labor Day Weekend.

### 4. Discussion

Despite an unexpectedly high awareness level of the recent beach closures in HB, respondents at both beaches felt that the water was safe for swimming. The low-degree of perceived risk was independent of age, gender and number of media reports seen about the beach closures. Although perception of swimming-related health risk was low and did not significantly differ between the two beaches, the averaged weekly ENT densities were higher at HB than at LB for 12 of 15 weeks. Average weekly HCGI risk was nearly twice as high at HB than at LB over the study period. Measured ENT levels at HB indicated an unacceptably high risk to bathers for the week preceding this investigation, suggesting a discrepancy between actual risk and perceived risk.

Canter (1994) suggested that individuals may use water quality information provided by experts or policy
makers and their own experiences to form risk perception. Although respondents who lived farther from the beach had significantly lower beach closure awareness in our study, a high level of trust in health agency officials to properly decide when beaches should be open or closed was evident at both locations. This high level of confidence in local health agency officials' beach closure decisions was independent of educational status.

The results suggest that beach visitors may equate open beaches with safe swimming water. Alternately, beach visitors who swam immediately following closures may have been well aware of the risks but not concerned with becoming ill. Previous investigations (e.g. Sandman, 1987; Scherer, 1990) have suggested that locus of control in risk-related activities is an influential factor on risk perception. Because the choice to swim is voluntary, perceived risk may be lower than in less risky activities outside the subjects' control. Risk perception might be elevated in visitors with previous illnesses from ocean swimming experiences (Langford et al., 1996), a factor not fully examined in this study. Indeed, two respondents cited previous illness as their reason for abstention from swimming.

Our survey was administered exclusively to beachgoers who had attended public beaches within 24 h of a major beach closure, introducing the possibility of response bias. The sample size \( n = 204 \) limits the predictive statistical capability. Potential beachgoers concerned about water quality may be dissuaded from attending the beach (see Pendleton et al., 2001), and these results are not generalizable to all beachgoers.

Risk perception study at these beaches is timely and pertinent, considering the extent of usage, closure frequency, and tourism value. Efforts to increase swimming-related health risk awareness through communication programs may heighten risk perception and hamper beach attendance, thus conflicting with economic goals. Therefore, conveying a “healthy” understanding of risks is a challenge.

References


