



Florida red tide knowledge and risk perception: Is there a need for tailored messaging



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ARTICLE INFO

Article history:

Received 8 July 2013

Received in revised form 23 September 2013

Accepted 23 September 2013

Keywords:

Florida red tide

Karenia brevis

K. brevis

Outreach

Messaging

Harmful algal blooms

ABSTRACT

Harmful algal blooms of the toxic dinoflagellate, *Karenia brevis*, occur throughout the Gulf of Mexico. Recent research efforts sponsored by the National Institute of Environmental Health Sciences (NIEHS) and others found that Florida red tide causes both acute and possibly chronic health effects from the toxic aerosols. Florida red tide also demonstrated significant social and economic impacts to both coastal residents and visitors. In conjunction with the research, persistent outreach efforts were conducted over the 11-year period. The goal of this project was to assess potential needs for tailored messaging needed among different red tide information user groups. Survey participants included 303 local residents, both with asthma and without, and 'snowbirds' (seasonal residents that reside in the Sarasota area for more than 3 months but less than 6 months/year), also both with asthma and without. The questionnaire assessed Florida red tide knowledge and risk perception regarding Florida red tide using items drawn from two previously published surveys to allow comparison. Our results reveal that overall knowledge of Florida red tide has not changed. We found that knowledge was consistent across our selected groups and also did not vary by age, gender and education level. However, knowledge regarding consumption of seafood during Florida red tide has declined. Risk perception increased significantly for people who have asthma. Individuals responsible for public health communication regarding Florida red tide and human health concerns need to continue to pursue more effective outreach messages and delivery methods.

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1. Introduction

Karenia brevis is a dinoflagellate that can form a HAB known as "Florida red tide," an event that occurs throughout the Gulf of Mexico with blooms observed as far north as North Carolina. The blooms can last for a few weeks to over a year, and may be growing in size, with the 2007 bloom affecting the Florida panhandle, the east coast of Florida, and the Florida Keys. *K. brevis* blooms produce a group of powerful natural neurotoxins known as brevetoxins (Baden et al., 1995; Kirkpatrick et al., 2004). In recent research, supported by the National Institute of Environmental Health Sciences (NIEHS) and others, Florida red tide was demonstrated to cause both acute and possibly chronic health effects from the toxic aerosols, as well as significant social and economic impacts to both coastal residents and visitors (Kirkpatrick et al., 2004, 2006; Hoagland et al., 2009; Watkins et al., 2008; Backer et al., 2003, 2005a,b; Fleming et al., 2005, 2007, 2009; Milian et al., 2007).

Several studies in the past have detailed currently held knowledge of residents and tourists regarding Florida red tide. Nierenberg et al. (2010) found inconsistent and inaccurate Florida red tide knowledge among both residents and tourists. When queried regarding where people wanted to get their information, the Internet was cited as the preferred resource. In another study that examined the perceptions of individuals regarding Florida red tide, Kuhar et al. (2009) found that women and older individuals reported higher perceived health and other risks associated with red tide, consistent with other findings showing that women generally have higher health concerns than men (Flynn et al., 1994).

Since these studies were conducted there have been significant scientific advances in the understanding of the human health effects from the toxic aerosols, including *Karenia brevis*. In parallel, the corresponding information available on the Internet, (e.g., Mote Marine Laboratory website, the National Oceanic and Atmospheric Administration HAB Bulletin, and Florida Fish and Wildlife Conservation Commission/Fish and Wildlife Research Institute Red Tide website, Florida Department of Health website, and citizen group efforts such as Solutions To Avoid Red Tide (START)), has been greatly improved (Nierenberg et al., 2011).

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Despite the extensive outreach, it is unknown whether individuals who are in areas that are at risk for Florida red tide have used these resources to increase their knowledge of red tide. Therefore, we initiated this study to determine whether Florida red tide knowledge and perceptions have changed since our last survey, and specifically whether outreach messages need to be tailored for specific groups. We compare the current findings with previous studies to determine whether outreach has been successful in improving knowledge and perceptions about Florida red tide.

2. Methods

The University of Miami Institutional Review Board classified the study as exempt.

The study population included residents of Sarasota FL, and individuals who spend a significant part of the year in that area (>3 months but <6 months) but are not residents (“snowbirds”). For each of these groups, we sought to include equal numbers of individuals with and without asthma, as individuals with asthma are at higher risk for respiratory illness during and after a visit to the beach during a red tide event (Fleming et al., 2005, 2007). Thus, a 2 × 2 design was employed with an overall sample size of 300. The goal was to recruit 75 adults age ≥18 years for each of the 4 groups. Asthma was defined by self-report of an asthma diagnosis by a physician or other health care provider. The sample reflected the population in Sarasota County which has a high proportion of retirees. Therefore, the residents sampled were age-matched with the snowbirds. Potential participants were informed that this was a one time survey exploring aspects of Florida red tide. All participants received a \$50 gift card after completing the survey.

2.1. Participant recruitment

A variety of strategies were used to recruit participants in the study. e-Newsletters from Mote Marine Laboratory and Aquarium and START carried short news articles as well as postings on their websites. Mote’s large (>1600 people) volunteer group was informed at their monthly meetings and also via e-newsletter. Advertisements were purchased in 4 local free beach weekly newspapers. To specifically recruit asthmatics, flyers were distributed in the waiting rooms of 2 large pulmonary physician groups in both Sarasota and Manatee Counties, and the project was advertised on the Sarasota County Health Department e-newsletter. Finally, multiple Mote Marine Aquarium Facebook postings advertised the study.

2.2. The survey

Survey questions were duplicated from 2 previous studies regarding Florida red tide, knowledge, and risk perception (Nierenberg et al., 2010; Kuhar et al., 2009). As described above, significant public outreach materials and publications on the

human health impacts from the toxic aerosols have been produced since these two prior studies. The survey was participant self-administered at Mote Marine Laboratory and delivered via laptop computer, taking approximately 45 min to complete. Research team members were available to answer questions, if necessary.

2.3. Statistical analysis

Descriptive statistics (means and standard deviations, or percentages) were calculated for all demographic variables. For some of the knowledge questions that had multiple correct responses, different strategies can be used to assign a score. Participants could be scored as getting the question “completely correct”, “partially correct”, or “not at all correct” (for example, if the participant correctly identified only 1 of the impacts of a red tide). We counted a correct answer as only those answers that were “completely correct (all correct choices were selected).” Percentages of correct answers for each of the knowledge questions for each of our subpopulations were calculated, and compared using chi-squared tests. Perceived risk questions were assessed on a 5 point Likert scale with 1 = strongly disagree and 5 = strongly agree. Means and standard deviations were calculated for each subpopulation and compared using *t*-tests.

Logistic regression models were conducted to determine whether there were demographic or subgroup differences in knowledge of Florida red tide. Responses to the perceived risk questions were dichotomized and logistic regressions run to examine potential demographic or subgroup differences in Florida red tide risk perception.

Finally, we compared our results with data from two previous surveys: 2005 (Nierenberg et al., 2010) and 2007 (Kuhar et al., 2009). Both of these surveys included residents and tourists, with tourists defined as those residing in Florida less than a month. Thus, we restricted all comparisons to residents. We compared demographics (2005 and 2007), knowledge (2005), and perceived risk (2007).

3. Results

3.1. Demographics

Demographic characteristics are shown in Table 1. Of note, the snowbird population is skewed to the elderly ages, as few younger people have the financial ability or time to relocate for 3 months or longer per year. More females participated than males, and snowbirds, particularly asthmatic snowbirds, had a higher percentage of participants with advanced degrees (master’s degree or higher).

3.2. Florida red tide knowledge

The Florida red tide knowledge questions are shown in Table 2. No significant differences were found between residents and

Table 1
Demographics.

n=303	Healthy residents, n (%)	Asthmatic residents, n (%)	Healthy snowbirds, n (%)	Asthmatic snowbirds, n (%)	X ²	p
Age	117	101	55	30		
18–29	8 (6.8)	5 (4.9)	0	0	49.61	<0.0001*
30–49	49 (41.9)	29 (28.7)	2 (3.6)	2 (6.7)		
50–69	53 (45.3)	55 (54.5)	35 (63.6)	21 (70.0)		
70–89	7 (6.0)	12 (11.9)	18 (32.7)	7 (23.3)		
Female	67 (57.3)	74 (73.3)	28 (50.9)	18 (60.0)	9.44	0.024*
Education						
High school, diploma or less	17 (14.5)	10 (9.9)	1 (1.8)	1 (3.3)	23.73	0.001*
Some higher education	76 (65.0)	74 (73.3)	30 (54.5)	17 (56.7)		
Masters/doctorate	24 (20.5)	17 (16.8)	24 (43.6)	12 (40.0)		

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