Florida Red Tide Exposure: Systematic Review analyzing the respiratory effects experienced by the Gulf Coast population

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GW | Public Health

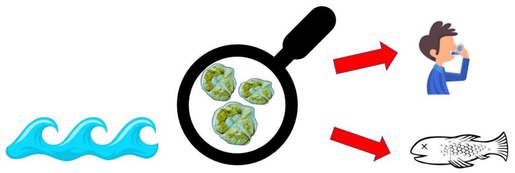
PECO Statement/Research Question

- **Population:** humans on Florida's west coast beaches
- **Exposure:** time spent on the beach during a red tide occurrence
- **Comparator:** population before their exposure to red tide on the beach
- **Outcome:** respiratory irritation

Do those who live along Florida's west coast experience respiratory irritation associated with red tide?

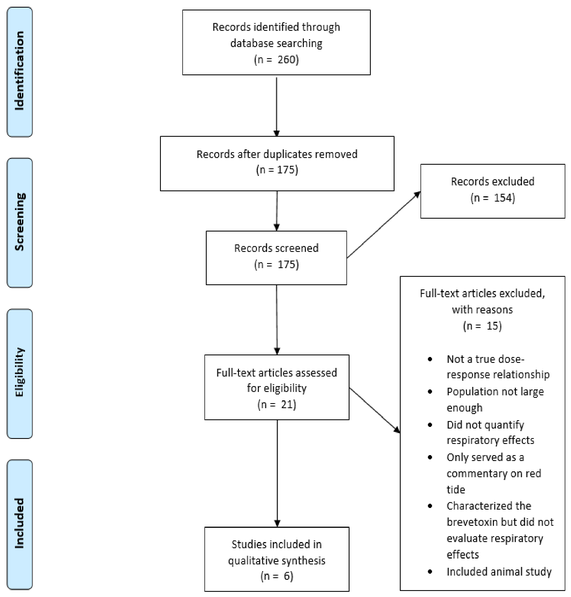
Background

- Florida red tide is a harmful algal bloom that annually occurs in the Gulf of Mexico
- Red tide is caused by a marine dinoflagellate called Karenia brevis (*K. brevis*), which emits brevetoxins that can cause mass fish kills
- Human health impacts = respiratory irritation from brevetoxin inhalation and neurotoxic poisoning from ingestion of tainted seafood



- Agricultural runoff into the Gulf of Mexico has exacerbated this naturally occurring event
- 4 billion people die from chronic respiratory conditions annually, 180,000 of them contributed to asthma
- Aerosolized brevetoxin exposure can lead to asthma attacks in susceptible subjects
- Even in those without asthma, brevetoxins are known to cause upper and lower respiratory irritation in their aerosol form

Study Selection



METHODS: NAVIGATION GUIDE

Data Sources

- PubMed
- Scopus
- Greenfile
- CINAHL
- Agricultural & Environmental Science Database

Example of Search Terms

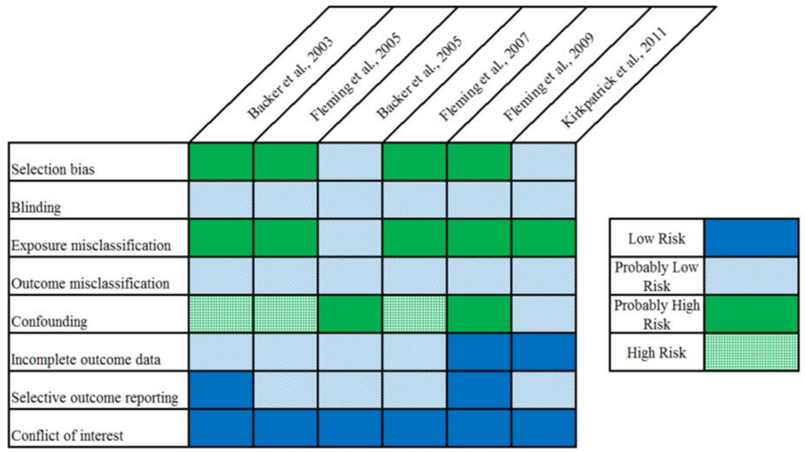
Exposure	(harmful algal bloom [Mesh] OR red tide [tiab] OR harmful algal bloom* [tiab] AND brevetoxin* [tiab] OR Karenia brevis [tiab] OR K. brevis [tiab] OR FRT [tiab] OR dinoflagellida [mesh] OR dinoflagellida [tiab]) AND (florida [mesh] Or florida [tiab])
Outcome	(Signs and Symptoms, Respiratory [mesh] OR respiratory [tiab] OR asthma [mesh] OR asthma* [tiab] OR lung [tiab] OR lung [mesh] OR aerosol* [tiab] OR aerosols [mesh])

Exclusion Criteria

- the report did not contain original data
- the report did not quantify the brevetoxin exposure of human study populations
- the study did not speak to inhalation as the primary route of exposure for Florida red tide brevetoxin
- there was no comparator-control group
- the study did not evaluate the negative respiratory health effects experienced by the study population
- the study only analyzed respiratory effects in animal subjects.

"Wildlife is kind of the proverbial canary in the coal mine…and right now, the canary just died." –Heather Barron, Florida's Clinic for the Rehabilitation of Wildlife

Results



Quality of Evidence
Upgrading factors: Confounding minimizes effect

Downgrading factors:
- Risk of bias
- Imprecision

Overall Quality of Evidence: Low

Strength of Evidence
Strength considerations:
- quality
- direction of and confidence in effect estimate
- additional compelling evidence

Overall Strength of Evidence: Inadequate

First Author and Date	Study population	Location	Sample size	Self-Reported Symptoms	Spirometry measures
Backer, 2003	Beachgoers, ≥ 18 years old	Beaches in Sarasota and Jacksonville, FL	129	Increase	No change
Backer, 2005	Healthy lifeguards, ≥ 18 years old	Beaches in Sarasota or Manatee counties in Florida	28	Increase	No change
Fleming, 2009	Open cohort of asthmatics (" ≥ 12 years of age, history of smoking ≤ 10 years; able to walk on the beach continuously for at least 30 min; and at least 6 months residence in the Sarasota area")	Siesta Beach (Sarasota, FL)	87	Increase	No change
Fleming, 2005	persons who reported a physician's diagnosis of asthma, ≥ 12 years of age	Siesta Beach (Sarasota, FL)	59	Increase	Decreased function
Fleming, 2007	persons ≥ 12 years of age with physician-diagnosed asthma	Siesta Beach (Sarasota, FL)	97	Increase	Decreased function
Kirkpatrick, 2011	≥ 12 years of age; history of smoking ≤10 years; able to walk on the beach continuously > 30 minutes; and > 6-month residence in the Sarasota area	Siesta Beach (Sarasota, FL)	52	Increase	No change

Conclusions/Recommendations

Based on our application of the Navigation Guide, we conclude that there is an **inadequate evidence of correlation** between red tide exposure and respiratory effects. There may be existing uncertainty, as studies did include an increase in self-reported symptoms and 2 populations who experienced decreased pulmonary function. However, the size and strength of the included studies do not independently support a significant correlation. We do not discourage further expert judgment and recommend additional research on the true short- and long-term effects of red tide on both asthmatic and non-asthmatic populations.

Limitations
- All studies conducted in a short time frame
- Same cohort of researchers conducted all studies
- Lack of diversity in study design

Strengths
- Ability to quantify respiratory effects through pulmonary function tests
- Correlation of greater risks of respiratory effects for those with asthma
- Consistency of studies

Knowledge Gaps
- Impacts of regular red tide exposure over time
- Chronic diseases potentially associated with red tide exposure

Recommendations
- Future long term prospective studies
- More thoughtful management of the increased nutrients that runoff into Florida waterways
  - reduce red tide presence to begin with

References

*indicates studies included in systematic review

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