Abstract

Limited understanding exists regarding the association between extreme weather events and risk of Campylobacteriosis, particularly for communities in coastal regions. We linked laboratory culture-confirmed cases of Campylobacteriosis for Maryland (2002-2012) with extreme temperature and precipitation events calculated using a 30-year baseline (1960-1989). We employed multivariate negative binomial regression utilizing generalized estimation equations to investigate the associations between Campylobacteriosis and extreme weather events. A one-unit increase in extreme precipitation event was associated with a 5% increase in risk of Campylobacteriosis in the Eastern Shore region (IRR 1.05, 95% CI: 1.02, 1.09). The increase in risk associated with extreme precipitation was particularly higher during the El Niño period (IRR 1.10, 95% CI: 1.06, 1.13). Our data suggests that Campylobacteriosis is associated with extreme precipitation events in Maryland, with higher risk in the coastal region and during El Niño periods. Extreme precipitation related flooding in coastal areas could bring water contaminated with bacterial pathogens (originating from point sources such as municipal wastewater treatment plants and animal feeding operations) into close proximity with individuals, where frequency of contact (via swimming or recreation) may be increased. Increased risk associated with the El Niño period could be related to the more intense precipitation events during this time period.

Introduction

- 2nd most common cause of food and waterborne disease (behind salmonella) with 1.3 million people affected annually in the U.S.
- Estimated negative impact to the U.S. economy is $6.9 billion (e.g. medical care, quality of life, productivity loss, etc…)
- Incidence rates continue to rise despite interventions focused upon food safety operations
- Climatic factors (i.e., extreme temperature and precipitation events) may impact a pathogen’s ability to develop and its routes of transmission
- United Nations International Panel on Climate Change projects extreme weather events to increase in intensity, frequency, and duration
- Limited understanding of the impact that extreme weather events have upon the risk of campylobacteriosis

Methods

Upon the risk of campylobacteriosis

Study

• Maryland counties split into 3 regions (Eastern Shore, Water Inland, and Western)

Data

• Maryland Foodborne surveillance network (2002-2012)

Approach

• Case data linked with location and calendar day specific extreme temperature and precipitation events calculated using a 30-year baseline (1960-1989)

Extreme temperature and precipitation events determined based upon 90th percentile threshold

Statistical Analysis

• Negative binomial regression utilizing generalized estimation equations was used to investigate the associations between campylobacteriosis and extreme weather events

Results

Stratified Analysis: Incident Rate Ratios (95% CI) for Extreme Precipitation (EPT90) and Extreme Temperature (ETT90) Events

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Precipitation (EPT90)</th>
<th>Temperature (ETT90)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Season</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter</td>
<td>0.99 (0.94, 1.04)</td>
<td>0.96 (0.94, 0.98)</td>
</tr>
<tr>
<td>Spring</td>
<td>1.00 (0.96, 1.03)</td>
<td>0.95 (0.92, 0.99)</td>
</tr>
<tr>
<td>Summer</td>
<td>1.00 (0.98, 1.02)</td>
<td>1.00 (0.99, 1.02)</td>
</tr>
<tr>
<td>Autumn</td>
<td>1.01 (0.97, 1.04)</td>
<td>0.97 (0.94, 1.01)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Shore</td>
<td>1.05 (1.02, 1.09)</td>
<td>1.00 (0.97, 1.03)</td>
</tr>
<tr>
<td>Water Inland</td>
<td>1.02 (1.00, 1.04)</td>
<td>1.00 (0.98, 1.02)</td>
</tr>
<tr>
<td>Western Counties</td>
<td>1.01 (0.98, 1.05)</td>
<td>1.00 (0.97, 1.02)</td>
</tr>
<tr>
<td>ENSO Period</td>
<td>ENSO Neutral: 1.02 (0.99, 1.04)</td>
<td>1.00 (0.98, 1.03)</td>
</tr>
<tr>
<td></td>
<td>El Niño: 1.10 (1.06, 1.13)</td>
<td>1.01 (0.99, 1.02)</td>
</tr>
<tr>
<td></td>
<td>La Niña: 0.96 (0.93, 1.00)</td>
<td>0.99 (0.97, 1.01)</td>
</tr>
</tbody>
</table>

Summary & Implications

Study

• Eastern shore and Water Inland counties found to have increased risk of 5% and 2% with extreme precipitation events, respectively
• Association between extreme precipitation and Campylobacteriosis was particularly high during El Niño periods
• No association found with extreme temperature events

Direction of Future Research

• Risk analysis can be integrated into future disease burden projections
• Communities developing adaptation strategies to climate change need to be informed of potential risks associated with extreme weather events and Campylobacteriosis

Acknowledgements

Research Collaborators
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