Associations between Upper Respiratory Symptom Scores of Puerto Rican Residents, Pro-Inflammatory Potential of Indoor Settled Dust, and Level of Water Damage to Homes during Hurricane Maria

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Abstract:
The atmosphere of post-Hurricane Maria Puerto Rico left behind, among other things, upper respiratory hardships to many of its residents. The residents from an affected community in San Juan, Puerto Rico were interviewed and self-reported upper respiratory symptoms (i.e. rhinitis, nasal congestion, and nasal, throat, & eye irritation) were obtained. Each of these symptoms were then assessed using an Upper Respiratory Symptom Score (URSC) with > 3 (worsening symptoms) scored as 1 and symptoms ≤ 3 (improved symptoms) scored as 0. Each individual’s URSC scores were compared to their self-reported level of water damage, and indoor dust pro-inflammatory (IL-1β)-inducing potential.

To identify the relationships between URSC, self-reported residence water damage, and IL-1β-inducing potential by indoor settled dust from homes in a community in San Juan, PR affected during Hurricane Maria (see Fig 2)

Methods

Figure 1: Map of total rainfall in Puerto Rico during the Hurricane Maria. NOAA Tropical Cyclone Report: Hurricane Maria (Accessed Feb, 2019).

To identify the relationships between URSC, self-reported residence water damage, and IL-1β-inducing potential by indoor settled dust from homes in a community in San Juan, Puerto Rico were interviewed and self-reported upper respiratory symptoms (i.e. rhinitis, nasal congestion, and nasal, throat, & eye irritation) were obtained. Each of these symptoms were then assessed using an Upper Respiratory Symptom Score (URSC) with > 3 (worsening symptoms) scored as 1 and symptoms ≤ 3 (improved symptoms) scored as 0. Each individual’s URSC scores were compared to their self-reported level of water damage, and indoor dust pro-inflammatory (IL-1β)-inducing potential.

Introduction

The atmosphere of post-Hurricane Maria Puerto Rico left behind, among other things, upper respiratory hardships to many of its residents. The residents from an affected community in San Juan, Puerto Rico were interviewed and self-reported upper respiratory symptoms (i.e. rhinitis, nasal congestion, and nasal, throat, & eye irritation) were obtained. Each of these symptoms were then assessed using an Upper Respiratory Symptom Score (URSC) with > 3 (worsening symptoms) scored as 1 and symptoms ≤ 3 (improved symptoms) scored as 0. Each individual’s URSC scores were compared to their self-reported level of water damage, and indoor dust pro-inflammatory (IL-1β)-inducing potential.

Figure 2: Site of study (Figueroa Community) in San Juan, PR. Image retrieved with the ggmap R package.

Table 1: Proportion of URSC by self-reported level of water damage

<table>
<thead>
<tr>
<th>Level of water damage</th>
<th>Upper Respiratory Symptom Score (proportions %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Damage</td>
<td>0 1 2 3 4 5</td>
</tr>
<tr>
<td>Damage/Dry Area</td>
<td>37.5 12.5 25.0 20.0 0.0 16.7</td>
</tr>
<tr>
<td>Damage/Flooded Area</td>
<td>25.0 0.0 25.0 20.0 33.3 66.7</td>
</tr>
<tr>
<td>Fully Flooded</td>
<td>16.7 37.5 25.0 40.0 33.3 0.0</td>
</tr>
</tbody>
</table>

Figure 3: Summary of the sampling sites, timing of survey for self-reported respiratory symptoms, and variables to evaluate against self-reported symptoms.

Conclusion

• Our findings suggest that individuals with higher URSC lived in homes that reported to have water damage or inside flooding.
• The increased IL-1β inducing potential in homes with lower URSC suggest immunosuppressing properties in the dust from homes self-reported to have been fully flooded or water-damaged without inside flooding. Damaged and located in flooded areas.

Future Studies

Future studies, will evaluate relationships of URSC with other pro-inflammatory biomarkers induced by the indoor settled dust samples.
• will evaluate the relationships between URSC and fungal and microbiome profiles of the indoor settled dust.

Acknowledgments

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• The Field Team for their remarkable job administering the surveys and carrying out the indoor sampling of the homes.

Conflict of Interest

• The authors have no conflict of interest to disclose.

Figure 4: Approach to calculate the Upper Respiratory Score (URSC)

Figure 5: Residents from homes that did not experience any water damage reported the lowest URSC. No water damage: 1 = water damage but house in non-flooded area; 2 = house damage, in flooded area but no inside flooding; 3 = house fully flooded.

Figure 6: The IL-1β inducing potential of dust was highest, but not statistically significant, in homes which residents had the lowest URSC. The exception would be outliers in URSC of 5.

Figure 7: The IL-1β inducing potential of dust was highest, but not statistically significant, in homes which residents had the lowest URSC. The exception would be outliers in URSC of 5.