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Reply to Christensen and Christensen and to Malter: Pitfalls of erroneous analyses of hurricanes names

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Reply to Christensen and Christensen and to Malter: Pitfalls of erroneous analyses of hurricanes names

Our article (1) reports evidence for a relationship between femininity of hurricane names and fatality rates, along with experimental evidence that female-named storms elicit lower risk perceptions and preparedness intentions. In response, Malter (2) cites some bloggers' critiques about inclusion of hurricanes from the era of female-only names, interpretation of results, and external validity of experiments. Christensen and Christensen (3) assert that the conclusions are invalidated by another significant interaction in the model. We show below that these critiques arise from inappropriate statistical treatments or other misunderstandings and do not qualify our findings.

Malter (2) gives no compelling reason for excluding data before 1979 when only female names were given. Because we focused on name gender as a continuous variable, our modeling of 92 hurricanes appropriately included those data. To reiterate those results (1), modeling fatalities using a masculinity-femininity index (MFI) showed a significant interaction: for less damaging storms, MFI did not predict fatalities. However, for highly damaging storms, where taking protective action has the greatest impact on survival, a more feminine name predicted more fatalities. These findings do not appear to be explained by historical artifacts (e.g., more deaths during the female-only era due to inferior warning systems). We included years elapsed since the hurricane as a covariate, but it had no effect in any models (1).

Even if we model only the data since 1979 ($n = 54$), we observe the same effect. [Note that, in the article, we neglected to apply the robust estimator to adjust extra SEs, recommended as the default standard error for count models (4–7). That adjustment, which affects the P values but not the coefficients, strengthens our conclusions.] The interaction between MFI and normalized damage that was reported as marginally significant ($P = 0.073$) is clearly significant with the recommended robust estimator ($P = 0.004$). It is also significant when examining name gender as a binary variable ($P = 0.02$). Although Christensen and Christensen (3) assert that "no effect can be observed" in these data that are significant "on a 10% level," their analysis is simply incorrect. The focal interaction is clearly significant.

In short, whether considering the full dataset or only storms since 1979, the femininity of hurricane names significantly predicts fatality rates for damaging storms.

Christensen and Christensen (3) make more assertions based on improperly conducted analyses. Their critique of our figure 1 misconstrued its purpose. It is a method of visualizing the focal interaction by factoring normalized damage into high/low groups at its median (Fig. 1*A*). This illustrates changes in predicted fatalities at each MFI value without generating extreme predictions. It is not a test of the interaction. (Their assertion about the sign of the parameter is also mistaken.)

Their subsequent analysis (3) excluding observations ≥100 deaths is also invalid and reflects a common misconception among researchers used to working with normal distributions. Hurricane fatality data are expected to be skewed. It is inappropriate to try to normalize the distribution by, for instance, arbitrarily deleting what one imagines are high counts (2, 3). Count models are specifically designed for such skewed datasets (5, 6).

Christensen and Christensen (3) also assert that an extreme prediction of deaths for Hurricane Sandy undermines the model. However,

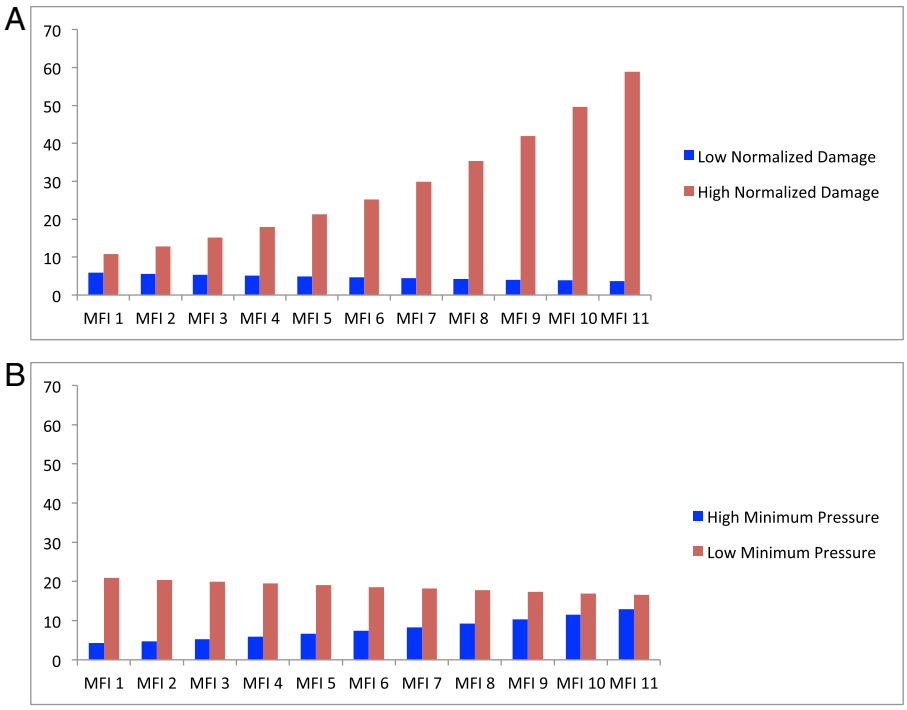

Fig. 1. (*A*) Predicted fatality counts for MFI and binary normalized damage interaction (split at its median). Higher values on MFI indicate more feminine names. Predicted counts were estimated separately for each value of MFI of hurricanes, holding minimum pressure at its mean (964.90 mb). (*B*) Predicted fatality counts for MFI and binary minimum pressure interaction (split at its median). Higher values on MFI indicate more feminine names. Predicted counts were estimated separately for each value of MFI of hurricanes, holding normalized damage at its mean ($7,269.78 million).

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our goal is to find a model that fits most of the data. Using extreme values of multiple overdispersed predictors can expectedly generate some extreme predictions. This criticism does not take into account the point of modeling aggregate-level data.

Christensen and Christensen (3) are correct that the interaction between MFI and minimum pressure differs from the focal interaction. However, as described below, they used misleading calculations to assert that this effect is contradictory.

A priori, normalized damage is more reflective of a storm's impact on human population centers than is minimum pressure. Some strong low-pressure systems do not hit highly populated areas, whereas some higher-pressure systems do. Our analysis of minimum pressure as an indicator of severity failed to find a reliable interaction with name gender. Across the full sample of storms, there is an interaction ($P < 0.05$), but an additional bootstrapping test (1,200 resamples) does not show full statistical significance ($P = 0.077$), whereas the focal interaction of MFI and normalized damage remains significant ($P = 0.035$). Moreover, the interaction with minimum pressure is not observed in any models of the data since 1979, either with ($P = 0.206$) or without a robust estimator ($P = 0.189$) (1).

Christensen and Christensen (3) misrepresent this interaction in their figure 1 and table 1 by apparently fixing minimum pressure at values rarely observed in the dataset. There is only one hurricane ≤920 mb and eight hurricanes that are ≥990 mb. It is misleading to probe the interaction while fixing minimum pressure at such extreme and uncommon values.

Fig. 1*B* shows the appropriate analysis, using the procedure described in the article (1), factoring minimum pressure at its median (46 hurricanes ≤963 mb and 46 hurricanes >963 mb). It can clearly be seen that this interaction effect is weaker than the focal interaction of MFI and normalized damage (Fig. 1*A*). For lower pressure storms, there is a slight trend for masculine-named storms to be deadlier, but for higher pressure storms, there is a stronger trend for feminine-named storms to be deadlier. This is driven by some feminine storms that were high in both normalized damage and minimum pressure.

Because the interaction with minimum pressure is not robust across analyses and is driven by some highly damaging feminine storms, it does not challenge our conclusions. The evidence does not support any assertion that masculine storms are deadlier.

Our model was designed to test our hypothesis about the relationship between name gender and severity of hurricanes (1). We included predictors specifically to address this. In contrast, Malter (2) argues for the addition of an interaction term for which there is no conceptual rationale.

Finally, Malter (2) complains about the external validity of our experiments for addressing at-risk contexts. However, there is ample evidence that subtle and implicit biases can predict consequential real-world decisions, even in stressful contexts (e.g., 8–10). Malter offers no reason to dismiss the relevance of a name–gender effect for at-risk populations. Across our experiments, whether with participants from around the United States, ages 18–81 y, or with University of Illinois students, our findings were consistent.

For people in at-risk contexts, the name–gender effect may be weaker. Alternatively, it may be accentuated under uncertainty and stress. These are important questions for future research. Our research demonstrates that a factor completely irrelevant to hurricane risk, the gendered name of a storm, affects risk perceptions and preparedness motivations. We are grateful for this opportunity to provide additional support for our conclusions about the role of name femininity in responses to storms.

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