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## Response to Commentary on Disparities in Infant Mortality Due to Congenital Anomalies on Guam

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# Response to Commentary on Disparities in Infant Mortality Due to Congenital Anomalies on Guam

Jonathan K. Noel MPH; Sara Namazi MS; and Robert L. Haddock DVM, MPH

Dear Editors,

We thank the authors who commented on our recent paper<sup>1</sup> for their lengthy discussion regarding congenital anomalies on Guam, a discussion that nearly exceeded the original article in length. After a thorough review of their critiques, we agree in part and we disagree in part.

We agree that the original study is not perfect. The ecological study design cannot determine causation; the sample size was low; the models could have been over-parameterized; and confounding variables could explain the relationship between the independent and dependent variables. We respond to each critique in turn.

Ecological studies are not, and should not, be used to determine cause and effect or to confirm existing hypotheses. Our study is no different. Their very nature, examining differences between populations, prohibits such profound statements from being made. This does not mean ecological studies are not meaningful or that they should not be published. Indeed, they allow for initial examinations of health conditions across communities and serve as hypothesis generators.<sup>2</sup> Again, our study is no different. Regarding the former, as of July 25, 2016, our study was the only result of a PubMed search using the terms “congenital anomalies” and “Guam,” and the first citation since 1991 using the terms “infant mortality” and “Guam.” Regarding the latter, we hope our research can generate as many hypotheses as other successful ecological studies, particularly those on cancer.<sup>3,4</sup>

The low sample size is due to the low number of villages on Guam and is a limitation that must be taken into consideration, as we did, when forming conclusions about the data. As we stated in the original article, Guam is a small island,<sup>1</sup> and it is simply not possible to increase the sample size further at the ecological level. Any attempts to do so would be artificial, statistically unwise, and biased.

Over-parameterization of the multivariable models is possible. If this is a concern, we suggest our commentators, and other interested readers, focus instead on Table 3 of the article.<sup>1</sup> This table presents the results of univariable linear regression models for each independent variable included in the analysis. From this table, it is clear that the independent variable with the strongest association to infant death due to congenital anomalies was Agent Orange (AO) spray area. This holds true for statistical significance (the lowest p-value), practical significance (the largest coefficient), and the ability to explain the variance in the dependent value ( $R^2$ ).

However, other confounding variables may explain the relationship between AO spray area and infant deaths, particularly

tobacco and alcohol consumption, and this is another limitation that must be taken into consideration, as we did. Unfortunately, we were unable to locate appropriate village-level data on these and several other potential confounders to include in the models. We hope to correct this deficiency in future studies.

In the space available in the original article, we attempted to address as many limitations as possible, which, admittedly, did not cover every conceivable limitation, although few studies do. However, we went to great pains to assert that the study was not definitive and causal inferences should not be made. From our article, “...it is important to stress that the ecological design of the study makes causal inferences of the study results impossible.”<sup>1</sup> That said, we believe that the methodological weaknesses of the current study can be resolved with a well-designed case-control or retrospective cohort study, and we encourage the National Institutes of Health, the Centers of Disease Control and Prevention, private foundations, and other grant making bodies to make sufficient funds available to conduct such research. If funds are available, we will happily apply.

As for the remainder of the commentary, we generally disagree. First, the reliance on memory recall in scientific research is the basis of some of the largest and most productive research studies in recent memory, and self-report is a meaningful part of nearly every surveillance study currently implemented by the United States government. To dismiss a study simply because a portion of it used recall reveals more about the biases of the commentators against social science than about the study itself.

In our study, a single individual came forward on his own accord and identified villages where AO was sprayed, a task that was a part of his daily duties while enlisted in the military and stationed on Guam. We agree with our commentators that this method was not standard scientific procedure and caution is warranted regarding his identification of AO spray villages, a fact that we freely expressed. As we wrote in the article, “caution is required because [the individual] may harbor significant biases.”<sup>1</sup> Unfortunately, past efforts to obtain relevant information regarding AO use on Guam have failed. Multiple Freedom of Information requests made by one of the study authors were denied and government resources have not been allocated to perform sufficient chemical testing in all Guamanian villages. We strongly encourage the Department of Defense (DOD) to de-classify and release all information regarding the storage and use of AO so that the reliance on such individuals is no longer required.

This leads us to an important issue implied by the paper. Was AO ever used on Guam? Our commentators imply that AO could have only been used as a wartime jungle defoliant with no pos-

sible other applications. Thus, logic dictates that AO could not have been used on Guam. Yet there are several plausible uses for a defoliant in and around the area of a military base, and it is naïve to assume otherwise. Defoliants can hold vegetation encroaching upon airstrips, roads, buildings, and pipes in check. Clear lines of sight between landmarks on and off the island can be maintained. Furthermore, Veterans Administration officials have previously concluded that defoliants were used on Guam and AO was stored on Guam.

*“Although the [Veterans Benefits Administration] and [Joint Services Records Research Center] provided evidence that the Veteran was not exposed, their findings were based on the DOD list and historical reports with little or no consideration to the other evidence of record clearly demonstrating that herbicides were used in Guam, Agent Orange was stored in Guam, and there was a heavy concentration of dioxin found in the soil many years later.”<sup>5</sup>*

If we ask the readers anything, it is to consider the plausible scenario that a useful chemical stored at a military base during wartime could also have been used in and around the same location.

The interesting aspect of our results is that there is no reason for our “AO Spray Area” variable to be significant. Guam is a small island, and for most environmental toxins, we would expect relatively homogeneous exposures and relatively homogeneous outcomes between villages. The sample size was very small, and the memory of the individual could have been compromised over time. Combined, these suggest that a null finding was more than probable. Yet, we found the opposite. We found something. Something that deserves further investigation.

The rest of our commentator’s critiques we largely dismiss. They are reminiscent of attacks made by the tobacco industry in attempts to silence researchers who published unfavorable research. Such attacks do not further scientific progress. They diminish it. They do not encourage the pursuit of new information. They quell it. Every study has some flaw, some limitation,

and few studies pass through peer-review unscathed. This should not prohibit the publication of a study because these are the baseline studies that scientific progress is built upon. Whether future studies confirm or reject our findings, we hope our article is one such baseline study.

In summary, we knew mentioning the phrase “Agent Orange” was controversial and would provoke a reaction. It did, on both sides of the issue. We did not shy away from the controversy but embraced the idea that we could start an uncomfortable conversation and, hopefully, better the lives of a population that is often neglected. We look forward to publishing similar studies that will provoke more responses, generate more hypotheses, and produce more research questions. We also look forward to the day when funding is made available that will allow us to complete the necessary series of studies that provide definitive answers to these very serious questions.

### **Conflict of Interest**

None of the authors identify any conflict of interest.

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