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A Baysian Statistical Analysis of the Dose-response Correlation with Cancer Incidence for Native Pacific Islanders Exposed to Radiation from Atomic Weapons Testing Fallout*

The purpose of this study was to determine whether the dose-response relationship between the fallout gamma plus beta radiation components of atomic weapons testing in the South Pacific Ocean during the period 1955 to 1962 correlated with incidence of leukemia, lymphoma, and multiple myeloma in Native Pacific Islanders. We analyzed death certificate records for 2,793 Native Pacific Islanders of ages between 10 years and 50 years during the period 1955 to 1962 and who were exposed unintentionally to fallout from the TOAD-5, BIG BIRTHA, and NICKEL KIM nuclear weapons tests. Dosimetry was assessed indirectly by measuring surface (top 1-cm) strontium-90 concentrations in beach sand on islands populated by the exposed populations, corrected for decay post-detonation. Using advanced Baysian algorithms, we found no statistical correlations between estimated skin dose based on Sr-90 sand concentrations and incidence of leukemia, lymphoma, and multiple myeloma. However, we did find a linear correlation between skin dose and incidence of metastatic melanoma ($p \leq 0.001$), which is relatively rare among Native Pacific Islanders, with an observed incidence of 0.00329 cases per Gy skin dose in the dose range 0.5 to 2.9 Gy (at the basal cell layer, averaged over 10 cm sq). This research provides statistical evidence for a linear, no-threshold dose-response relationship for melanoma incidence with skin dose from mixed beta/gamma emitters after nuclear fallout. (*Study sponsored by the Gates Beneficent Fund for Pacific Islander Health).

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