

## Supplemental Method:

1. **Calculation of age-standardized rates:** Age-standardized rates were calculated based on the standard world population 2025 (obtained from SEER website).
2. **More on UVI collection:** UVI information was obtained as previously described from local satellite stations (Liu-Smith et al., JAAD, 2017) , except for a few areas where no station was placed. UVI was estimated for these areas based on the similarity of latitude from another area where monitoring station was available. Local median latitude was obtained as where the central line lays for that area, without weighing out the area shape.
3. **Statistical Models:** As shown in Supplemental Figure 1, the histogram shows that case numbers follow a Poisson distribution. The dispersion calculated by maximum likelihood estimation was 2.035 with 95% Wald confidence interval of 1.888 to 2.169, significantly different than 0, suggesting a negative binomial model was more suitable for parameter estimation. Estimated by Pearson chi square the data fitted well into negative binomial distribution (data not shown). Log-transformed case number was dependent variable; and log-transformed population was used as an offset. Scale was defined as deviance. The age category was converted into numerical age using the middle point of that category. For example, numerical age for age category 5 (20-24 years old) is 22.5, and so on.

The base model (Model 1) included sex, age and UVI as independent variables. Next we added potential interactions among sex, age and UVI in Model 1 and sequentially generated Model 2 (with interaction between UVI and sex, UVI\*sex), Model 3 (UVI\*age) and Model 4 (age\*sex). Model 5 included all three 2x2 interactions.

Model A and Model B were also based on the negative binomial regression on each age strata. Model A included only UVI and sex and Model B included UVI\*sex interaction as an additional variable.

## Supplemental Table 1

Supplemental Table 1: parameter estimate from different models using latitude

		Coefficient	Standard Error	Wald 95% Confidence Limits		Wald Chi-Square	Pr > ChiSq	p value for model comparison
Model 1	Intercept	-10.149	0.1123	-10.369	-9.929	8162.22	<.0001	
	latitude	-0.0307	0.002	-0.0346	-0.027	229	<.0001	
	sex	-0.1374	0.048	-0.2314	-0.044	8.22	0.0042	
	age	0.0631	0.0012	0.0607	0.066	2679.83	<.0001	
	LL*	-8867.5						NA
Model 2	Intercept	-10.548	0.1405	-10.823	-10.27	5638.65	<.0001	
	latitude	-0.0218	0.0028	-0.0273	-0.016	59.82	<.0001	
	sex	0.6568	0.1856	0.293	1.021	12.52	0.0004	
	age	0.063	0.0012	0.0607	0.065	2711.69	<.0001	
	latitude*sex	-0.0177	0.004	-0.0256	-0.010	19.56	<.0001	
	LL	-8855.8						<0.0001
Model 3	Intercept	-10.86	0.2342	-11.32	-10.40	2150.4	<.0001	
	latitude	-0.0147	0.0051	-0.025	-0.005	8.51	0.0035	
	sex	-0.1389	0.0477	-0.232	-0.046	8.5	0.0036	
	age	0.0788	0.0048	0.0695	0.0882	272.97	<.0001	
	latitude*age	-0.0004	0.0001	-0.0006	-0.0001	11.66	0.0006	
	LL	-8860.5						<0.0001
Model 4	Intercept	-9.6074	0.1222	-9.8468	-9.3679	6182.3	<.0001	
	latitude	-0.0305	0.002	-0.0343	-0.0267	244.79	<.0001	
	sex	-1.1911	0.1143	-1.4152	-0.967	108.55	<.0001	
	age	0.0504	0.0017	0.0472	0.0537	918.54	<.0001	
	age*sex	0.0233	0.0023	0.0188	0.0278	102.07	<.0001	
	LL	-8808.9						<0.0001
Model 5	Intercept	-10.499	0.2476	-10.984	-10.014	1798.35	<.0001	
	latitude	-0.0109	0.0052	-0.0211	-0.0006	4.34	0.0373	
	sex	-0.4523	0.2052	-0.8546	-0.05	4.86	0.0275	
	age	0.0621	0.0048	0.0528	0.0715	169.7	<.0001	
	latitude*age	-0.0003	0.0001	-0.0005	-0.0001	6.72	0.0096	
	latitude*sex	-0.016	0.0039	-0.0236	-0.0085	17.35	<.0001	
	age*sex	0.0229	0.0023	0.0184	0.0273	99.86	<.0001	
	LL	-8794.3						< 0.0001

\*LL, log likelihood value