

Longitudinal associations between behaviour concerning UV-light exposure and susceptibility to allergies in early childhood

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Introduction:

- Allergy is the most common and earliest manifestation of the vulnerability of the immune system to modern environmental and lifestyle change (Fig 1).
- 30-40% of the world's population is affected by at least one allergic disease. While multifactorial, a consistent allergy risk factor has been reduced UV-light exposure.
- However, vitamin D supplementation studies have been disappointing, raising the question whether independent effects of UV-light exposure may play a role.
- This is the first study to investigate longitudinally whether UV-light exposure and sun protective behaviours influence the development of early childhood allergic disease.

Methods

Data on outdoor/sunlight exposure, sun protective behaviours, skin type and vitamin D levels were collected. Children (n=195) were assessed for allergic disease outcomes at 3, 6, 12, and 30 months. Using generalized-linear-mixed-models (GLMM) we investigated changes over the four time points for any allergic disease outcomes and specifically eczema, food allergy, wheeze or allergen sensitisation. Fixed effects for confounding variables were examined in unadjusted models.

Table 1: Generalised Linear Mixed Models (binary logit link function) for outcomes atopy, eczema and wheeze.

Model Term	p-value	OR	95% CI for OR	
			Lower	Upper
Atopy Model				
Intercept	<.001	19.781	7.772	50.349
Daily Sun exposure	<.001*	0.987	0.981	0.992
Sunscreen				
Sunscreen always ^a	.050	0.494	0.244	1.000
Sunscreen sometimes ^a	.019	0.499	0.279	0.892
Skin exposed				
Skin exposed face ^b	.061	0.589	0.339	1.025
Skin exposed face, hands and arms ^b	.011*	0.469	0.261	0.841
Vitamin D supplementation	.109	0.992	.983	1.002
Eczema Model				
Intercept	.346	0.838	0.580	1.211
Sunscreen				
Sunscreen always ^a	0.254	0.400	1.239	0.752
Sunscreen sometimes ^a	0.172	.009	1.566	1.117
Wheeze Model				
Intercept	0.252	<.001	13.481	8.214
Season of birth				
summer ^c	0.379	.635	1.197	0.569
autumn ^c	0.332	.009*	0.417	0.217
winter ^c	0.306	.492	0.810	0.444
Outdoor exposure	0.001	.005*	0.996	0.993

Final adjusted GLMM examined wheeze with confounders season of birth and outdoor exposure, with both remaining significant effects. Note: OR odds ratio; ^acompared to never; ^bcompared to face, hands, arms and legs; ^ccompared to spring *bolded represents a statistically significant group difference at p<.05.

Results

- Focussing on any allergic disease development, protective fixed effects were found for outdoor daily sun exposure time (F=32.0; OR 0.98; CI 0.98–0.99; p<0.001) and sunscreen use (F=9.51; p<0.001).
- The individual eczema outcome model reported that children who sometimes wore sunscreen were at increased risk of eczema development (OR 0.50; CI 0.28-0.89;p=0.02).
- Wheeze models showed protective fixed effects for season of birth (F=3.35; p=0.02) with a decreased risk for children born in autumn (OR=0.39; CI 0.20-0.75; p=0.005), time spent outdoors (F=9.1; OR=1.00; CI 0.99-1.00; p=0.003) and increased daily sun exposure (F=8.1; OR 0.91; CI 0.86-0.97; p=0.004).
- Final adjusted GLMM examined wheeze with confounders season of birth and outdoor exposure with both remaining significant results (Table 1, Figure 2).
- No effects were detected for vitamin D levels/supplementation, skin type or exposure.

Figure 1: Potential environmental factors influencing the development of allergic disease in early childhood.

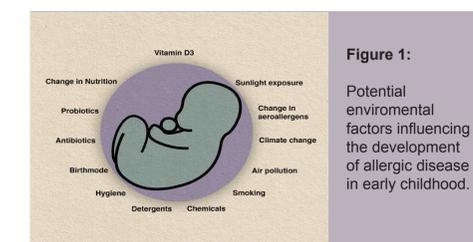


Figure 2: Summary of the major factors within the first 2.5 years of life that were associated with medically diagnosed wheeze outcomes

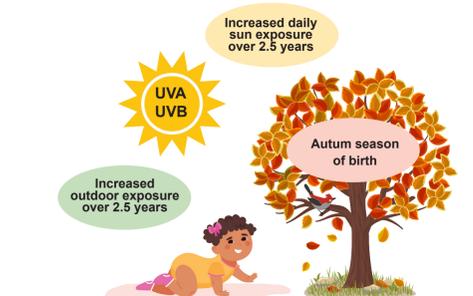
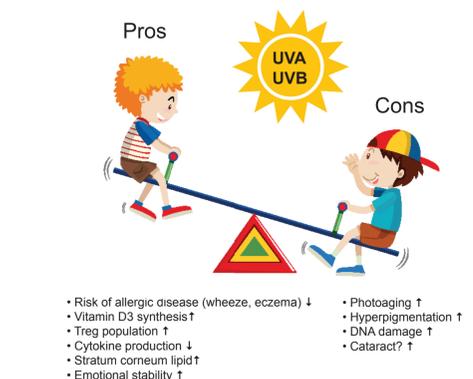


Figure 3: Pros and cons of sunlight exposure



Conclusion

- Observational studies have described an inverse association between vitamin D status and allergic disease. However, none of these previous studies evaluated UV-light exposure in addition to vitamin D status.
- Longitudinally our data shows a protective link between time spent outdoors/in the sun and any allergic disease outcomes, specifically wheeze outcomes.
- Our results suggest that vitamin D independent UV-light induced effects may be responsible for these associations.
- Larger, well designed studies are required to explore the role of UV- light exposure on allergy outcomes outweighing potential benefits and cancer risks (Figure 3).

Literature:

1. Rueter K, et al. JACI 2019; 143: 1012-1020
2. Alfredson L, et al. Environ. Res. Publ. Health 2020; 17: 5014
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4. Hart P, et al. Nat Rev 2011; 11: 584-596