

Mapping Rosacea and Socioeconomic Inequality Impact Across the United Kingdom: Evidence from a Large-Scale Population-Based Cohort

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Background

Rosacea is a chronic inflammatory skin condition affect about 5% of the global population (~ 415 million). Rosacea primarily affects individuals ages 40-60^{1,3-5}. Pathophysiology is multifactorial, involving genetic susceptibility and environmental triggers. Established non-modifiable risk factors include Fitzpatrick skin types I-II, Celtic and Northern European ancestry, female sex, and older age^{1,3-5}. Established modifiable risk factors include UV exposure, heat, alcohol use, smoking, and psychological stress^{1,3-5}.

Whiles the relationship between the association between rosacea and socioeconomic factors has not been extensively studied, there is some evidence that socioeconomic indicators

Study Objective

Index of Multiple Deprivation Combined Score (England, Scotland, Wales), Index of Multiple Deprivation Score England, Crime Score England, Education Score England, Employment Score England, Housing Score England, Health Score England, Income Score England, Living Environment Score England



Establish Risk Factors:

Sex, Skin Color, Body Mass Index (BMI), Alcohol Frequency, Smoking Status, Vitamin D Levels

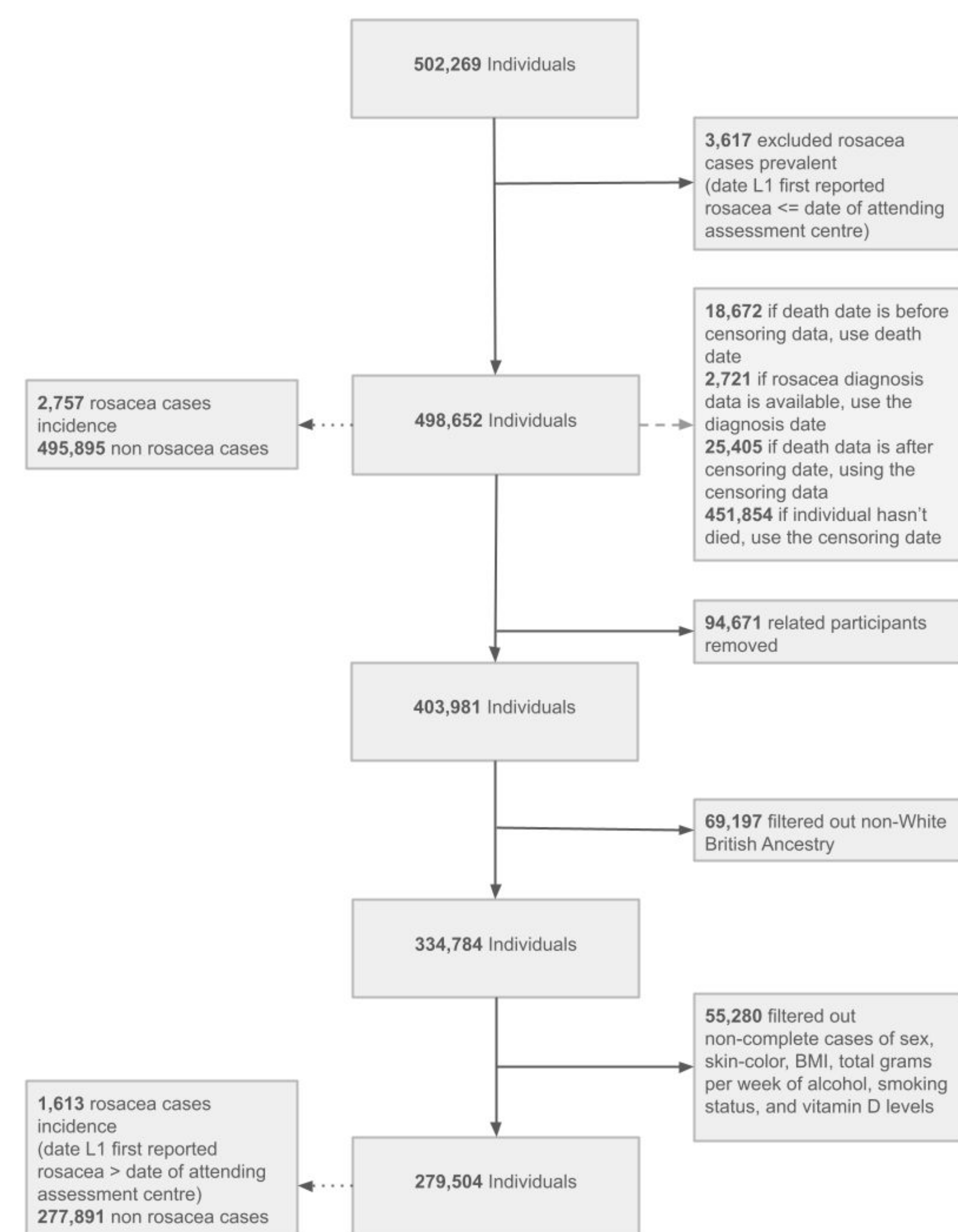


Does socioeconomic inequalities affect rosacea incidence independent of established triggers?

This study aims to address the gap. The socioeconomic variables studied are modifiable risk factors and finding a correlation between rosacea and air pollution could potentially improve the lives of patient with rosacea. This study is using the largest cohort to date.

Study Population

The UKBioBank (UKBB) comprises of 502,269 participants enrolled between 40 to 69 years old from 2006 to 2010. Participants were recruited across 22 assessment centers in England, Scotland, and Wales. Our Study comprises of 301,348 UKBB participants of unrelated White British ancestry without prior rosacea.



Statistical Analysis

A series of generalized linear models (glm) were fitted, each model included a single socioeconomic variable, while adjusting for relevant covariants. The models were adjusted for the following risk factors: alcohol intake frequency, skin colour, body mass index (BMI), smoking status, sex, and vitamin D levels.

Socioeconomic Factors in the UKBB

The English Indices of Deprivation 2010 are measures of multiple deprivation at the small area level. It is based on the model of model of multiple deprivation, recognizing distinct domains that can be measured separately. Domains reflect forms of deprivation experience by individuals; people may fall into multiple domains depending on their circumstances. Seven main domains: incomes, employment, health, education, housing, living environment, and crime.

Scottish Index of Multiple Deprivation (SIMD) 2009 ranks 6,505 small areas across Scotland by relative deprivation using seven domains. Lower ranks indicate higher deprivation.

Welsh Index of Multiple Deprivation (WIMD) 2008 measures deprivation in small areas using eight domains.

All domains standardized before combining into the overall index.

Descriptive Statistics of the UK BioBank Study Population

Characteristic	Non Rosacea N = 277,891 ¹	Incident Rosacea N = 1,613 ¹	p-value ²
Sex			<0.001
Female	145,085 (52%)	917 (57%)	
Male	132,806 (48%)	696 (43%)	
Age at Assessment	58 (50, 63)	58 (50, 63)	0.045
BMI Category (kg/m²)			>0.9
Healthy Range (18.5-24.9)	89,302 (32%)	502 (31%)	
Underweight (<18.5)	1,367 (0.5%)	7 (0.4%)	
Overweight (25.0-29.9)	120,305 (43%)	710 (44%)	
Obesity (30.0-39.9)	61,960 (22%)	363 (23%)	
Morbid Obesity (≥40.0)	4,957 (1.8%)	31 (1.9%)	
Smoking Status			0.020
Never	152,235 (55%)	888 (55%)	
Previous	98,258 (35%)	598 (37%)	
Current	27,398 (9.9%)	127 (7.9%)	
Alcohol Consumption			0.027
Never	17,021 (6.1%)	99 (6.1%)	
Occasional	27,786 (10.0%)	173 (11%)	
1-3x/month	30,550 (11%)	186 (12%)	
1-2x/week	73,356 (26%)	417 (26%)	
3-4x/week	68,333 (25%)	297 (25%)	
Daily	60,845 (22%)	341 (21%)	
Vitamin D Category (nmol/L)³			0.027
Sufficient (Normal)	33,306 (11%)	183 (11%)	
Severely Deficient	50,933 (18%)	324 (20%)	
Deficient	94,993 (34%)	585 (36%)	
Insufficient	98,130 (35%)	520 (32%)	
High (Above Recommended)	529 (0.2%)	1 (<0.1%)	
Skin Colour			0.2
Very Fair	21,247 (7.6%)	128 (7.9%)	
Fair	200,635 (72%)	1,189 (74%)	
Light Olive	50,447 (18%)	272 (17%)	
Dark olive and darker	5,562 (2.0%)	24 (1.5%)	

¹n (%) Median (Q1, Q3)

²Wilcoxon rank sum test; Pearson's Chi-squared test

³Serum vitamin D levels were categorized as severe deficiency (< 30 nmol/L), deficiency (30–50 nmol/L), insufficiency (50–75 nmol/L), sufficiency (> 75 nmol/L), and high levels (> 125 nmol/L).

Baseline study population descriptive statistics for non-rosacea (N=299,617) and incident rosacea (N=1,613) group. P-values estimated using Pearson's chi-squared test for categorical variables and Wilcoxon rank sum test for continuous variables. Categorical variables are represented as number (percentage). Continuous variables are reported as median (interquartile range). Abbreviations: BMI = body mass index.

Characteristic	Non Rosacea N = 277,891 ¹	Incident Rosacea N = 1,613 ¹	p-value ²
Index of Multiple Deprivation Combined Score^a			<0.001
Mean (SD)	47.41 (28.45)	48.18 (28.40)	
Median [Min-Max]	46.32 [0.00-100.00]	46.34 [0.00-99.70]	
Missingness	6,853 (2.47%)	36 (2.23%)	
Index of Multiple Deprivation Score England			<0.001
Mean (SD)	12.83 (17.08)	13.54 (17.40)	
Median [Min-Max]	5.40 [0.00-98.20]	6.00 [0.00-89.70]	
Crime Score England			<0.001
Mean (SD)	-0.12 (0.78)	-0.12 (0.79)	
Median [Min-Max]	-0.12 [-2.73-3.81]	-0.13 [-2.55-3.52]	
Education Score England			0.9999
Mean (SD)	14.79 (15.61)	14.12 (14.81)	
Median [Min-Max]	9.32 [0.02-98.09]	9.41 [0.08-98.83]	
Employment Score England			0.8466
Mean (SD)	0.09 (0.06)	0.09 (0.06)	
Median [Min-Max]	0.07 [0-0.75]	0.07 [0.01-0.39]	
Housing Score England			0.1588
Mean (SD)	19.23 (9.89)	18.44 (9.75)	
Median [Min-Max]	18.01 [0.34-70.14]	17.45 [0.59-53.04]	
Health Score England			0.3339
Mean (SD)	-0.13 (0.85)	-0.08 (0.85)	
Median [Min-Max]	-0.12 [-3.1-3.79]	-0.07 [-2.91-2.43]	
Income Score England			0.8671
Mean (SD)	0.11 (0.09)	0.10 (0.09)	
Median [Min-Max]	0.08 [0.01-0.77]	0.07 [0.01-0.49]	
Living Environment Score England			0.9883
Mean (SD)	17.27 (14.32)	16.23 (13.22)	
Median [Min-Max]	13.04 [0.08-92.99]	12.36 [0.33-75.74]	

¹n (%) Median (Q1, Q3)

²Wilcoxon rank sum test; Pearson's Chi-squared test

^aThe Index of Multiple Deprivation (IMD) was used as a measure of socioeconomic status. Because IMD scores are calculated separately and are not directly comparable across England, Scotland, and Wales, we standardized scores within each country.

For each country-specific IMD measure, Z-scores were computed by subtracting the country-specific mean and dividing by the standard deviation. These standardized values were then converted into percentile ranks (range: 0-100), with higher values indicating greater deprivation.

A unified IMD variable was created by combining country-specific percentile scores using a coalescing approach, such that each participant was assigned a single deprivation percentile corresponding to their country of residence.

Additionally, a categorical variable indicating country (England, Scotland, or Wales) was included as a covariate in all analyses.

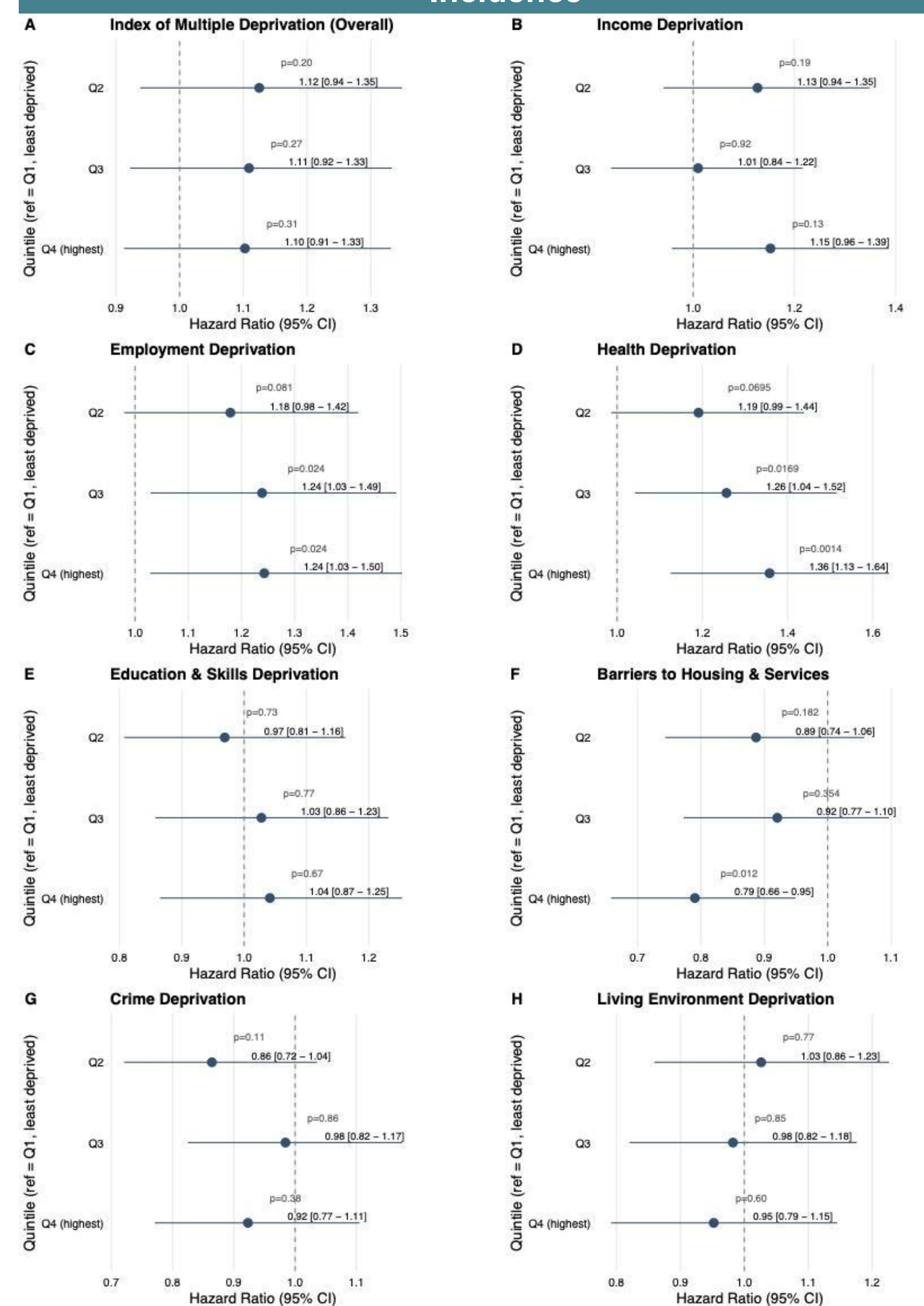
Baseline study population descriptive statistics for non-rosacea (N=299,617) and incident rosacea (N=1,613) group. P-values estimated using Pearson's chi-squared test for categorical variables and Wilcoxon rank sum test for continuous variables. Categorical variables are represented as number (percentage). Continuous variables are reported as median (interquartile range).

Results

The final study population comprised of 301,348 participants, 1,613 developed incidence rosacea during follow up. Males had 16% lower odds of developing rosacea compared to females. Current smokers had a 20-26% lower odds compared to never smokers; former smokers has not association. There was no effect using alcohol categorical intake, but continuous intake showed minimal increase risk (0.05% per gram/week).

For socioeconomic over deprivation, there was no clear effect. Health deprivation showed a 33% increase in rosacea risk (Q3: OR = 1.21, Q4: OR = 1.33). Conversely, Housing deprivation showed a 22% decreased rosacea risk (Q4: OR = 0.78). The other domains, crime, education, income, employment, and environment, had no significant associations.

Association Between the Deprivation Scales and Rosacea Incidence



Forest plots displaying the Odds Ratios (OR) and 95% Confidence Intervals (CIs) across eight domains of deprivation. Results compare quintiles 2, 3, and 4 (highest deprivation) against the reference group (Q1, least deprived). P-values indicates statistical significance, with the vertical dashed line representing a Hazard Ratio of 1.0 (no difference in risk).

Conclusions

- No strong overall deprivation-rosacea link
- Health deprivation ↑ = rosacea ↑ (dose-response)
- Housing deprivation ↑ = rosacea ↓ (unexpected)
- Other domains: no association
- Suggests heterogeneity + possible detection bias

Limitations

- 1 UKBB is subject to a "healthy volunteer" selection bias; case ascertainment may be imperfect (based on health-records & self-reported data)
- 2 Socioeconomic exposures were deprived from area-level deprivation indices rather than individual-level socioeconomic measures
- 3 Analysis restricted to White British Ancestry & PCA
- 4 Several covariates were self-reported & subject to recall and reporting bias
- 5 The exposures were measured at a single baseline time point which precludes causal inference

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