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Lifetime incidence and healthcare disparities in alopecia areata: a UK population-based cohort study

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The study protocol for this retrospective observational study was registered a priori with ClinicalTrials.gov (Identifier: NCT05727306).

Abstract

Background Alopecia areata (AA) is an immune-mediated form of hair loss that can occur at any age, often with a significant mental health burden.

Objectives We aimed to provide estimates of the lifetime incidence of AA, and the impacts on mental health, healthcare utilization and work-related outcomes, assessing variation across major sociodemographic subgroups.

Methods AA cases were identified in primary care from the UK population-based Oxford-Royal College of General Practitioners Research and Surveillance Centre database (2009–2018). Lifetime incidence of AA was estimated at age 80 years using modified time-to-event models with age as the timescale, overall and stratified by sex, ethnicity, deprivation and geography. Mental health, healthcare utilization and work-related outcomes were assessed in the 2 years after AA diagnosis compared with matched unaffected controls, and stratified by the same sociodemographic subgroups.
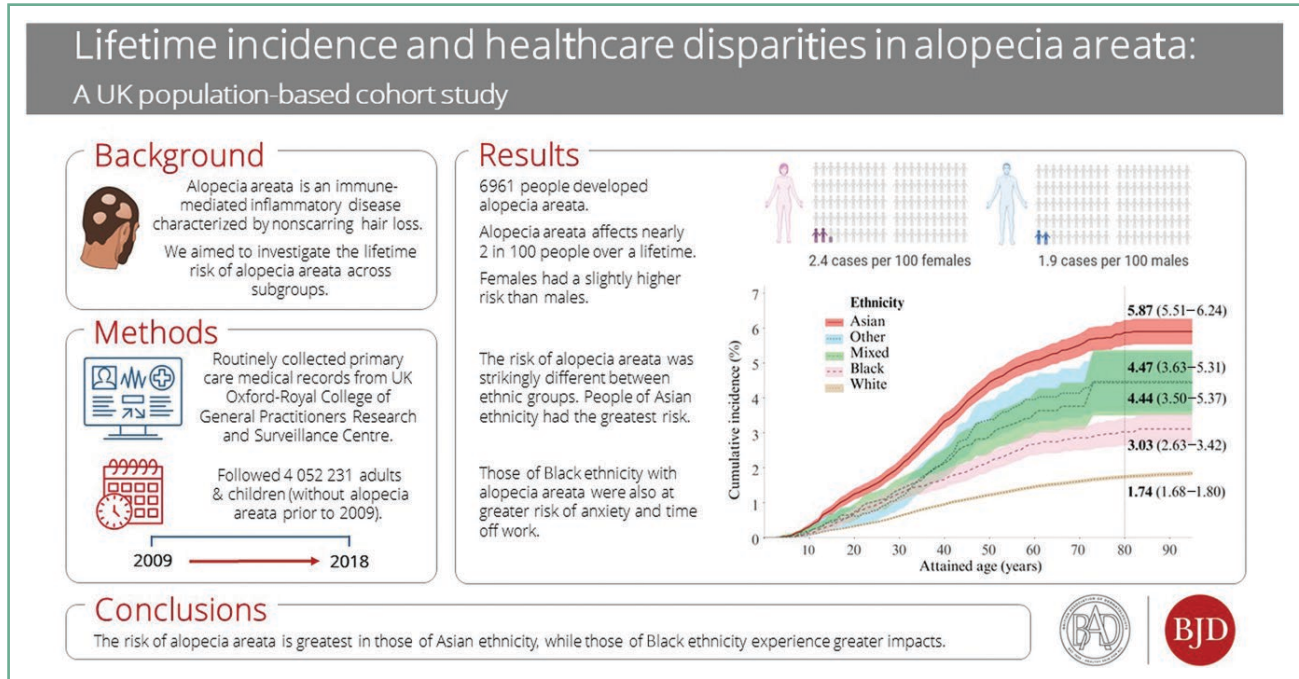
Results During the study period, 6961 people developed AA. Overall lifetime incidence of AA was 2.11% [95% confidence interval (CI) 2.06–2.16]. Females had a higher lifetime incidence (2.35%, 95% CI 2.28–2.43) than males (1.88%, 95% CI 1.81–1.94). Lifetime incidence was higher in those of Asian ethnicity (5.87%, 95% CI 5.51–6.24), Other (4.5%, 95% CI 3.63–5.31), Mixed (4.4%, 95% CI 3.50–5.37) and Black (3.0%, 95% CI 2.63–3.42) ethnicity, compared with White ethnicity (1.7%, 95% CI 1.68–1.80). Lifetime incidence was highest in those with the greatest deprivation: most-deprived quintile (2.92%, 95% CI 2.77–3.07) compared with least-deprived (1.68%, 95% CI 1.59–1.78). Across sociodemographic subgroups, people with AA of Black ethnicity were most likely to have anxiety (adjusted odds ratio vs. matched controls 2.92, 95% CI 1.71–4.91), and had the greatest risk of time off work (adjusted hazard ratio vs. matched controls 2.54, 95% CI 1.80–3.56).

Conclusions AA affects around 1 in 50 people over their lifetime. The incidence and impact of AA on mental health and work outcomes is highest in ethnic groups other than White. Clinicians should be aware of the marked heterogeneity in the incidence and impact of AA, and support targeted healthcare to groups at the highest risk of alopecia and its consequences.

Graphical Abstract

Lifetime incidence and healthcare disparities in alopecia areata:
A UK population-based cohort study

Background

Alopecia areata is an immune-mediated inflammatory disease characterized by nonscarring hair loss.

We aimed to investigate the lifetime risk of alopecia areata across subgroups.

Methods

Routinely collected primary care medical records from UK Oxford-Royal College of General Practitioners Research and Surveillance Centre.

Followed 4 052 231 adults & children (without alopecia areata prior to 2009).

2009 ——→ 2018

Results

6961 people developed alopecia areata.

Alopecia areata affects nearly 2 in 100 people over a lifetime.

Females had a slightly higher risk than males.

The risk of alopecia areata was strikingly different between ethnic groups. People of Asian ethnicity had the greatest risk.

Those of Black ethnicity with alopecia areata were also at greater risk of anxiety and time off work.

2.4 cases per 100 females   1.9 cases per 100 males

Ethnicity: Asian, Other, Mixed, Black, White

Cumulative incidence (%) vs Attained age (years)

5.87 (5.51−6.24)
4.47 (3.63−5.31)
4.44 (3.50−5.37)
3.03 (2.63−3.42)
1.74 (1.68−1.80)

Conclusions

The risk of alopecia areata is greatest in those of Asian ethnicity, while those of Black ethnicity experience greater impacts.

Lay summary

Alopecia areata (AA) is a condition characterized by hair loss that involves the immune system. AA can develop at any age but commonly affects young adults. The symptoms are often unpredictable, and people with AA can experience distress or in some cases, mental health conditions.

In this study, we investigated how the impact of AA varies between groups of people. We used electronic medical records from general practices in the UK from 2009 to 2018. We looked at how many people developed AA, their age at diagnosis, the risk of AA between females and males, and the risk between different ethnic groups, and between areas in which people lived. We found that 2 in every 100 people will develop AA across their lifetime. The risk of AA was different across ethnic groups. People from the Asian ethnic group had the greatest risk with nearly 6 cases per 100 people, compared with fewer than 2 cases per 100 people for the White ethnic group. People living in deprived or urban areas were also at higher risk of AA. We also found the impact of having AA differed between ethnic groups. People from the Black ethnic group with AA were most likely to have anxiety and most likely to have time off work certificates issued by their doctor.

Overall, our study findings suggest that both the risk and impact of AA varies across the population of the UK. This information should help clinicians target support towards people experiencing the greatest burden.

What is already known about this topic?

- Alopecia areata (AA) is an immune-mediated form of hair loss, which can occur at any age.
- AA can be a distressing condition and is associated with a high burden of mental health comorbidity.
- Although it is known that the incidence of AA peaks in young adults, how the lifetime incidence and impact of AA varies by sex, ethnicity and socioeconomic status has not previously been described.

What does this study add?

- Overall lifetime incidence of AA in the UK is 2.1%, with marked variation across ethnic groups, with people of Asian ethnicity having the greatest risk (5.9%).
- The lifetime risk of AA is also higher for people from more deprived and urban areas.
- The impact of AA differs by ethnic group, with people of Black ethnicity experiencing the greatest burden of anxiety and time off work.

Alopecia areata (AA) is a nonscarring, immune-mediated form of hair loss. AA can occur at any age, although incidence peaks in young adults.[1,2] UK data suggest a point prevalence of 0.58% in adults, and an annual incidence of 0.26 per 1000 person years.[1] The lifetime incidence of developing AA has been estimated at 2.1%,[3] although this was based on one relatively small (*n* = 530) population. Variation in AA lifetime incidence by sex, ethnicity and deprivation has not been previously described and may be important given the recently observed differences in prevalence of AA across ethnic groups.[4]

AA can be a distressing condition, especially as prognosis is unpredictable and relapse is common.[5] People with AA experience a high burden of mental health conditions,[6–10] including a 33% greater risk for new-onset anxiety and 38% greater risk for depression.[11] Furthermore, nearly 80% of people with AA report impacts on their quality of life[8] across a range of different measures,[12–15] and those with AA are 56% more likely to have time off work and 82% more likely to be unemployed.[11] Although people with AA from lower socioeconomic groups are more likely to attend primary care, they are less likely to be referred to specialist dermatology services.[1] To our knowledge no previous study has provided a comprehensive evaluation of variation in the impact of AA by age and major sociodemographic factors.

In a large-scale UK population-based study, we aimed to provide contemporary estimates of lifetime incidence of AA. We also sought to identify any sociodemographic disparities in lifetime incidence, and the wider impacts and healthcare burden of AA.

Patients and methods

Study design

The study protocol for this retrospective observational study was registered a priori with ClinicalTrials.gov (Identifier: NCT05727306). Routinely collected, population-based primary care data were extracted from the UK Oxford-Royal College of General Practitioners (RCGP) Research and Surveillance Centre (RSC) database (registered population 2.6 million), which is representative of the national population.[1,16–18]

Study population

All adults and children registered in the Oxford-RCGP RSC between 1 January 2009 and 31 December 2018, with at least 1 day of follow-up and without a diagnosis of AA prior to the study start date, were eligible for inclusion (excluding 1.8% who have opted out of record sharing).

Definition of sociodemographic characteristics
Sociodemographic data comprised age, sex, ethnicity, socioeconomic status (SES), geographic area and region. Ethnicity was grouped using standard UK groups: 'White' (Irish, Gypsy or Irish Traveller, Roma, other White), 'Black' (Black British, Black Welsh, Caribbean, African, other Black), 'Asian' (Asian, Asian British, Asian Welsh, Bangladeshi, Chinese, Indian, Pakistani, other Asian), 'Mixed or Other'

(mixed, Arab, any other ethnic group).[19] SES was derived from patient postcode and defined using the Index of Multiple Deprivation[20] stratified into quintiles of deprivation. Geographic area (urban/rural) and English region (London, East Midlands, East of England, North East, North West, South East, South West, West Midlands, Yorkshire and the Humber) were defined from patient postcode.

Alopecia areata case definition
Individuals newly diagnosed with AA (AA cases), either by a GP in primary care or by a dermatologist following referral, were defined by the presence of a first-ever AA-specific Read code and no diagnosis codes for an alopecia alternative condition (scarring alopecia, traction alopecia, congenital alopecia, androgenetic alopecia, telogen effluvium, tinea capitis, trichotillomania, or secondary syphilis of the scalp) in the subsequent 365 days.[17] People diagnosed with AA within 6 months of practice registration were excluded (to ensure we captured only incident AA cases). The index date of each AA case was assigned to the date of their AA diagnosis.

Definition of matched controls
A matched control population was defined to evaluate impacts of AA in those aged 12+ years. Each individual aged 12+ years diagnosed with new-onset AA during the study period was matched at their diagnosis date with up to four unaffected controls without a diagnosis of AA. Individuals without AA but with a diagnosis of a nonspecific or alopecia alternative condition, or less than 12 months of follow-up available, were excluded. A rolling matched-cohort design was used, defining eligible matched controls at the date of AA diagnosis for each case, and then exact matching on age category (adolescents aged 12–17 years, and adults aged 18–29, 30–49 and 50+ years), sex, ethnicity, SES, geographical area and region. To further improve matching quality, the algorithm included additional nearest-neighbour matching by age in years. After matching, the index date of each matched control was set to the index date of their matched AA case counterpart.

Study outcomes

Mental health outcomes
Three mental health condition outcomes were assessed – depressive episodes, recurrent major depressive disorder and anxiety disorders – defined by the International Statistical Classification of Diseases and Related Health Problems 10th Revision classification, and identified using algorithms validated for use in UK primary care data[21] (Appendix S1; see Supporting Information).

Healthcare utilization outcomes
Healthcare utilization comprised three outcomes: primary care visits, dermatology referrals and referrals for psychological therapy (including those via Improving Access to Psychological Therapies and psychiatric reviews) (Appendix S1).

Work-related outcomes
Work-related outcomes comprised time off work, identified by issued Med 3 certification from primary care for time off work, and unemployment, defined by issues of IB113 or ESA113 forms for unemployment (Appendix S1).

Statistical analyses

Lifetime incidence of alopecia areata

Cumulative lifetime incidence of AA was estimated in the whole study population using adapted survival models with age as the timescale, fitted as Aalen–Johansen cumulative risk estimates using the *etm* package in R[22] and adjusted for the competing risk of death.[23,24] Individuals were followed-up from the latest of their age at study start date or their age at their date of practice registration until the earliest of their age at an AA diagnosis (if recorded) or a censoring event (death, deregistration, date aged 95 years, or study end date). Lifetime incidence was calculated overall and by sociodemographic subgroups at age 80 years.

Disparities in the impact of alopecia areata

Mental health and healthcare utilization outcomes were compared in AA cases and matched controls. Analysis of work-related outcomes was restricted to individuals aged 18–65 years. All outcomes were evaluated in the overall matched population, and by sociodemographic subgroups with mixed and other ethnicity groups combined into a single 'other' group.

Burden of mental health conditions

The relative burden of each mental health condition recorded prior to and in the 2 years post-index date was estimated in AA cases vs. matched controls using logistic regression. Three adjustment sets were used to assess the robustness of the estimates by sequentially adding measured confounders: unadjusted, sex- and age-adjusted, and a set adjusted for sociodemographic, clinical characteristics and count of 0–3+ major comorbidities (Table 1). Logistic regression models were reported using adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

Healthcare utilization and work-related outcomes

The relative incidence of dermatology referrals, referrals for psychological therapy, time off work and unemployment were compared in AA cases vs. matched controls up to 2 years post-index date using Cox proportional hazard regression, with visual assessment of proportional hazards assumptions, and applying the same three covariate adjustment sets as for mental health outcomes. Negative binomial regression, accounting for overdispersion, was used to compare rates of primary care visits, also using the same covariate adjustment sets.

Sensitivity analysis

To evaluate the magnitude of potential bias from including, as matched controls, individuals who are registered with a GP but who do not attend their practice, we repeated the analysis for mental health, healthcare utilization and work-related outcomes restricting the matched-control set to individuals with at least one primary care consultation in the year preceding their index date. Furthermore, a parallel sensitivity analysis was performed to assess the impact of missing ethnicity data, by amending missing ethnicity entries to White.

All statistical analyses were performed using R version 4.2.1. The study was conducted and reported following RECORD (REporting of studies Conducted using Observational Routinely collected health Data) guidelines.[25] There was one change to the methods stated in the study protocol registered with ClinicalTrials.gov (Identifier: NCT05727306), which is noted in Appendix S2 (see Supporting Information).

Results

Cumulative lifetime incidence of alopecia areata is highest in people of Asian ethnicity, with greater deprivation, and in urban areas

Of the 4 052 231 individuals in the final study population (Figure S1; see Supporting Information), 6961 developed AA over the study period. The median age of those with AA was 35 years (interquartile range 26–47). People were commonly diagnosed in childhood (8.6% aged 12–17 years) and early adulthood (27.5% aged 18–29 years). The largest proportion of AA cases (43.1%) were aged 30–49 years, with 20.8% aged over 50 years (Table 1), although alopecia can be diagnosed at any age and risk continued to accumulate into later life (Figure S2; see Supporting Information). This translated to a cumulative lifetime incidence of 2.11% (95% CI 2.06–2.16; Figure 1a) by age 80 years. Females had a slightly higher lifetime incidence of 2.35% (95% CI 2.28–2.43) compared with males (1.88%, 95% CI 1.81–1.94), although no difference was evident until after age 50 years (Figure 1b). Marked differences existed between ethnic groups: those of Asian ethnicity had the greatest lifetime incidence of 5.87% (95% CI 5.51–6.24; Figure 1c). Lifetime incidence was highest in those with the greatest deprivation (2.92%, 95% CI 2.77–3.07) and lowest in those with least deprivation (1.68%, 95% CI 1.59–1.78) (Figure 1d). London had a higher lifetime incidence than any other geographical area (3.15%, 95% CI 2.98–3.31); there was no clear variation in lifetime incidence across the remaining geographical areas (Table S1; see Supporting Information). Lifetime incidence was higher in those from urban areas (2.27%, 95% CI 2.21–2.33) compared with rural areas (1.49%, 95% CI 1.39–1.58) (Table S1).

Disparities in mental health, healthcare utilization and work-related impacts

Eligible adults and adolescents with incident AA (*n*=6183) were matched to 24 718 controls without AA (Figure S1). AA cases and controls were well matched on all sociodemographic and clinical characteristics except for smoking status (Table 1).

Burden of mental health comorbidity was highest in those of Black ethnicity

AA was associated with a greater risk of depressive episodes (aOR 1.35, 95% CI 1.25–1.46; Figure 2a, Table S2; see Supporting Information), recurrent major depressive disorder (aOR 1.45, 95% CI 1.32–1.58; Figure 2b, Table S3; see Supporting Information) and anxiety disorders (aOR 1.40, 95% CI 1.30–1.51; Figure 2c, Table S4; see Supporting Information). The AA-associated increase in risk was consistent across age and ethnicity groups, with the exception

Table 1 Sociodemographic and clinical characteristics of alopecia areata (AA) cases and matched controls

Characteristics, n (%)[a]	AA cases	Matched controls	SMD[b]
	6183	24 718	
Follow-up duration years, median (IQR)	3.5 (1.7–6.0)	3.1 (1.5–5.8)	0.061
Sex			
Female	3342 (54.1)	13 366 (54.1)	< 0.001
Male	2841 (45.9)	11 352 (45.9)	
Age (years), median (IQR)	35.0 (26.0–47.0)	35.0 (25.0–47.0)	0.003
Age (years) group			0.001
12–17	529 (8.6)	2111 (8.5)	
18–29	1699 (27.5)	6792 (27.5)	
30–49	2666 (43.1)	10 659 (43.1)	
50+	1289 (20.8)	5156 (20.9)	
Ethnicity			0.002
White	3205 (66.2)	12 820 (66.3)	
Black	241 (5.0)	960 (5.0)	
Asian	1129 (23.3)	4515 (23.3)	
Other	264 (5.5)	1047 (5.4)	
Missing	1344	5376	
IMD quintile			0.001
1 (most deprived)	1339 (22.1)	5356 (22.1)	
2	1277 (21.1)	5108 (21.1)	
3	1091 (18.0)	4356 (18.0)	
4	1144 (18.9)	4573 (18.9)	
5 (least deprived)	1205 (19.9)	4818 (19.9)	
Missing	127	507	
Geographic area			< 0.001
Urban	5150 (84.9)	20 590 (84.9)	
Rural	913 (15.1)	3648 (15.1)	
Missing	120	480	
Region			0.001
London	1488 (24.6)	5952 (24.6)	
East Midlands	227 (3.7)	904 (3.7)	
East of England	253 (4.2)	1009 (4.2)	
North East	209 (3.5)	833 (3.4)	
North West	1160 (19.2)	4640 (19.2)	
South East	1053 (17.4)	4212 (17.4)	
South West	635 (10.5)	2540 (10.5)	
West Midlands	417 (6.9)	1665 (6.9)	
Yorkshire and The Humber	614 (10.1)	2456 (10.1)	
Missing	127	507	
BMI category			0.112
< 18.5 Underweight	315 (6.0)	1303 (6.5)	
18.5–25 Normal weight	2277 (43.1)	8842 (43.9)	
25–30 Overweight	1644 (31.1)	5901 (29.3)	
30–35 Class I obesity	665 (12.6)	2664 (13.2)	
35–40 Class II obesity	245 (4.6)	941 (4.7)	
40+ Class III obesity	132 (2.5)	496 (2.5)	
Missing	905	4571	
Smoking status			0.222
Nonsmoker	2538 (42.8)	11 676 (50.8)	
Active smoker	1868 (31.5)	5561 (24.2)	
Ex-smoker	1529 (25.8)	5741 (25.0)	
Missing	248	1740	
Alcohol status			0.096
Nondrinker	1272 (26.4)	4628 (25.1)	
Safe use	2750 (57.0)	10 927 (59.2)	
Hazardous use	686 (14.2)	2596 (14.1)	
Alcoholism	117 (2.4)	314 (1.7)	
Missing	1358	6253	
Comorbidities			
Type 2 diabetes	173 (2.8)	822 (3.3)	0.031
Hypertension	521 (8.4)	2098 (8.5)	0.002
Atrial fibrillation	37 (0.6)	140 (0.6)	0.004
Angina	50 (0.8)	183 (0.7)	0.008
Myocardial infarction	32 (0.5)	143 (0.6)	0.008
Stroke	31 (0.5)	120 (0.5)	0.002
Heart failure	21 (0.3)	84 (0.3)	< 0.001
Chronic liver disease	40 (0.6)	104 (0.4)	0.031
Dementia	65 (1.1)	224 (0.9)	0.015
Rheumatoid arthritis	31 (0.5)	91 (0.4)	0.020

(*Continued*)

Table 1 (*Continued*)

Characteristics, *n* (%)[a]	AA cases	Matched controls	SMD[b]
Asthma	1230 (19.9)	3913 (15.8)	0.106
Chronic obstructive pulmonary disease	86 (1.4)	301 (1.2)	0.015
Malignancy	105 (1.7)	452 (1.8)	0.010
Irritable bowel disease	56 (0.9)	248 (1.0)	0.010
Chronic kidney disease	98 (1.6)	370 (1.5)	0.007

BMI, body mass index; IQR, interquartile range, IMD, Index of Multiple Deprivation; SMD, standard mean difference. [a]Unless otherwise noted; [b]Total AA cases compared with matched controls. SMD > 0.1 indicates meaningful imbalance between AA cohort and matched control cohort.

of the Black ethnicity subgroup, which had a higher rate of AA-associated risk of anxiety disorders (aOR 2.92, 95% CI 1.71–4.91; Figure 2c, Table S4). AA-associated increase in risk for depressive episodes, recurrent major depressive disorder and anxiety disorders were observed in urban but not rural areas (Tables S2–S4). There were no clear trends across English geographical regions (Tables S2–S4). These associations were consistent only when evaluating new-onset mental health diagnoses in the 2 years post-index date with the exception of the Black ethnicity subgroup (Tables S5–S7; see Supporting Information).

Healthcare utilization was highest in men and those of Asian ethnicity

People diagnosed with AA were more likely to attend primary care compared with matched controls without AA [adjusted incident rate ratio (aIRR) 1.42, 95% CI 1.37–1.46; Figure 3a, Table S8; see Supporting Information]. This association was consistent across deprivation quintiles and between urban and rural areas. Those with AA aged over 50 years were less likely to attend primary care (aIRR 1.22, 95% CI 1.14–1.30; Table S8). Males with AA were more likely to attend primary care (aIRR 1.54, 95% CI 1.46–1.63) than females with AA (aIRR 1.35, 95% CI 1.30–1.40). Those of Asian ethnicity with AA (aIRR 1.64, 95% CI 1.51–1.78) were more likely to attend primary care than those of White ethnicity (aIRR 1.30, 95% CI 1.25–1.36; Figure 3a, Table S8).

Dermatology referral rates were similar across all subgroups, with the exception of those aged over 50 years with AA who were less likely to be referred to dermatology than younger groups with AA (Table S9; see Supporting Information).

People with AA were more likely to be referred for psychological therapy [adjusted hazard ratio (aHR) 1.36, 95% CI 1.17–1.57; Table S10; see Supporting Information] compared with matched controls, although higher referral rates were not observed in all subgroups. Those subgroups with higher referral rates included females, those under 18 years or over
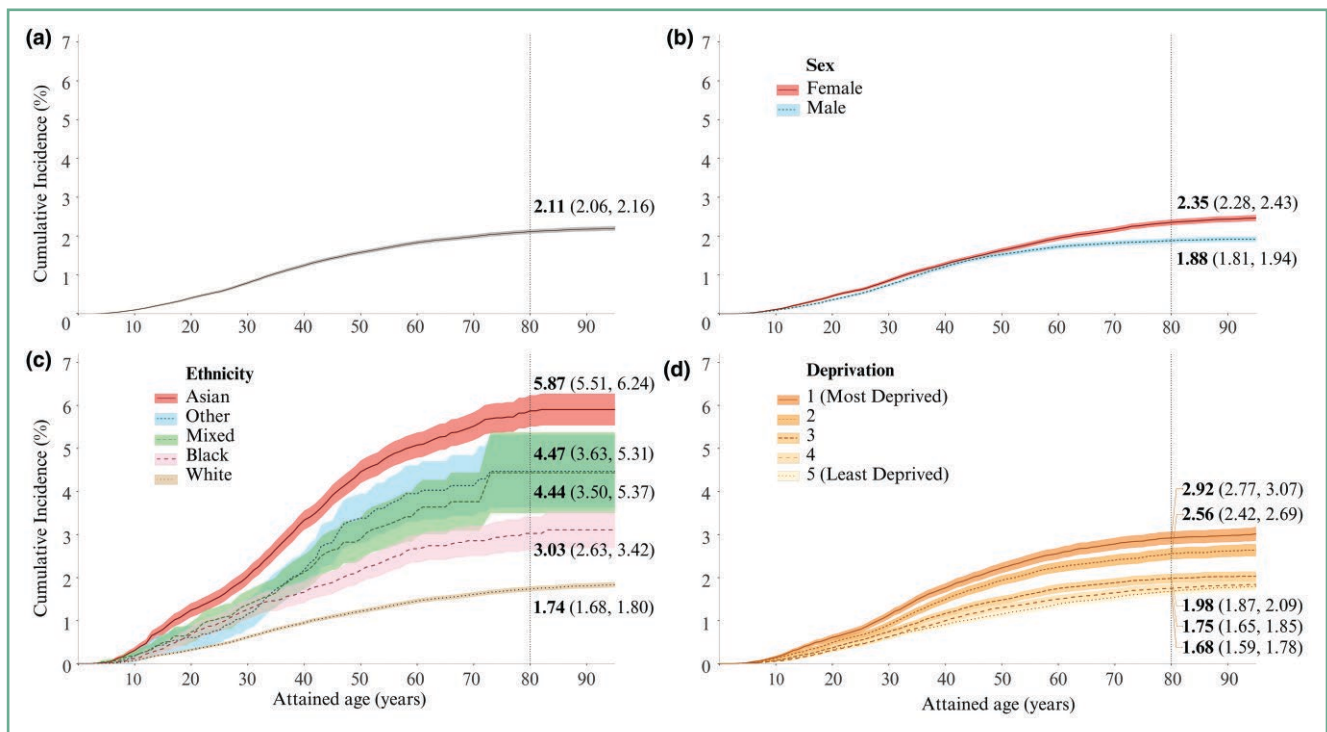

Figure 1 The cumulative lifetime incidence (95% confidence interval) of alopecia areata: (a) overall and stratified by (b) sex, (c) ethnicity and (d) Index of Multiple Deprivation quintile.
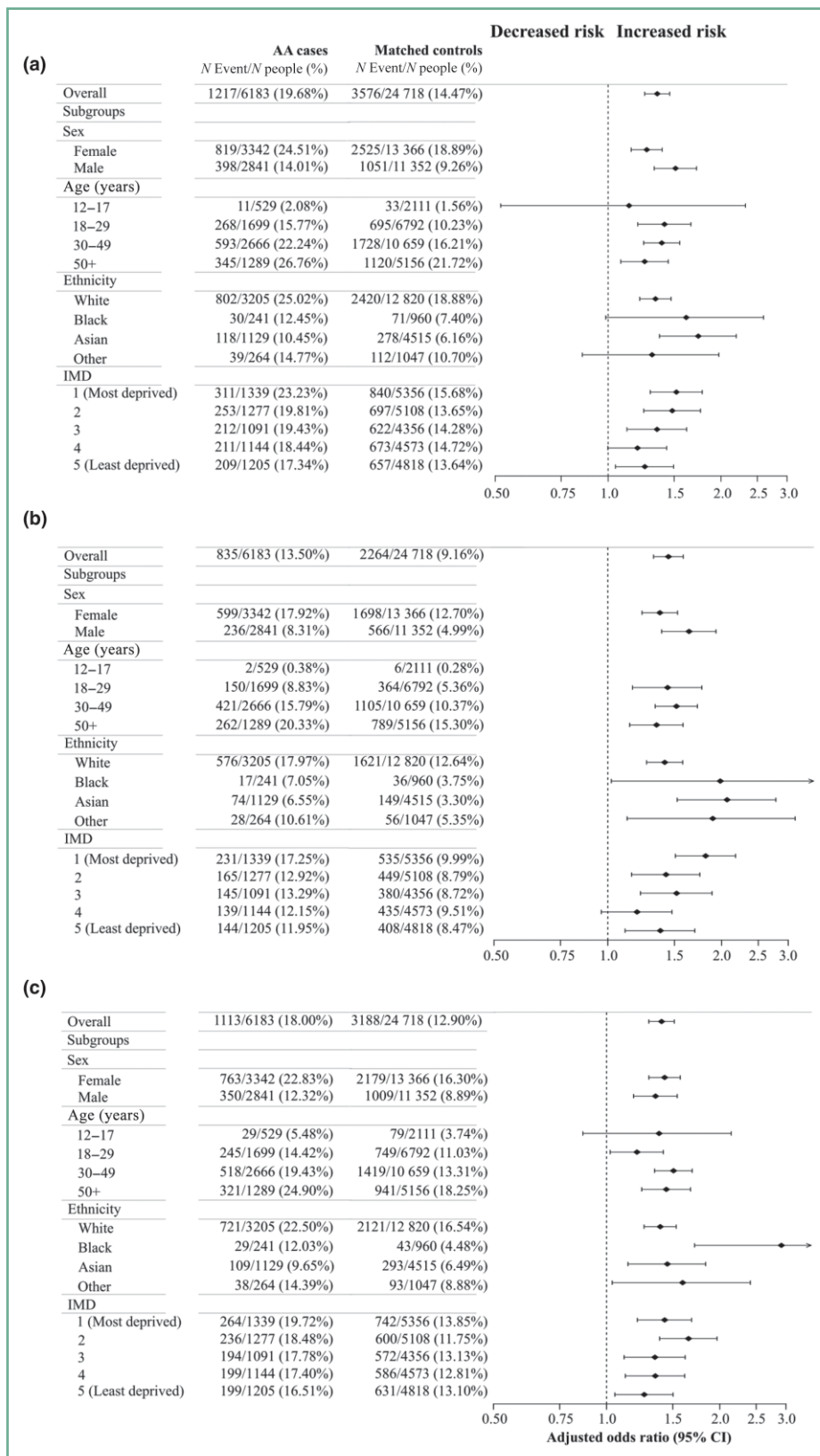
Figure 2 The adjusted odds ratios (aORs) for (a) depressive episode, (b) recurrent major depressive disorder and (c) anxiety disorder in alopecia areata cases compared with matched controls in the overall cohort and sociodemographic subgroups. CI, confidence interval; IMD, Index of Multiple Deprivation. Outcomes with fewer than 10 events in total were not examined as specified a priori due to lack of power in statistical models. aOR adjusted for age (3-knot spline), sex, socioeconomic status, ethnicity, region, urban/rural classification, body mass index category, smoking status, alcohol status and count of major comorbidities (0–3+); type 2 diabetes, hypertension, atrial fibrillation, angina, acute myocardial infarction, stroke, heart failure, chronic liver disease, dementia, rheumatoid arthritis, asthma, chronic obstructive pulmonary disease, chronic kidney disease, malignancy and inflammatory bowel disease.
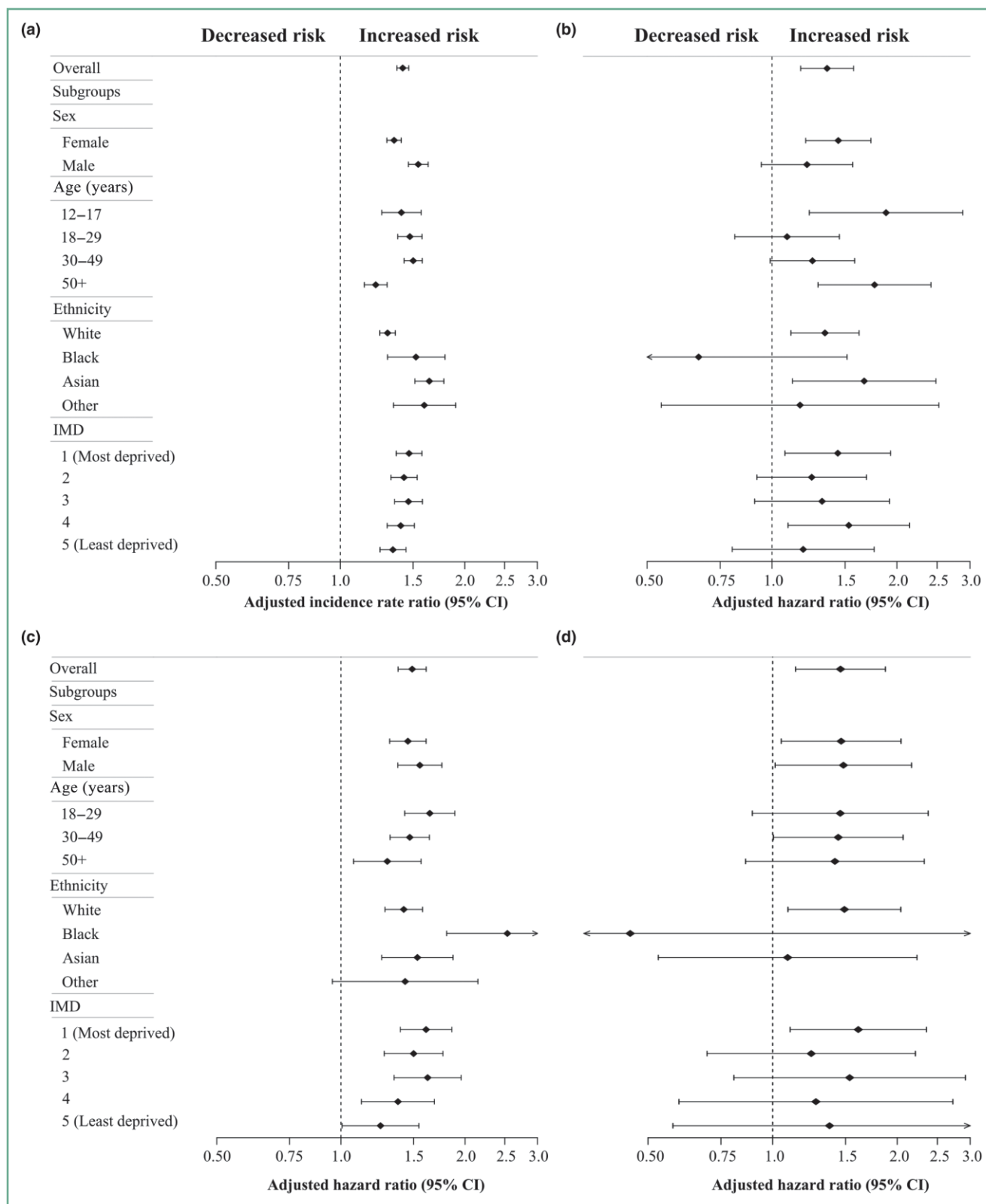
Figure 3 Adjusted incident rate ratios (aIRRs) for (a) primary care visits; and adjusted hazard ratios (aHRs) for (b) psychology referrals, (c) time off work and (d) unemployment in alopecia areata cases compared with matched controls in the overall cohort and sociodemographic subgroups. CI, confidence interval; IMD, Index of Multiple Deprivation. Outcomes with fewer than 10 events in total were not examined as specified a priori due to lack of power in statistical models. aHR and aIRR adjusted for age (3-knot spline), sex, socioeconomic status, ethnicity, region, urban/rural classification, body mass index category, smoking status, alcohol status and count of major comorbidities (0–3+); type 2 diabetes, hypertension, atrial fibrillation, angina, acute myocardial infarction, stroke, heart failure, chronic liver disease, dementia, rheumatoid arthritis, asthma, chronic obstructive pulmonary disease, chronic kidney disease, malignancy and inflammatory bowel disease.

50 years, and those of White or Asian ethnicity (Figure 3b, Table S10).

Burden of work-related impacts was highest in those of Black ethnicity

People with AA were more likely to have time off work (aHR 1.49, 95% CI 1.38–1.61; Figure 3c, Table S11; see Supporting Information) and were more likely to be unemployed (aHR 1.46, 95% CI 1.14–1.87; Figure 3d, Table S12; see Supporting Information) compared with matched controls. These associations were consistent across subgroups for sex, age and deprivation, with the exception of those of Black ethnicity who had a greater risk of time off work (aHR 2.54, 95% CI 1.80–3.56) than those of White ethnicity (aHR 1.42, 95% CI 1.28–1.58) (Table S11). Associations between AA and unemployment were observed in males and females, the 30–49 years age group, those of White ethnicity, those with the greatest deprivation and those in urban areas. Associations between AA and unemployment were observed only in the 'South West' and 'Yorkshire and The Humber' regions (Figure 3d, Table S12).

Sensitivity analysis

Associations remained consistent when evaluating all outcomes following exclusion of matched controls without at least one recent primary care consultation in the year preceding their index date ($n = 9168$ matched controls excluded) (Tables S13 and S14; see Supporting Information). Associations were also consistent when missing ethnicity was replaced with White ethnicity (Tables S15–S17; see Supporting Information).

Discussion

Our contemporary population-based study identified major variations in the lifetime incidence and impact of AA. Overall, AA lifetime incidence was 2.1%, but this differed markedly across ethnic groups: Asian (5.9%), Other (4.5%), Mixed (4.4%), Black (3.0%) and White (1.7%). We identified a clear socioeconomic gradient, with a greater than 50% excess lifetime incidence in individuals from the most deprived compared with least deprived areas, and in those living in urban compared with rural locations. The impacts of AA also differed by ethnic group: people with AA of Black ethnicity had the greatest burden of concomitant anxiety and were the most likely to have recorded time off work. Despite this, there were no clear differences between ethnic groups in the provision of specialist referrals to either dermatological or mental health services.

To our knowledge, our overall lifetime incidence estimate is concordant with the only population-based study, which reported a very similar lifetime incidence of 2.1%.[3] By evaluating a greater than 10-fold number of AA cases, we are able to demonstrate that this summary estimate masks considerable heterogeneity in AA risk and major differences by ethnicity.

There is a lack of research investigating rates of AA across differing ethnic groups within populations. Where research has investigated ethnic differences in AA within a population, the risk of AA tends to be greater in ethnic groups other than White, although it is not always easy to draw comparisons between studies with populations of differing ethnicity profiles. A cross-sectional analysis in the US found higher odds of AA in those of African-American ethnicity compared with those of White ethnicity, and conversely lower odds in those of Asian ethnicity, although noncases in this registry are nonblood relatives or friends, research team members or were recruited at alopecia conferences and via internet advertising, and so are potentially subject to significant selection bias.[26] This lower risk of AA in those of Asian ethnicity contrasts with our findings, in which the Asian ethnic group had the highest lifetime incidence of AA, but this may at least in part be explained by differences in ethnic composition between countries. For example, within the UK, those who identify as Indian, Pakistani or Bangladeshi make up around 74% of the Asian ethnic group with only 7.5% identifying as Chinese,[19] compared with the US, where just under 25% identify as Indian, Pakistani or Bangladeshi, and around 20% identify as Chinese.[27]

Cross-sectional results in nurses also found higher AA in women of Black ethnicity compared with White, although this was based on self-reported diagnosis of AA.[28] For analysis of immune-mediated conditions using US electronic medical records, a higher incidence was observed in African-Americans, Asian or Pacific Islanders, multiracial and Native American compared with the reference White population.[29] However, this analysis is limited because it covers only people seen in healthcare facilities during the study period and therefore comparisons are not made against a true denominator population. Taken collectively, these prior studies suggest potential important ethnicity differences, but no assessment of lifetime AA incidence across ethnicity groups with a population-representative denominator has been previously conducted.

Similarly, there is limited previous research investigating disparities in the impact of AA. While there is a growing body of evidence investigating a strong negative overall impact of AA on mental health comorbidity, in particular depression and anxiety,[8,9,30] we are not aware of any previous studies investigating sociodemographic variation in mental health outcomes. In concordance with our findings, AA has previously been associated with negative impacts on self-reported work productivity,[15,31] and with increased healthcare utilization,[32–34] with one US study suggesting AA-associated healthcare utilization is higher in females and older individuals, and varies with geographical area.[35]

It is likely that AA shares features with other immune-mediated conditions, where it has been highlighted that disparities between sociodemographic subgroups will comprise a combination of contributing factors. For example, there are biological factors such as genes,[36] immunological mechanisms[37] and development in early life. There are also environmental determinants of health, including housing and pollution,[38] as well as sociocultural factors.[39] All these may influence not only the disease course but may also impact on access to healthcare.[40] It is recognized that health disparities are linked to multiple disadvantages experienced by different groups of people, and further research is a key part in addressing these inequalities,[41] especially in groups that are at increased risk but are often less well represented in clinical and epidemiological research.

A considerable strength of our study is the use of a population-representative primary care database, meaning that results are likely to be generalizable to the wider UK population, although generalizability may not extend to other populations, especially those in different sociocultural settings. Disparities do not occur in isolation and our subgroup-stratified lifetime incidence estimates are unadjusted, and so reflect other disparities experienced by each group (such as socioeconomic differences), meaning they should not be interpreted as causal differences. However, our evaluation of the impacts of AA is strengthened by our use of an extensive matching algorithm.

It is a limitation that people with an existing condition, such as AA, may have more regular contact with healthcare providers and therefore increased chances of having other conditions or outcomes detected. We sought to minimize the risk of this detection bias by using a sensitivity analysis, repeating the same analysis but restricting matched controls to those with at least one primary care consultation in the year preceding their index date and found that associations remained consistent. In the case of the primary care visits outcome, we did not have details of the reasons for visits, so cannot draw conclusions as to whether the increased visits were for AA or other conditions. We did not include thyroid disorders and atopic dermatitis, both common comorbidities in people with AA,[18] in our comorbidity count when evaluating healthcare disparities, although, as we show consistent effects with sex- and age-adjusted and fully adjusted models, we expect this to have a minimal impact on our findings. We were also unable to investigate more detailed aspects of AA, such as the locations and extent of hair loss, or if the condition was stable or worsening, as this information is more often coded in detailed notes and is not routinely available for research.

A further limitation of our analysis is the use of routine primary care data, which is dependent on accurate diagnosis and coding. Within the UK most patients would initially visit their GP and typically about a quarter of patients with AA are referred to secondary care within the first year.[1] Diagnoses made within secondary care are routinely transcribed into the primary care record; however, the provenance of the diagnosis (primary or secondary care) is not recorded and it is possible that capture might not be complete. Furthermore, events may not be repeatedly coded within primary care, so it can be harder to ascertain if a condition is ongoing or if it has resolved. To mitigate as far as possible against this, we used validated algorithms to identify outcomes and extensive code lists where no validated definition exists. Patients were excluded if an alternative differential diagnosis was recorded. However, our analysis is likely to under-capture the true burden of AA and its impacts as not all individuals will seek healthcare.

Given the disparities in risk of developing AA, there is a need for better targeting of support to those groups most affected, especially those from ethnic groups other than White who experience the greatest AA burden. Although our study did not identify consistent disparities in healthcare provision, we found no evidence to suggest that healthcare provision is being effectively targeted to those with greatest burden.

In conclusion, AA affects around 1 in 50 people over their lifetime. However, there is considerable variation in lifetime incidence, which in the UK, is highest in those of Asian ethnicity, those experiencing greater socioeconomic deprivation, and those living in urban areas. The striking differences in risk of AA across ethnic groups warrants further research to identify the underlying mechanisms involved, and ultimately to develop precision treatment.

The impacts of AA also vary markedly across the population; in particular, the mental health and work-related impact of AA may be highest in ethnic groups other than White. Clinicians should be aware of the marked heterogeneity in both the risk and impact of AA. There is a need for psychological assessment and targeted support to be included in the dermatology service for patients with AA. Future research is needed to understand the experiences of patients from minority ethnic groups living with AA and to inform strategies to optimize clinical care for those most at risk of AA and its consequences.

Conflicts of interest

ART has no competing interest to declare. CT is a principal and (national) chief investigator on the Pfizer-funded ALLEGRO clinical trials in alopecia areata; CT provides consulting services to Pfizer, and has received speaker fees from Leo Pharma. JN, RR and MC are employees and shareholders of Pfizer Ltd. AGM provides consultancy for Manentia and Pfizer.

Data availability

The Oxford-RCGP RSC dataset is held securely at Oxford University and can be accessed by bona fide researchers. Approval is on a project-by-project basis (www.rcgp.org.uk/rsc). Ethical approval by an NHS Research Ethics Committee or other appropriate approval may be needed before any data release. Researchers wishing to directly analyse the patient-level pseudonymized data will be required

to complete information governance training and work on the data from university secure servers. Patient-level data cannot be taken out of the secure network.

Ethics statement

Study approval was granted by the Royal College of General Practitioners Research and Surveillance Centre research committee. The study did not meet the requirements for formal ethics board review as defined using the National Health Service Health Research Authority research decision tool (http://www.hra-decisiontools.org.uk/research).

Patient consent

Not applicable.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website.

References

1 Harries M, Macbeth AE, Holmes S *et al.* The epidemiology of alopecia areata: a population-based cohort study in UK primary care. *Br J Dermatol* 2022; **186**:257–65.

2 Sinclair R, Eisman S, Song W *et al.* Incidence and prevalence of alopecia areata in the Australian primary care setting: a retrospective analysis of electronic health record data. *Australas J Dermatol* 2023; **64**:330–8. https://doi.org/10.1111/ajd.14126.

3 Mirzoyev SA, Schrum AG, Davis MDP, Torgerson RR. Lifetime incidence risk of alopecia areata estimated at 2.1% by Rochester Epidemiology Project, 1990–2009. *J Invest Dermatol* 2014; **134**:1141–2.

4 Sy N, Mastacouris N, Strunk A, Garg A. Overall and racial and ethnic subgroup prevalences of alopecia areata, alopecia totalis, and alopecia universalis. *JAMA Dermatol* 2023; **159**:419–23. https://doi.org/10.1001/jamadermatol.2023.0016.

5 Tosti A, Bellavista S, Iorizzo M. Alopecia areata: a long term follow-up study of 191 patients. *J Am Acad Dermatol* 2006; **55**:438–41.

6 Lee S, Lee H, Lee CH, Lee WS. Comorbidities in alopecia areata: a systematic review and meta-analysis. *J Am Acad Dermatol* 2019; **80**:466–77 e16.

7 Villasante Fricke AC, Miteva M. Epidemiology and burden of alopecia areata: a systematic review. *Clin Cosmet Investig Dermatol* 2015; **8**:397–403.

8 Toussi A, Barton VR, Le ST *et al.* Psychosocial and psychiatric comorbidities and health-related quality of life in alopecia areata: a systematic review. *J Am Acad Dermatol* 2021; **85**:162–75.

9 Okhovat JP, Marks DH, Manatis-Lornell A *et al.* Association between alopecia areata, anxiety, and depression: a systematic review and meta-analysis. *J Am Acad Dermatol* 2023; **88**:1040–50. https://doi.org/10.1016/j.jaad.2019.05.086.

10 Lauron S, Plasse C, Vaysset M *et al.* Prevalence and odds of depressive and anxiety disorders and symptoms in children and adults with alopecia areata: a systematic review and meta-analysis. *JAMA Dermatol* 2023; **159**:281–8.

11 Macbeth AE, Holmes S, Harries M *et al.* The associated burden of mental health conditions in alopecia areata: a population-based study in UK primary care. *Br J Dermatol* 2022; **187**:73–81.

12 Rencz F, Gulacsi L, Pentek M *et al.* Alopecia areata and health-related quality of life: a systematic review and meta-analysis. *Br J Dermatol* 2016; **175**:561–71.

13 Liu LY, King BA, Craiglow BG. Health-related quality of life (HRQoL) among patients with alopecia areata (AA): a systematic review. *J Am Acad Dermatol* 2016; **75**:806–12 e3.

14 Gelhorn HL, Cutts K, Edson-Heredia E *et al.* The relationship between patient-reported severity of hair loss and health-related quality of life and treatment patterns among patients with alopecia areata. *Dermatol Ther (Heidelb)* 2022; **12**:989–97.

15 Senna M, Ko J, Glashofer M *et al.* Predictors of QOL in patients with alopecia areata. *J Invest Dermatol* 2022; **142**:2646–50 e3.

16 Correa A, Hinton W, McGovern A *et al.* Royal College of General Practitioners Research and Surveillance Centre (RCGP RSC) sentinel network: a cohort profile. *BMJ Open* 2016; **6**:e011092.

17 Harries M, Macbeth AE, Holmes S *et al.* Epidemiology, management and the associated burden of mental health illness, atopic and autoimmune conditions, and common infections in alopecia areata: protocol for an observational study series. *BMJ Open* 2021; **11**:e045718.

18 de Lusignan S, Alexander H, Broderick C *et al.* Atopic dermatitis and risk of autoimmune conditions: population-based cohort study. *J Allergy Clin Immunol* 2022; **150**:709–13.

19 Office for National Statistics. *Ethnic group, England and Wales: Census 2021*. Office for National Statistics; 29 November 2022. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/culturalidentity/ethnicity/bulletins/ethnicgroupenglandandwales/census2021.

20 Department for Communities and Local Government. English Indices of Deprivation 2015. 30 September 2015. Available at: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015.

21 John A, McGregor J, Fone D *et al.* Case-finding for common mental disorders of anxiety and depression in primary care: an external validation of routinely collected data. *BMC Med Inform Decis Mak* 2016; **16**:35. https://doi.org/10.1186/s12911-016-0274-7.

22 R Project. Empirical Transition Matrix. Available at: https://cran.r-project.org/web/packages/etm/index.html.

23 Rapsomaniki E, Timmis A, George J *et al.* Blood pressure and incidence of twelve cardiovascular diseases: lifetime risks, healthy life-years lost, and age-specific associations in 1.25 million people. *Lancet* 2014; **383**:1899–911. https://doi.org/10.1016/S0140-6736(14)60685-1.

24 Gershon AS, Warner L, Cascagnette P *et al.* Lifetime risk of developing chronic obstructive pulmonary disease: a longitudinal population study. *Lancet* 2011; **378**:991–6.

25 Benchimol EI, Smeeth L, Guttmann A *et al.*; RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statement. *PLoS Med* 2015; **12**:e1001885. https://doi.org/10.1371/journal.pmed.1001885.

26 Lee H, Jung SJ, Patel AB *et al.* Racial characteristics of alopecia areata in the United States. *J Am Acad Dermatol* 2020; **83**:1064–70.

27 Monte LM, Shin HB. *20.6 million people in the U.S. identify as Asian, Native Hawaiian or Pacific Islander*. United States Census Bureau; 25 May 2022. Available at: https://www.census.gov/library/stories/2022/05/aanhpi-population-diverse-geographically-dispersed.html.

28 Thompson JM, Park MK, Qureshi AA, Cho E. Race and alopecia areata amongst US women. *J Investig Dermatol Symp Proc* 2018; **19**:S47–50.

29 Roberts MH, Erdei E. Comparative United States autoimmune disease rates for 2010–2016 by sex, geographic region, and race. *Autoimmun Rev* 2020; **19**:102423.

30 Tzur Bitan D, Berzin D, Kridin K, Cohen A. The association between alopecia areata and anxiety, depression, schizophrenia,

and bipolar disorder: a population-based study. *Arch Dermatol Res* 2022; **314**:463–8.

31 Edson-Heredia E, Aranishi T, Isaka Y *et al.* Patient and physician perspectives on alopecia areata: a real-world assessment of severity and burden in Japan. *J Dermatol* 2022; **49**:575–83.

32 Senna M, Ko J, Tosti A *et al.* Alopecia areata treatment patterns, healthcare resource utilization, and comorbidities in the US population using insurance claims. *Adv Ther* 2021; **38**:4646–58.

33 Mostaghimi A, Xenakis J, Meche A *et al.* Economic burden and healthcare resource use of alopecia areata in an insured population in the USA. *Dermatol Ther (Heidelb)* 2022; **12**:1027–40.

34 Ray M, Swallow E, Gandhi K *et al.* Healthcare utilization and costs among US adolescents with alopecia areata. *J Health Econ Outcomes Res* 2022; **9**:11–18.

35 Gao W, Mostaghimi A, Gandhi K *et al.* Patient characteristics associated with all-cause healthcare costs of alopecia areata in the United States. *J Med Econ* 2023; **26**:441–4.

36 Gupta J, Johansson E, Bernstein JA *et al.* Resolving the etiology of atopic disorders by using genetic analysis of racial ancestry. *J Allergy Clin Immunol* 2016; **138**:676–99.

37 Brown-Korsah JB, McKenzie S, Omar D *et al.* Variations in genetics, biology, and phenotype of cutaneous disorders in skin of color – Part I: Genetic, biologic, and structural differences in skin of color. *J Am Acad Dermatol* 2022; **87**:1239–58.

38 Lowe ME, Akhtari FS, Potter TA *et al.* The skin is no barrier to mixtures: air pollutant mixtures and reported psoriasis or eczema in the Personalized Environment and Genes Study (PEGS). *J Expo Sci Environ Epidemiol* 2023; **33**:474–81. https://doi.org/10.1038/s41370-022-00502-0.

39 Martinez A, de la Rosa R, Mujahid M, Thakur N. Structural racism and its pathways to asthma and atopic dermatitis. *J Allergy Clin Immunol* 2021; **148**:1112–20.

40 Croce EA, Levy ML, Adamson AS, Matsui EC. Reframing racial and ethnic disparities in atopic dermatitis in Black and Latinx populations. *J Allergy Clin Immunol* 2021; **148**:1104–11.

41 Davis CM, Apter AJ, Casillas A *et al.* Health disparities in allergic and immunologic conditions in racial and ethnic underserved populations: a Work Group Report of the AAAAI Committee on the Underserved. *J Allergy Clin Immunol* 2021; **147**:1579–93. https://doi.org/10.1016/j.jaci.2021.02.034.