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Epidemiology of Pediatric Alopecia Areata

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ABSTRACT

This contemporary scoping narrative review examines the epidemiology of pediatric alopecia areata (AA), focusing on incidence, prevalence, racial and ethnic differences, and comorbidities. Articles containing original epidemiology on pediatric AA published between 2013 and 2024 were identified. From these studies, the estimated US child and adolescent incidence of AA is between 13.6 and 33.5 per 100,000 person-years, and the prevalence of AA is between 0.04% and 0.11%. Incidence and prevalence rates vary widely by geographic region and nation. A general pattern of highest estimated lifetime prevalence in North African and Middle Eastern nations, followed by high-income North American countries, then by Asian and Western European nations, and, lastly, by Latin America and sub-Saharan Africa emerged. Though infrequently reported, racial and ethnic differences were noted in the largest pediatric-specific studies: Hispanic/Latino, Black, and Asian children were affected by AA at higher rates compared to those who self-identify as White/Caucasian. AA carried a high burden of comorbidities, including atopic disease, vitiligo, mental illness, and thyroid conditions. The existing pediatric epidemiology can help identify potential disparities in care and guide additional research, advocacy, and policy.

1 | Introduction

Analysis of the epidemiology of alopecia areata (AA), including incidence and prevalence, is needed to estimate the burden of disease locally and globally. Understanding of the global adult AA epidemiology has improved with recent papers highlighting a global incidence of 180 per 100,000 person-years (PY) in 2019 [1] and pooled prevalence of AA in adults at roughly 1.47% [2]. Adult data suggest that the incidence is rising slowly in higher-income countries, and in these countries, there is a trend toward increased prevalence over time [3, 4]. Pediatric population data are more limited and must be largely extracted from population-based studies that include mostly adults. There are a few pediatric-specific epidemiology reports that aid with understanding the burden of disease. This scoping narrative review examines the contemporary epidemiology of AA among children and adolescents through the evaluation of incidence and prevalence, differences in rates by race and ethnicity, risk factors, disease burden, and associated comorbidities.

2 | Methods

English-language pediatric AA epidemiology articles with full text available published between Jan 1, 2013 and July 5, 2024 were identified through specific word/phrase searches on PubMed, EMBASE, and Scopus including (individually and any combination thereof) “alopecia,” “alopecia areata,” “pediatric alopecia areata,” “epidemiology”, “prevalence,” “incidence,” “risk factors,” “genetics,” “family history,” “race,” “ethnicity,” “comorbidities,” “mental health,” and “disease burden.” Additional

Leslie Castelo-Soccio denotes equal contributions as co-first authors.

historical papers were manually added and summarized. See Table S1 for papers.

3 | Incidence and Prevalence of Pediatric AA

3.1 | Incidence

The incidence of pediatric AA among US children and adolescents ranges between 13.6 per 100,000 PY (95% confidence interval [CI] 13.1–14.2) [3] and 33.47 per 100,000 PY (95% CI 33.00–33.94) [4] (Table 1). The lower estimate was collected from five large academic children's hospitals using PEDSNet, a pediatric learning health system [3], and the higher one was derived from a commercial claims database [4]. Both studies show increased incidence over time [5, 7]. An additional retrospective analysis of the Explorys database showed an incidence rate of 20.9 per 100,000 PY (95% CI 18.5–23.5) with subtype analysis showing a standardized incidence rate of 1.0 (95% CI 0.5–1.7) for alopecia totalis (AT) and 0.7 (95% CI 0.3–1.3) for alopecia universalis (AU) [12].

Incidence rates vary widely by geography. Globally, the incidence of pediatric AA was estimated to be much higher with 181.88 per 100,000 PY (95% CI 170.84–193.12) in 1990 and 180.34 per 100,000 PY (95% CI 169.26–191.77) in 2019 [1]. This is accounted for by rates being higher outside of the US. For example, in South Korea, the estimate is 63 per 100,000 PY for children aged 0 to 9 years [8]. In Germany, rates vary from 46 to 73 per 100,000 depending on location within the country [11].

With the exception of one recent study, adult incidence in the US is reported to be higher than in children (rates between 37 and 40 per 100,000 PY) [13]. This is similar to previous data that show a pattern of lower incidence rates for children compared to adults 18–50 years of age and an increase in incidence from age 4 years to a peak in ages 25–29 years, which then decreases in middle adulthood [4, 6, 7, 9, 10, 13].

Within the US, pediatric AA incidence varies according to self-reported race and ethnicity (Table 2) [3]. In a multicenter cohort study analyzing electronic health records from five pediatric hospitals, the incidence was found to be highest among Hispanics (31.5 per 100,000 PY), followed by Asians (23.1 per 100,000 PY), then by Blacks (17.0 per 100,000 PY), and lastly by non-Hispanic Whites (8.8 per 100,000 PY) [3]. A similar observation was made in a population-based cohort study using United Kingdom electronic primary care records, where increased incidence was noted in children who self-identified as Asian, Black, and multiracial [9]. Additionally, a recent retrospective analysis of electronic health records from the Explorys database looking at all ages revealed that standardized incidence rates of AA were highest among Asians (56.2 per 100,000 PY), followed by other/multiracial individuals (39.7 per 100,000 PY), then by Hispanics/Latinos (27.1 per 100,000 PY) and Blacks (24.1 per 100,000 PY), and lastly by Whites (18.6 per 100,000 PY) [12].

There is no clear trend in sex-based differences in pediatric AA incidence [3, 5–8]. Globally, the incidence is higher in women over 40 years of age in Denmark [6], Germany [11], United Kingdom [9], and US [7] but higher incidence varies in males and females under age 40 years.

3.2 | Prevalence

The reported prevalence of pediatric AA ranges between 0.04% [18] and 0.11% [3] among US children and adolescents (Table 3). The lower value was estimated from an analysis of the Explorys database of electronic health records of over 8 million pediatric patients. Limited data from South Korea on the prevalence of subtype of AA shows a combined prevalence of AT and AU of 0.004% in children 0–9 years of age and 0.018% in children 10–19 years of age [22].

Notably, prevalence has risen over time. In a systematic review and meta-analysis of over 90 observational studies on the epidemiology of AA in children and adults, the overall prevalence of AA was shown to have increased over time from 1.01% (95% CI 0.81–1.22) before 2000%, to 1.76% (95% CI 1.51–2.03) in the period of 2000–2009, and then to 3.83% (95% CI 2.77–5.06) following 2009 ($p < 0.0001$) [2]. Among severe subtypes of AA in combined children and adult data, prevalence has also grown: before 2000, prevalence of AT was measured at 0.06% (95% CI 0.01–0.17), while from 2000 to 2009 it was 0.12% (95% CI 0.04–0.25) ($p = 0.0001$) [2]. Similarly, the prevalence of AU increased from 0.03% (95% CI 0.01–0.08) before 2000 to 0.06% (95% CI 0.01–0.15) in the period ranging from 2000 to 2009 ($p = 0.02$) [2].

A systematic review and modeling study in 2024 [13] estimated the worldwide prevalence of pediatric AA to be 0.03%. Notwithstanding, stark geographic differences in overall AA prevalence have been documented. For example, prevalence estimates have been reported to be as high as 0.57% in Egyptian children [20]. Comparatively, they are lower for example in Australia (0.09% [10]), South Korea (0.05% [8] and 0.20% [22]), Taiwan (0.07%) [25] and in Gabon and Rwanda (0.00%) [21]. A general trend has thus emerged: estimated lifetime prevalence of AA in children is typically highest in North African and Middle Eastern nations, followed by high-income North American countries, then by Asian and Western European nations; lowest lifetime prevalence can be found in Latin America and sub-Saharan Africa [13].

Prevalence of pediatric AA varies with age. In a 2023 cohort study of US Employer-sponsored insurance population [4], the point prevalence of pediatric AA was highest among adolescents aged 12–17, moderate among children 6–11 years of age, and lowest among children aged 0–5 years. Following a similar trend, Augustin et al. [11] found that AA prevalence was 0.043% in children 0–9 years and 0.110% in children 10–19 years. Additional studies show a similar pattern of higher AA prevalence among pediatric patients aged 10 years or above compared to those younger than 10 years of age [14, 18]. Nevertheless, due to conflicting evidence, it remains unclear at which age AA reaches its highest prevalence. A systematic review and meta-analysis demonstrated that AA prevalence was significantly higher in children (1.92%, 95% CI 1.31–2.65) than adults (1.47%, 95% CI 1.18–1.80) ($p < 0.0001$) [2]. However, other studies have contested this trend, instead reporting the opposite

TABLE 1 | Incidence of pediatric AA.

Reference	Brief study details	Diagnostic method	Age (years)	Children analyzed	Cases of AA	Incidence rate per 100,000 PY (95% CI, if available)		
						Whole cohort	Females only (if available)	Males only (if available)
Ali et al. 2022 [5]	Analysis of medical records for people living in Olmsted County, Minnesota, US 1966–1969 1970–1979 1980–1989 1990–1999 2000–2009 2010–2013	Chart review	0–18	258	25 44 47 55 58 29	18.9 14.3 15.7 15.9 15.1 18.3	16.9 15.4 14.5 15.4 17.0 15.5	20.8 13.2 16.9 16.3 13.2 21.1
Jacobsen et al. 2019 [6]	Analysis of medical records for people living in Faroe Islands, Denmark	Chart review	0–9 10–19	2,86,593 PY 296,275 PY	23 31	8.0 (5.1–12.0) 10.5 (7.1–14.9)	5.7 (2.5–11.3) 9.8 (5.4–16.5)	10.2 (5.7–16.8) 11.1 (6.4–17.7)
Lv and Zheng 2024 [1]	Analysis of Global Burden of Disease Study 2019, World 1990 2019	Modeling study	0–19 0–19	NR NR	NR NR	181.88 (170.84–193.12) 180.34 (169.26–191.77)	NR NR	NR NR
Mirzoyev et al. 2014 [7]	Analysis of medical records for residents in Olmsted County, Minnesota, US, 1990–2009	Chart review	0–9 10–19	530	59 59	15.8 17.0	14.9 19.4	16.7 14.6
Cho et al. 2022 [8]	Analysis of a national health insurance claims database, South Korea, 2002–2006	Insurance/ diagnostic codes	0–9	73,637	768	62.7 (58.4–67.3)	57.8 (51.0–65.2)	65.5 (60.0–71.3)

(Continues)

TABLE 1 | (Continued)

Reference	Brief study details	Diagnostic method	Age (years)	Children analyzed	Cases of AA	Incidence rate per 100,000 PY (95% CI, if available)		
						Whole cohort	Females only (if available)	Males only (if available)
McKenzie et al. 2022 [3]	Analysis of electronic medical records from 5 children's hospitals, US, 2009–2020	EHR query	0–17	2,896,241	2398	13.6 (13.1–14.2)	15.1	12.3
			1	606,880	47	11.8 (8.7–15.7)	(14.3–16.0)	(11.6–13.0)
			2	825,490	107	15.7 (12.8–18.9)	NR	NR
			3	943,240	146	17.9 (15.1–21.1)	NR	NR
			4	1,017,405	187	21.0 (18.1–24.2)	NR	NR
			5	1,062,273	174	18.5 (15.9–21.5)	NR	NR
			6	1,081,318	203	21.2 (18.4–24.4)	NR	NR
			7	1,084,755	191	19.9 (17.2–22.9)	NR	NR
			8	1,076,042	163	17.1 (14.6–20.0)	NR	NR
			9	1,058,171	172	18.5 (15.8–21.5)	NR	NR
			10	1,033,552	139	15.3 (12.9–18.1)	NR	NR
			11	1,005,499	135	15.5 (13.0–18.3)	NR	NR
			12	969,035	140	16.7 (14.1–19.8)	NR	NR
			13	937,548	133	16.4 (13.8–19.5)	NR	NR
			14	912,306	125	15.9 (13.3–19.0)	NR	NR
			15	891,389	117	15.2 (12.6–18.3)	NR	NR
			16	870,095	125	16.6 (13.8–19.8)	NR	NR
			17	84,1275	94	12.9 (10.4–15.7)	NR	NR
							NR	NR
Harries et al. 2022 [9]	Population-based cohort study of United Kingdom primary care, United Kingdom, 2009–2018	Insurance/ diagnostic codes	0–4	1016305PY	79	8 (6–10)	11 (9, 14)	12 (9, 14)
			4–18	4,148,944 PY	1200	29 (27–31)	NR	NR
			5–9	NR	NR	NR	31 (27, 35)	21 (18, 25)
			10–14	NR	NR	NR	34 (30, 39)	25 (22, 29)
			15–19	NR	NR	NR	35 (31, 40)	33 (29, 38)
Sinclair et al. 2023 [10]	Real-world observational analysis of Australian electronic health record data from the MedicalDirector national clinical practice management software, Australia, 2011–2020	EHR query	0–18	26,4137	157	18.5 (15.6–21.4)	NR	NR

(Continues)

TABLE 1 | (Continued)

Reference	Brief study details	Diagnostic method	Age (years)	Children analyzed	Cases of AA	Incidence rate per 100,000 PY (95% CI, if available)		
						Whole cohort	Females only (if available)	Males only (if available)
Augustin et al. 2024 [11]	Analysis of a 40% random sample of a German statutory health insurance company, Germany, 2016–2020	Insurance/ diagnostic codes	0–9	NR	NR	20 (10–29)	20 (10–30)	21 (7–34)
			10–19	NR	NR	57 (45–68)	50 (34–65)	67 (49–84)
Kang et al. 2024 [12]	Analysis of a 15% random sample of the Explorys database population, US, 2016–2019	Insurance/ diagnostic codes	0–17	669,227	278	20.9 (18.5–23.5)	NR	NR
			0–9	386,697	156	21.1 (17.9–24.6)	NR	NR
			10–17	282,530	122	21.0 (17.5–25.1)	NR	NR
Mostaghimi et al. 2023 [4]	Analysis of MarketScan commercial claims, US	Insurance/ diagnostic codes	0–17	NR	NR	28.02 (27.58–28.46)	NR	NR
	2016		0–5	NR	NR	23.55 (22.93–24.18)	NR	NR
			6–11	NR	NR	13.48 (12.52–14.48)	NR	NR
	2017		12–17	NR	NR	22.33 (21.31–23.38)	NR	NR
	2018		0–17	NR	NR	30.41 (29.95–30.88)	NR	NR
	2019		0–5	NR	NR	25.82 (25.17–26.49)	NR	NR
			6–11	NR	NR	13.74 (12.78–14.76)	NR	NR
			12–17	NR	NR	26.25 (25.13–27.40)	NR	NR
			0–17	NR	NR	31.24 (30.78–31.70)	NR	NR
			0–5	NR	NR	27.88 (27.21–28.55)	NR	NR
			6–11	NR	NR	15.17 (14.18–16.22)	NR	NR
			12–17	NR	NR	25.68 (24.60–26.79)	NR	NR
			0–17	NR	NR	33.47 (33.00–33.94)	NR	NR
			0–5	NR	NR	25.36 (24.74–26.00)	NR	NR
			6–11	NR	NR	14.41 (13.46–15.42)	NR	NR
			12–17	NR	NR	26.00 (24.92–27.10)	NR	NR

Note: Adapted from Jeon et al. 2024 [13].
Abbreviations: AA, alopecia areata; CI, confidence interval; EHR, electronic health record; NR, not reported; PY, person-years; US, United States.

TABLE 2 | Racial and ethnic differences in pediatric vs. adult AA.

Subgroup	Region/ country	Study type	Summary	Reference
Children	US UK	Multicenter cohort study (US) Matched-cohort study (UK)	Hispanic children had the highest incidence and prevalence of AA, followed by Asian, Black, and other children. White children had the lowest incidence and prevalence of AA Asian children displayed the highest incidence of AA, followed by children of mixed, Black, and other ethnic descent. White children displayed the lowest incidence of AA	[3] [9]
All age groups	US	Cross-sectional study (US)	In all age groups (children, adolescents, and adults), Asian patients displayed the highest prevalence of AA, followed by patients of multiple/other races, Black patients, and Hispanic patients. White patients displayed the lowest prevalence of AA	[14]
Adults	US US US	Cross-sectional study (US) Cross-sectional study (US) Cross-sectional study (US)	Black adults had greater odds of AA and increased risk of AAT/AAP and AT/AU, while Asian adults had lower odds of AA and decreased risk of AAT/AAP and AT/AU. There was no difference in the risk of AA in Hispanic/Latino AA patients and White AA patients Black and Hispanic women had increased odds of AA compared to non-Hispanic white women Black and Hispanic women had an increased lifetime incidence of AA compared to non-Hispanic white women Black, Hispanic, and other race adults had increased OR of AA prevalence when compared to White adults	[15] [16] [17]

pattern with a worldwide lifetime AA prevalence of 0.12% in adults compared to 0.03% in children [4, 13]. In a cross-sectional study using the Explorys database to evaluate electronic medical records in the US, prevalence rates were measured to peak around 30–49 years of age [14].

Within the US, pediatric AA prevalence varies with self-reported race and ethnicity [3, 18]. McKenzie et al. [3] reported that pediatric AA prevalence was highest among Hispanic/Latino children (0.23%), intermediate among Asian (0.17%) and Black (0.12%) patients, and lowest in White children (0.08%). Likewise, a separate US study concluded that children affected by AA were more likely to be African American relative to controls without AA (18.5% vs. 12.4%) [18]. Sy et al. [14] found that patients of Asian descent exhibited the highest standardized prevalence of AA succeeded by patients identifying with multiple races/other races, then by Black patients, and followed by Hispanic/Latino individuals [14]. This is similar to what has been found in adults in the Nurses' Health Study [16] and the National AA Registry [15].

An overall trend in pediatric AA prevalence by sex cannot be readily discerned. Of the contemporary studies examined, six included information on prevalence rates by sex. Of these, three reported higher rates in female children [3, 18, 24], two showed increased prevalence in male children [11, 23], and one found equal rates [22].

3.3 | Risk Factors/Family History

Individuals with a family history of AA, particularly those with an affected first-degree relative, face an increased risk of developing the condition. A study on familial aggregation of AA involving 206 European AA patients found that 5.5% of first-degree and 1.5% of second-degree relatives also had AA. Similarly, parents, siblings, and children of the AA patients had risks of 7.8%, 7.1%, and 5.7%, respectively [26]. A 2019 US observational study, using data from the National AA Registry, reported that the prevalence of AA in first-degree relatives was 7.8% compared to general population prevalence of 2.1% (95% CI 4.1%–13.2%, $p = 4.19 \times 10^{-7}$) [27].

4 | Comorbidities and Disease Burden

AA carries a considerable disease burden and is associated with a variety of other conditions (Table 4).

4.1 | Atopy

Children and adolescents with AA are much more likely to have concomitant atopy. A retrospective matched cohort study utilizing the Rochester Epidemiology Project found significant associations between AA and atopic dermatitis (hazard ratio [HR]

TABLE 3 | Prevalence of pediatric AA.

Country	Years of study	Number of children analyzed	Prevalence overall	Prevalence female Only (If available)	Prevalence male only (If available)	Reference
Australia	2011–2020	91,498	0.09%	NR	NR	Sinclair et al. 2023 [10]
Denmark	1996–2011	85,890	0.06%	NR	NR	Hamann et al. 2019 [19]
Egypt	2011–2012	6162	0.57%	NR	NR	El-Khateeb et al. 2014 [20]
Gabon	2005	454	0.00%	NR	NR	Hogewoning et al. 2013 [21]
Germany	2016–2020	NR	0.043% (0–9 y) 0.110% (10–19 y)	0.040% (0–9 y) 0.106% (10–19 y)	0.046% (0–9 y) 0.117% (10–19 y)	Augustin et al. 2024 [11]
Ghana	2004, 2007	1857	0.05%	NR	NR	Hogewoning et al. 2013 [21]
Rwanda	2007	2528	0.00%	NR	NR	Hogewoning et al. 2013 [21]
South Korea	2002–2006	2,331,360	0.05%	NR	NR	Cho et al. 2022 [8]
South Korea	2006–2015	10,586,401	0.114% (0–9 y) 0.263% (10–19 y)	0.133% (0–9 y) 0.248% (10–19 y)	0.096% (0–9 y) 0.277% (10–19 y)	Lee et al. 2019 [22]
South Korea	2007–2018	77,122	0.53%	0.50%	0.56%	Lim et al. 2022 [23]
Taiwan	2004–2017	2,625,440	0.05%	0.05%	0.04%	Wong et al. 2022 [24]
Taiwan	2004–2017	1,750,456	0.07%	NR	NR	Ho et al. 2021 [25]
US	2009–2020	5,409,919	0.11%	0.12%	0.09%	McKenzie et al. 2022 [3]
US	2016–2019	NR	0.065%–0.078%	NR	NR	Mostaghimi et al. 2023 [4]
US	2019	8,314,220	0.04%	0.05%	0.04%	Conic et al. 2020 [18]
US	2019	274,935	0.10%	NR	NR	Sy et al. 2023 [14]

Note: Adapted from Jeon et al. 2024 [13].
Abbreviations: NR, not reported; US, United States.

TABLE 4 | Comorbidities in pediatric AA.

Comorbidity	Type of Study	Summary	Reference
Atopy	Observational cross-sectional study (US) Cross sectional study (US) Retrospective matched cohort study (US) Cross-sectional* (Korea)	Children with AA are more likely to concomitantly have AD, asthma, allergic rhinitis, and allergies The prevalence of AD in pediatric AA was higher than in controls AD and asthma were more likely to develop among pediatric AA patients than pediatric non-AA patients Pediatric AA patients with severe hair loss were significantly more likely to concomitantly have AD	[28] [18] [5] [29]
Vitiligo	Retrospective (US)	Concomitant vitiligo and AA were more prevalent in children who have severe AA	[30]
Mental Disorders	Cross-sectional study (US) Systematic review and meta-analysis (US) Retrospective matched cohort study (US) Case–control study (Turkey)	Stigma associated with chronic pediatric skin disorders, including AA, strongly predicts poor QOL and correlates with childhood depression, anxiety, and impaired psychosocial functioning Children with AA are likely to experience depressive and anxiety symptoms and have concomitant depressive and anxiety disorders Depression and/or anxiety were more likely in pediatric AA patients than in pediatric non-AA controls Children with AA were more likely to have at least one psychiatric condition, multiple psychiatric diseases, symptoms of depressive disorders, ADHD, and at least one anxiety spectrum disorder when compared with children without AA	[31] [32] [5] [33]
QOL	Cross-sectional study* (Korea)	Severity of AA is indirectly proportional to the QOL of pediatric AA patients and their families.	[29]
Other Autoimmune Disease	Cross-sectional study (US) Retrospective matched cohort study (US)	Autoimmune diseases, including AD, vitiligo, psoriasis, systemic lupus erythematosus, Hashimoto's Thyroiditis, Celiac Disease, Juvenile Rheumatoid Arthritis, Juvenile Idiopathic Arthritis, and ulcerative colitis were more common in pediatric AA patients compared to pediatric non-AA patients Any autoimmune disease was more likely to develop in pediatric AA patients than in pediatric non-AA controls	[18] [5]
Thyroid	Cross-sectional study (US)	The prevalence of hypothyroidism and Hashimoto's Thyroiditis are higher in pediatric AA compared to controls	[18]
Vitamin D Deficiency	Retrospective (US) Comparative case–control study (India) Retrospective case–control study (Turkey)	Low serum vitamin D levels were commonly seen in children with AA, AT, and AU Pediatric AA patients were found to have significantly lower serum vitamin D levels than healthy controls Serum vitamin D concentrations in pediatric AA patients negatively correlated with Severity of Alopecia Tool scores, number of patches, and duration of disease	[34] [35] [36]
Nail Involvement	Observational cross-sectional study (US)	Nail involvement was observed in children with AA, including nail pitting, nail dystrophy, onycholysis, nail ridging, and onychomycosis	[28]

Note: Adapted from Dainichi et al. 2023 [37].
Abbreviations: AA, alopecia areata; AD, atopic dermatitis; AT, alopecia totalis; AU, alopecia universalis; QOL, quality of life.

2.71, $p = 0.050$) and asthma (HR 2.10, $p = 0.012$) [5]. One observational cross-sectional study of the National AA Registry showed concomitant atopic dermatitis (32.7%), asthma (20.7%), hay fever (20.0%), and allergies (14.2%) [28].

Another cross-sectional study of 3510 patients with AA and 8,310,710 without AA found that atopic dermatitis (AD) was the most common comorbidity, presenting in 17.4% of pediatric AA patients and 2.2% of pediatric patients without AA [18].

Globally, a cross-sectional study in Korea with 268 pediatric (5–18 years) patients with AA found 21.3% had AD. Children with severe AA were more likely to have AD (37.1%) than those with moderate AA (23.0%) and mild AA (13.8%) [29].

4.2 | Mental Illness

Mental health is an important component of the burden of AA. In a cross-sectional study of 1671 children aged 8–17 years with chronic skin diseases (including 189, 11.3% with AA), researchers explored stigma, disease visibility and severity, and associations with mental health and quality of life in chronic pediatric skin disease. Patient Reported Outcomes Measurement Instrumentation System (PROMIS) Pediatric Stigma Skin (PPS-Skin) T scores indicated that children with AA had a mean T score of 44.2, falling within the mild stigma range (T score 40-<45). Parent-reported history of bullying was significantly associated with higher stigma scores (Cohen's $d = -0.79$ for bullied vs. not bullied), poorer peer relationships ($d = 0.54$), increased depression ($d = 0.48$), and higher levels of anxiety ($d = 0.41$) [31].

A systematic review and meta-analysis of 29 articles on depression and 26 articles on anxiety revealed that one-third of individuals with AA, including both children and adults, experience depressive and anxiety symptoms. Additionally, between 7% and 17% of pediatric and adult patients with AA are diagnosed with depressive and anxiety disorders that necessitate psychiatric intervention and medication [32]. In an earlier study, a higher proportion of children with AA (51.8%) were found to have at least one anxiety-spectrum disorder in comparison to children without AA [33].

A retrospective matched cohort study in Olmsted County, Minnesota involving 258 children (0–18 years) with AA and 2 age and sex-matched controls per AA patient (516 controls) found that depression (HR 1.33, $p = 0.091$), anxiety (HR 1.43, $p = 0.13$), or any mental health condition (HR 1.45, $p = 0.021$) were more likely to develop in pediatric AA patients than in pediatric non AA controls [5].

Globally, a small case–control study in Turkey found that 62.9% of AA patients had at least one psychiatric condition compared to 16.6% of patients without AA [33].

4.3 | Thyroid Disease

In a cross-sectional study using aggregated health record data, the prevalence of comorbidities was compared between pediatric patients with and without AA and found a strong association between pediatric AA and thyroid disease, including hypothyroidism (2.6% AA vs. 0.2% controls) and Hashimoto's Thyroiditis (0.85% AA vs. 0.02% controls) [18].

4.4 | Vitiligo and Other Autoimmune Disease

A retrospective review using data from the National AA Registry analyzed 922 children and found that after atopic dermatitis, vitiligo was the second most common comorbidity, with a prevalence of 3.14%. Out of 10 patients with severe AA, 7 of them also had vitiligo, suggesting that concomitant vitiligo and AA were associated with severe AA [30].

A cross-sectional study investigating the comorbidities in pediatric patients with AA compared to those without found that other autoimmune diseases were more prevalent, including vitiligo (1.4% AA vs. 0.04% controls), psoriasis (1.4% AA vs. 0.07% controls), celiac disease (0.57% AA vs. 0.07% controls), ulcerative colitis (0.14% AA vs. 0.02% controls), systemic lupus erythematosus (0.29% AA vs. 0.02% controls), juvenile rheumatoid arthritis (0.29% AA vs. 0.04% controls), and juvenile idiopathic arthritis (0.14% AA vs. 0.008% controls) [18].

A retrospective matched cohort study in Olmsted County, Minnesota, including 258 children (0–18 years) with AA and 516 age and sex-matched controls found that any autoimmune disease (HR 2.59, $p = 0.004$) was more likely to develop in pediatric patients with AA than without [5].

5 | Discussion

We reviewed pediatric AA incidence and prevalence. Contemporary US pediatric AA incidence is estimated to be between 14 and 33 per 100,000 PY [3, 4] and prevalence ranging from 0.04% to 0.11% [3, 18]. These values represented the minimum and maximum estimates among the set of studies we identified. The true population incidence and prevalence rates are likely contained within these ranges. Altogether, the epidemiologic estimates of pediatric AA across these studies were largely congruent, increasing our confidence in the range of rates.

While US-based studies suggest a slowly increasing incidence of childhood AA among higher-income nations [3, 4], reports on global incidence implicate stable rates from 1990 through 2019 [1]. It remains unclear whether readily available and accessible health services may influence this trend.

Furthermore, although multiple individual studies found lower rates of AA incidence or prevalence in children compared with adults [4, 13, 14], a systematic review and meta-analysis of over 90 studies measured a significantly higher prevalence in children [2]. This study-to-study variability makes it challenging to provide broad statements about patterns in pediatric AA epidemiology. Additional research evaluating AA across the lifespan is needed to elucidate the age groups most affected as well as trends in incidence and prevalence over time.

Incidence and prevalence of pediatric AA varied dramatically based on geography. A recent Global Burden of Disease analysis estimated the worldwide incidence of pediatric AA for patients aged 19 and under to be approximately 180 per 100,000 PY in 2019 [1], which would suggest that countries outside the US must have considerably higher rates of new cases. Indeed, in the studies we reviewed, we found that incidence and prevalence rates were higher in Asian and Middle Eastern nations compared to the US [8, 20, 22, 23]. Although the precise mechanism underlying differences in AA based on place remains elusive, a combination of genetic, environmental, and perhaps cultural factors related to reporting may be at play. Notwithstanding, diverse population-based cohort studies, which are largely lacking for AA, would help establish more accurate incidence and prevalence estimates among children nationally and internationally.

The limited number of available studies suggested that Asian, Black, Hispanic/Latino, and multiracial US children shared a higher burden of AA relative to non-Hispanic White children [3, 18]. Reviewing studies conducted on adults, we found patients who self-identify as Black and Hispanic consistently had elevated odds of AA compared to Whites [12, 14, 16, 17]. What contributes to these disparities by race and ethnicity are unclear from the current literature but may involve genetic and environmental factors. Given that AA is associated with both medical and psychiatric comorbidities and that racial and ethnic minoritized communities were affected at higher rates, we postulate that there is likely a growing need for advocacy and equity work related to AA. Additionally, future studies on racial and ethnic differences in pediatric AA are needed to inform epidemiologic estimates, establish possible disparities, and guide intervention, advocacy, and policy efforts aimed at alleviating the burden of disease and associated comorbidities in historically marginalized communities.

As an autoimmune disease, AA carries a high burden of disease and comorbidities. Several of the most common conditions associated with AA include atopic diseases, particularly atopic dermatitis [5, 18, 28, 29], vitiligo [30], psychiatric disorders [5, 29, 32, 33], and hypothyroidism [18]. Vallerand et al. [38] found evidence of a bidirectional relationship between AA and major depressive disorder, suggesting commonalities in the underlying inflammatory and genetic signatures of both conditions. Given high rates of coprevalence, treatment of comorbid depression and anxiety may improve patients' ability to cope with the physical and psychological burden associated with this challenging disease. In fact, considering the high rates of baseline depression in children with AA compared to those without AA (15% vs. 3%) [33], we encourage healthcare providers to consider screening for mental illness comorbidities in newly diagnosed patients. In contrast, although rates of hypothyroidism including Hashimoto's thyroiditis have been demonstrated to be increased in patients with AA [18], routine screening in asymptomatic children is not recommended owing to low overall prevalence.

5.1 | Limitations

This report has several limitations. First, the design was scoping rather than systematic, and many of the papers reviewed had differing approaches to assessing epidemiology, making direct comparison challenging. Second, estimates of epidemiologic measures of AA and related comorbidities may be biased due, in part, to differing methods of ascertainment of diagnoses. Furthermore, most studies reported on patients presenting to clinics with AA but did not capture data on individuals in the general population who may have AA but were unable to access care for diagnosis or treatment. This may be particularly pronounced in resource-limited settings across different geographical regions. For these reasons, the incidence and prevalence estimates described herein may undercount the true number of patients affected. Third, the inclusion criteria restricted articles to the most recent decade and English language only. Fourth, international and global trends in child AA epidemiology were limited by the number of articles on non-US populations. Some of the global estimates were derived from predictive modeling. AA-related comorbidities in children were also limited.

6 | Conclusion

Estimates of pediatric AA nationally and globally reflect epidemiologic measures from contemporary studies that conducted specific analyses in children and adolescents. While the international incidence of pediatric AA has been stable from 1990 through 2019, recent US-based studies have suggested rising incidence and, over time, prevalence. Despite limited reports, current evidence suggests considerable racial and ethnic differences in pediatric AA with higher rates of disease among Asian, Black, Hispanic/Latino, and multiracial children. AA is associated with reduced quality of life. A variety of comorbidities have been implicated in AA, including but not limited to atopic disease, vitiligo, and thyroid disorders. Additional studies on pediatric AA are warranted to inform epidemiologic estimates, establish racial and ethnic disparities, and guide intervention, advocacy, and policy efforts to address the burden of disease and associated comorbidities in children and adolescents.

Consent

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data sharing is not applicable to this article as no new data were generated or analyzed in this study.

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Supporting Information

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