Anxiety, depression, and quality of life in children and adults with alopecia areata: A systematic review and meta-analysis

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Introduction: Alopecia areata (AA) is a non-scarring hair loss condition, subclassified into AA, alopecia universalis, and alopecia totalis. There are indications that people with AA experience adverse psychosocial outcomes, but previous studies have not included a thorough meta-analysis and did not compare people with AA to people with other dermatological diagnoses. Therefore, the aim of this systematic review and meta-analysis was to update and expand previous systematic reviews, as well as describing and quantifying levels of anxiety, depression, and quality of life (QoL) in children and adults with AA.

Methods: A search was conducted, yielding 1,249 unique records of which 93 were included.

Results: Review results showed that people with AA have higher chances of being diagnosed with anxiety and/or depression and experience impaired QoL. Their psychosocial outcomes are often similar to other people with a dermatological condition. Meta-analytic results showed significantly more symptoms of anxiety and depression in adults with AA compared to healthy controls. Results also showed a moderate impact on QoL. These results further highlight that AA, despite causing little physical impairments, can have a significant amount on patients’ well-being.

Discussion: Future studies should examine the influence of disease severity, disease duration, remission and relapse, and medication use to shed light on at-risk groups in need of referral to psychological care.

Systematic review registration: [https://www.crd.york.ac.uk/prospero/], identifier [CRD42022323174].

KEYWORDS
alopecia, alopecia areata, psychosocial functioning, anxiety, depression, quality of life, meta-analysis
Introduction

Alopecia areata (AA) is a hair loss condition with a lifetime prevalence of 2.1% (1). AA has a peak onset between 25 and 29 years old, with a median age at diagnosis of 31 for males and 34 for females. It occurs more frequently in people with a non-white ethnicity (2). Males and females appear to be affected equally often (2), however research has also reported females to be slightly more likely to experience AA (2). AA is typically divided into AA (patchy hair loss), alopecia universalis (AU; total loss of scalp hair), alopecia totalis (AT; total loss of body hair) and alopecia ophiasis (band-like hair loss on the temporal and occipital scalp) (3).

Alopecia areata has an unpredictable disease course characterized by relapse and remission (4). Full hair regrowth may be observed in 50–80% of patients (5, 6), but relapse rates of 30–52% have been reported (5) with around 30% of patients with AA eventually progressing to complete hair loss (6). Relapse is more likely in patients with an earlier onset of AA, but is not related to gender, clinical severity and treatment given (5). Furthermore, medication often fails to provide sustained hair regrowth (3).

There are indications that people with AA experience adverse psychosocial outcomes. Qualitative studies, for instance, have shown that patients reported considerable distress (7). Feelings of sadness, insecurity, inadequacy, and self-consciousness (8), as well as feelings of depression, anxiety, and suicidal thoughts (7) were prevalent. The majority of qualitative research highlights that people struggle with everyday activities, such as participating in sports or social events, due to a fear of their appearance being noticed (7–9). The unpredictable nature of AA was also highlighted as a source of distress in particular (7, 8) and women seem to report more stress and distress than men (10, 11).

Most quantitative research has focused on anxiety, depression or quality of life (QoL). For anxiety, a meta-analysis including eight studies by Okhovat et al. (12) showed that people with AA are 2.50 times more likely to experience anxiety. However, it is unclear how the papers were selected and what type of control group was included in the meta-analysis. Other studies have shown that people with AA have a higher chance of being diagnosed with an anxiety disorder than healthy controls (13). When the amount of anxiety symptoms of people with AA is compared to people with other dermatological diagnoses mixed results have been found (14).

When looking at depression, the aforementioned meta-analysis found that people with AA are 2.71 times more likely to experience depression (12). This result is corroborated by other studies reporting people with AA to be more likely to be diagnosed with depression (13, 15). As for anxiety, it is unclear how people with AA compare to people with other dermatological diagnoses (16, 17).

A systematic review conducted in 2018 has shown that AA has a considerable impact on QoL (18). However, it remained unclear how QoL was related to disease severity (18). Furthermore, people with AA were not compared to people with different dermatological diagnoses in this review. More recent research has reported a moderate effect on QoL (19), as well as no effect (20). Comparisons to people with a different dermatological diagnosis have yielded mixed results. For instance, one study comparing people with AA to people with alopecia androgenetica reported people with AA to have better QoL (21), while another study found the opposite result (22).

Although previous systematic reviews on psychosocial consequences of AA have been conducted (e.g., 18, 23), it remains unclear how people with AA compare to people without AA or people with a different dermatological diagnosis. In addition, these reviews have not highlighted the psychosocial impact of AA on different age groups (i.e., children or adults). Therefore, the purpose of the current systematic review and meta-analysis was to update and expand previous systematic reviews, as well as describing and quantifying levels of anxiety, depression, and QoL in patients with AA, AU, or AT. We also aimed to explore whether gender or age would influence the amount of anxiety, depression, and QoL experienced by people with AA. We specifically sought to answer the following research question: What is the impact of living with alopecia areata, alopecia totalis or alopecia universalis on levels of anxiety, depression, and quality of life in children and adults? We also wanted to know how levels of anxiety, depression, and QoL of people with AA compared to people with a different dermatological condition and to healthy controls.

Materials and methods

This article was written in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (24) and was registered prospectively in the international prospective register of systematic reviews, PROSPERO, registration number CRD42022323174. The protocol was registered with a broad focus on psychological impact of AA, as it was unclear how many papers the search would yield. After selection of relevant papers, a decision was made to focus only on anxiety, depression and QoL and a further nine papers were excluded (see Figure 1).

Search strategy

As this article was part of a bigger project for the Dutch Alopecia Association, a broad search focusing on the psychosocial impact of living with AA was conducted by a research librarian on 28 March 2022. The following databases...
were searched from inception: Embase, Medline, Web of Science Core Collection, Cochrane Central Register of Controlled Trials, PsycInfo, and Google Scholar. The search included terms, both Mesh and free text, related to alopecia and the psychosocial impact, without restrictions on language or publication date. Only published, peer-reviewed papers were used. The full search is displayed in Supplementary material.

Eligibility criteria
Studies were included if they met the following eligibility criteria: (a) studied a sample with AA, AU, and/or AT, (b) reported quantitative data on anxiety, depression or QoL, and (c) the paper was an original research paper. Studies were excluded if they (a) reported no original data (e.g., case-reports, conference abstracts, and systematic reviews), (b) were not written in English, or (c) did not separate AA from other medical diagnoses. No criteria were set for the amount of timepoints in an article (i.e., the article being cross-sectional or longitudinal). In case of a longitudinal intervention study, only the baseline data were included.

Study selection
Studies were selected if they met the inclusion and exclusion criteria. Two reviewers (MD and KM) independently assessed the title and abstract. The interrater agreement was 81.55%. Discrepancies were resolved using consensus. Afterward, the
two reviewers independently assessed the full text for eligibility. Interrater agreement for this step was 87.46%. Discrepancies were again resolved using consensus. One of the reviewers (MD) checked the reference list of included articles for additional relevant references. Any references deemed relevant were first screened based on title and abstract. If still relevant, the full-text was read. When the article met the inclusion and exclusion criteria, it was included in the review. Endnote 20 was used to manage references.

Data extraction

Data collection was done by one researcher (MD) and checked by another researcher (KM) using a data extraction form. The following data were extracted: type of alopecia, sample size, percentage male, mean age (SD), age range, method involved (questionnaire or interview), main conclusions, mean score (when method is questionnaire), mean prevalence of symptoms/diagnosis, any relevant comparisons between groups (e.g., anxiety symptoms in AA vs. unaffected controls). Authors of papers were contacted when relevant data for meta-analyses was missing.

Quality and risk of bias

Quality and risk of bias were assessed using the relevant NIH quality assessment tool for controlled intervention studies, observational cohort and cross-sectional studies, case-control studies or before-after studies with no control group [National Heart, Lung, and Blood Institute (NIH), 2018] (25) or the QAVALS (26). Questions can be answered with “yes, no or cannot determine/not reported/not applicable responses.” We rated >80% points as good, 60–80% points as fair and <60% as poor quality. Quality assessment was performed independently by two reviewers (MD and KM). Half of the articles were discussed in a consensus meeting, after which the remaining half of the papers was checked by one reviewer (MD).

Data synthesis and statistical analyses

All studies were included in the qualitative synthesis. Meta-analyses were conducted for five or more similar studies. As a high level of between-study heterogeneity was expected, a random-effects model was used to pool effect sizes. The Restricted Maximum Likelihood Estimator (REML) was used to calculate heterogeneity variance (27). Means and standard deviations (SDs) of samples were used to compute effect sizes, the standardized mean differences (SMDs), quantified in the form of Hedges’ g (28). When means and SDs were not available, medians were transformed to means and SDs as described by Shi et al. (29). Publication bias was tested by visual inspection of a contour-enhanced funnel plot (30) and Egger’s test in case of ≥10 studies. Exploratory meta-regressions were conducted. For each meta-analysis, one model was created with mean age, percentage male, and quality rating as independent variables. The significance level was set to $\alpha = 0.05$. Analyses were done using the meta package (31) in RStudio.

Results

Study selection

After removing duplicate records, a total of 1,249 records were retrieved for screening. After title and abstract screening, 280 records were assessed for eligibility. Finally, 93 articles were included for the qualitative synthesis of which 26 articles were also included in the quantitative synthesis. The full selection process is displayed in Figure 1. Overall, 74 papers were of poor quality, 16 papers were of fair quality and 4 papers were of good quality.

A total of 52 papers studied anxiety in children and/or adults with AA. Seven papers (32–38) had a combined research group with children and adults ($n = 11,007$, $M_{age} = 41.78$, 43.63% male), eight papers (39–46) studied children with AA ($n = 398$, $M_{age} = 11.85$, 47.00% male) and 37 papers (13, 14, 17, 19, 22, 37, 38, 47–77) studied adults with AA ($n = 88,858$, $M_{age} = 40.03$, 41.25% male).

For depression, 65 papers were included. Fourteen papers (32–36, 38, 78–84) looked at children and adults ($n = 18,638$, mean age = 36.26, 43.44% male), nine papers (39–46, 85) studied children ($n = 3908$, $M_{age} = 11.85$, 44.82% male) and 42 papers (13–17, 19, 22, 47–53, 55–66, 68–77, 86–90) studied adults with AA ($n = 93,047$, $M_{age} = 41.69$, 40.39% male).

A total of 40 studies investigated QoL in people with AA. Five studies (36, 78, 83, 91, 92) combined children and adults into one sample ($n = 5,665$, $M_{age} = 31.43$, 60.09% male), three studies (41, 43, 93) investigated children ($n = 258$, $M_{age} = 11.50$, 47.45% male) and 32 studies (17, 19–22, 53, 61, 62, 67, 73, 75, 76, 94–113) investigated adults with AA ($n = 5,373$, $M_{age} = 41.38$, 42.83% male).

Anxiety

The results for anxiety are shown in Table 1.

Children and adults

Three studies with a total of 5,665 patients with AA, reported that people with AA experienced more symptoms of anxiety and were diagnosed with anxiety more often than healthy controls (32–34). One smaller study ($n = 24$) (35) did not find a difference
TABLE 1 Results for anxiety.

| References | Country   | Year          | N    | % male | Age (M, SD) | % AA, AT, AU | Controls | Measures | Conclusions | Quality score (%) |
|------------|-----------|---------------|------|--------|-------------|-------------|----------|----------|-------------|------------------|
| Pediatric and adult samples |           |               |      |        |             |             |          |          |             |                  |
| Ataseven et al. (32) | Turkey | NR 2006-2009 | 43   | 72.1   | 23.42 (11.41) | NR 30 healthy controls | HAM-A | AA more symptoms of anxiety than healthy controls | 30 | 4 |
| Chu et al. (37) | Taiwan | 2000ñ2009 | 5,117 | 49.2   | NR | 20,468 healthy controls | ICD-9 codes | AA diagnosed with anxiety more often than controls | 80 | 3 |
| Kokcam et al. (33) | Turkey | NR 2006-2009 | 17   | NR 26.47 (12.2) | NR 11 vitiligo, 20 healthy controls | SCL-90-R | AA more symptoms of anxiety than healthy controls, no differences with vitiligo | 20 | 3 |
| Marahatta et al. (38) | Nepal | August 2015ñJuly 2016 | 75 | NR 29.40 (9.90) | NR | No BAI 89.0% very low anxiety, 8.0% moderate anxiety, 0% severe anxiety | 45.83 | 4 |
| Singam et al. (34) | USA 2002ñ2012 | 5,605 hospitalized patients | 38.3 | 42.2 (NR) | NR | Hospitalized patients without AA (N unknown) | ICD-9 codes | AA diagnosed with anxiety more often than controls | 45 | 3 |
| Talaei et al. (35) | Iran | AprilñJuly 2005 | 24 | 33.33 | 25.38 (8.32) | NR 24 healthy controls | SCL-90-R | No significant difference with controls | 70 |
| Vélez-Muñiz et al. (36) | Mexico | March 2017ñFebruary 2018 | 32 | NR | 92.9% patchy AA, 3.2% AT, 1.6% ophiasis, 1.6% AU | No HADS | For adults: 19.1% heightened anxiety/depression, 34.1% no anxiety/depression | 50 | 4 |

| Pediatric samples |             |               |      |        |             |             |          |          |             |                  |
| Altunisik et al. (39) | Turkey | NR 2006-2008 | 27 | NR 29.6 | 11.9 (3.3) | 85.19% AA, 14.81% AU | 30 dermatology patients | K-SADS-PL; SCARED; STAI-C | No difference with controls on questionnaires or diagnoses. 51.8% of AA patients had at least 1 anxiety diagnosis | 65 |
| Andreoli et al. (45) | Italy | 1997ñ2000 | 176 | NR | A.A. diagnosis by psychologist | 16% diagnosis generalized anxiety disorder, 8% social anxiety disorder | 25 |
| Bilgiç et al. (41) | Turkey | NR 2006-2009 | 74 | NR 55.41 | 12.1 (2.8) | NR | 65 healthy controls | STAI-C | AA more state anxiety than controls. Children, but not adolescents more trait anxiety than controls | 65 |
| Díaz-Atienza and Gurpegui (42) | Spain | NR 2006-2008 | 31 | 52 | 12.2 (3.8) | 51.61% AA, 48.39% AU/AT | 23 epilepsy, 25 siblings | STAI-C | No difference on symptoms of anxiety between AA and epilepsy or sibling group | 65 |
| Erdogan and Gur (43) | Turkey | October 2018ñDecember 2019 | 31 | 54.83 | 12.54 (3.56) | 100% AA | 100% healthy controls | RCADS-C; RCADS-P | More social anxiety and total anxiety (child-reported) for HC. More panic disorder and total anxiety (parent-reported) for HC. No differences with vitiligo. | 60 |
| Ghanizadeh (44) | Iran | August 2004ñNovember 2006 | 14 | NR 11.66 | NR | No K-SADS-PL | No diagnosis K-SADS-PL | 7.1% diagnosis social anxiety, 28.6% specific phobia, 7.1% generalized anxiety disorder | 50 |
| Liakopoulou et al. (45) | Greece | NR 2006-2009 | 33 | NR 30.3 | 10.5 (0.3) | NR | 30 patients from pediatrician | CMAS | AA higher scores on worry, overactivity, and concentration compared to controls. 9 AA had at least 1 anxiety disorder diagnosis, a significant difference compared to controls. | 40 |
| Reeve et al. (46) | USA | NR 2006-2009 | 12 | NR 11.5 (2.9) | NR | No DICA-R, RCMAS-A | No anxiety or other mental health diagnoses | DICA-R, RCMAS-A | No significant difference with controls | 37 |

(continued)
### TABLE 1 (continued)

| References         | Country          | Year          | N   | % male | Age (M, SD) | % AA, AT, AU | Controls          | Measures                      | Conclusions                                              | Quality score (%) |
|--------------------|------------------|---------------|-----|--------|-------------|--------------|-------------------|-------------------------------|-----------------------------------------------------------|------------------|
| Adult samples      |                  |               |     |        |             |              |                   |                               |                                                           |                  |
| Aghaei et al. (47) | Iran             | NR            | 40  | 44.8   | 35.2 (9.2)  | NR           | 40 healthy controls | BAI                           | More symptoms of anxiety in AA patients than controls       | 35^3             |
| Alfani et al. (48) | Italy            | November 2009–October 2010 | 73  | 45.2   | 35.2 (9.2)  | 61.7% AA, 26.0% AT, 12.3% AU | 73 healthy controls | Clinical interview; MMPI-2 | More anxiety in AA patients than controls                  | 35^3             |
| Altinoz et al. (49) | Turkey           | September 2011–October 2012 | 30  | 50     | 33.3 (8.9)  | NR           | 30 urticaria, 39 healthy controls | HADS                          | More anxiety in AA patients than healthy controls. No difference with urticarial. | 40^3             |
| Amnagar et al. (50) | Turkey           | NR            | 73  | 65.75  | 27.66 (7.79) | 100% AA      | 78 healthy controls | SCL-90                        | No difference in symptoms of anxiety                      | 35^3             |
| Aty et al. (19)    | Turkey           | NR            | 39  | 59     | 33.5 (11.6) | NR           | 46 vitiligo, 46 healthy controls | HADS                          | AA more anxiety than healthy controls. No difference with vitiligo. | 20^3             |
| Baghestani et al. (51) | Iran          | NR            | 68  | 72     | 35.4 (7.6)  | 100% AA      | 68 healthy controls | HAMD-A                        | AA more symptoms of anxiety than healthy controls          | 60^3             |
| Bain et al. (52)   | UK               | NR            | 39  | 23.07  | 43.15 (12.43) | NR           | 23 Pa; 26 healthy controls | HADS^2                        | More anxiety in less severe AA and shorter disease duration | 30^3             |
| Balieva et al. (53) | 13 European countries | November 2011–February 2013 | 33  | 33.3   | 42.8 (14.1) | NR           | 1,359 healthy controls | EQ-5D-3L                       | AA 4 times higher chance of anxiety/depression than controls | 65^3             |
| Brajac et al. (54) | Croatia          | 1995–1999     | 45  | 37.78  | 40.24 (13.01) | 100% AA      | 45 benign scalp lesions | STAI                          | AA more symptoms of anxiety than healthy controls          | 60^3             |
| Bukharia et al. (55) | India          | NR            | 100 | 48     | 54% 15–30 years, 46% 31–50 years | NR           | 100 TE, 100 healthy controls | HAMD-A                        | 36.84% of AA and 43.94% of TE heightened anxiety           | 45^3             |
| Cakırcı et al. (56) | Turkey          | March–December 2017 | 33  | 75.8   | 26.33 (6.08) | NR           | 33 healthy controls | HADS                          | AA more symptoms of anxiety than healthy controls          | 30^3             |
| Colon et al. (57)  | USA              | April 1985–October 1987 | 31  | 29     | 35.70 (10.23) | 74% AA, 23% AT, 42% AU^3 | No | DIS                          | Lifetime prevalence generalized anxiety disorder 39%, specific phobia 23%, panic disorder 13% | 33.33^4 |
| Conic et al. (58)  | USA              | 2005–2014     | 584 | 31.5   | 35.54 (19.28) | 94.7% AA, 2.05% AT, 3.25% AU | 172 SD | Diagnoses in patient file | No difference with SD. 13.70% of AA has any diagnosis of anxiety | 35^3             |
| Cordan Yarici et al. (59) | Turkey       | NR            | 43  | 60.5   | 33.80 (10.02) | 95.35% AA, 4.65% AT | 53 healthy controls | HADS                          | No significant differences between AA and controls         | 25^3             |
| Devar (60)         | India            | NR            | 30  | 100    | NR           | NR           | 30 TV, 30 healthy controls | TMAS                          | AA more symptoms of anxiety than healthy controls, no difference with TV | 50^3             |
| Endo et al. (61)   | Japan            | June 2009–August 2010 | 122 | 33.1   | 38.3 (16.5)  | NR           | No | STAI                          | Anxiety not related to disease severity and disease duration | 56.25^3 |
| Gallo et al. (77)  | Italy            | NR            | 16  | 37.5   | 45.95 (13.25) | NR           | No | BSI                          | AA more symptoms of anxiety than norm group               | 39.29^6         |
| Güleç et al. (62)  | Turkey           | March 2001–January 2002 | 52  | 65.38  | 31.53 (12.61) | 94.23% AA, 3.65% AU, 1.92% AT | 52 healthy controls | BAI                          | No differences AA and controls                            | 25^3             |

(continued)
| References                | Country       | Year            | N     | % male | Age (M, SD) | % AA, AT, AU | Controls                          | Measures                      | Conclusions                        | Quality score (%) |
|---------------------------|---------------|-----------------|-------|--------|-------------|-------------|-----------------------------------|-------------------------------|------------------------------------|------------------|
| Karia et al. (17)         | India         | NR              | 50    | 60.0   | 27.76 (NR)  | NR          | 50 psoriasis, 50 healthy controls | DSM-IV-TR diagnosis            | 4% of AA any anxiety disorder diagnoses. More often than healthy controls, less often than psoriasis. | 60² |
| Kim et al. (13)           | South Korea   | 2002–2013       | 7,706 | 51.9   | 54.6% 20–39, 39.4% 40–59, 6.1% 60+ | NR          | 30,824 without AA               | ICD-10 codes                  | AA higher risk of anxiety disorder diagnosis than controls | 65³ |
| Kose et al. (63)          | Turkey        | NR              | 18    | 100    | 21.3 (NR)   | NR          | No                               | STAI                          | Positive correlation between anxiety and depression or hopelessness | 50.00² |
| Macbeth et al. (64)       | UK            | January 2009–December 2018 | 5,435 | 45.9   | 38.93 (14.35) | NR          | 21,470 healthy controls | Diagnoses in patient file | 3.24% of AA and 0.24% of healthy controls had anxiety disorder diagnoses | 80³ |
| Rajoo et al. (65)         | Australia     | NR              | 83    | NR     | 40.95 (13.24) | NR          | No                               | DASS-21                       | 66.3% reported extreme symptoms of anxiety | 54.17⁴ |
| Ruiz-Doblado et al. (66)  | Spain         | NR              | 32    | 15     | NR          | NR          | No                               | SCAN                         | 22.2% diagnosis generalized anxiety disorder, 7.4% social phobia | 37.5⁴ |
| Russo et al. (67)         | Italy         | September 2016–September 2017 | 27    | 33.3   | 37.55 (10.37) | NR          | 80 AGA, 36 TE                   | STAI, SPS                     | No differences in trait anxiety or social anxiety. AA less social phobias than AGA and TE | 50³ |
| Şahiner et al. (68)       | Turkey        | August 2009–July 2010 | 41    | 49     | 32.9 (10.5)  | NR          | 30 psoriasis, 50 healthy controls | BAI                           | AA more symptoms of anxiety than healthy controls, no difference with psoriasis | 20³ |
| Sayar et al. (69)         | Turkey        | NR              | 31    | 100    | 23.8 (2.5)   | NR          | 40 healthy controls              | STAI                          | AA more state and trait anxiety | 55³ |
| Sellami et al. (70)       | Tunisia       | March–July 2010  | 50    | 48     | 32.92 (11.81) | NR          | 50 healthy controls              | HADS                          | AA more symptoms of anxiety than healthy controls | 45³ |
| Senna et al. (71)         | USA           | January 2011–December 2018 | 68,121 | 39     | 40.3 (17.8)  | 98.1% AA, 1.3% AT, 0.6% AU | No | ICD-9 and ICD-10 codes | 8.4% had an anxiety disorder | 45.8³ |
| Sorour et al. (14)        | Egypt         | NR              | 208   | 58.65  | NR          | NR          | 1,042 dermatology patients       | DSM-5 interview               | 19.71% of AA had anxiety diagnosis, no effect of gender. No difference with psoriasis. Less symptoms than acne, vitiligo, urticaria, and atopic dermatitis. | 55³ |
| Tan et al. (72)           | China         | December 2012–August 2013 | 168   | 50     | 34.5 (11.5)  | 88.1% AA, 11.9% AT/AU | 100 healthy controls | SCL-90-R                     | AA more symptoms of anxiety and phobic anxiety than controls | 41.67⁷ |
| Titeca et al. (22)        | 13 European countries | 37    | NR    | NR     | NR          | NR          | 1,359 healthy controls, 20 AGA | HADS                         | AA more symptoms of anxiety than healthy controls and AGA | 70³ |
| Tzur Bitan et al. (15)    | Israel        | 2018            | 41,055| 62.9   | 39.97 (13.61) | NR          | 41,055 healthy controls | ICD-9 codes                  | AA higher risk of anxiety disorder than controls | 80³ |
| Willemsen et al. (73)     | Belgium       | September 2006–August 2009 | 21    | 24     | 41.95 (13.79) | 33% patchy AA, 14% ophiasis, 29% AT, 24% AU | No | SCL-90                      | AA more symptoms of anxiety than norm group | 54.17⁷ |

(continued)
TABLE 1 (continued)

| References          | Country       | Year            | N       | % male | Age (M, SD) | % AA, AT, AU | Controls               | Measures  | Conclusions                                                                 |
|---------------------|---------------|-----------------|---------|--------|-------------|--------------|------------------------|-----------|-----------------------------------------------------------------------------|
| Willemsen et al.    | Belgium       | April 1999–April 2004 | 28 | 35.71 | 33.4 | 21.43% AA, 21.43% ophtiasis, 28.57% AU, 3.57% AT | No | SCL-90 | AA more symptoms of anxiety than norm group | 50.00 |
| Yoon et al. (75)    | South Korea   | January 2015–February 2016 | 1,203 | 52.12 | 39.45 (12.21) | NR | No | BAI 10.1% symptoms of anxiety, 4.2% severe | 41.67 |
| Yu et al. (76)      | China         | October 2013–December 2014 | 130 | 41.5 | 31.78 (10.34) | NR | 212 AGA S-AS | No significant differences | 3 |

AA, alopecia areata; AGA, alopecia androgenetica; AU, alopecia universalis; AT, alopecia totalis; NR, not reported; PsA, psoriatic arthritis; SD, seborrheic dermatitis; TE, telogen effluvium; TV, tinea versicolor.

Some patients had multiple episodes, with different forms of alopecia. Hence, the total is higher than 100%.

This questionnaire was not administered to the control group.

As measured by the NIH Quality Assessment of Case-Control Studies.

As measured by the QAV ALS (26).

As measured by the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.

As measured by the NIH Quality Assessment Tool for Before-After (Pre-Post) Studies with no Control Group.

When people with alopecia were compared to people with another (dermatological) condition, studies found that people with AA were diagnosed with an anxiety disorder more often than other hospitalized patients in general (34), but no differences were found for people with vitiligo (33).

One study without a control group (36) found that 19.1% of the adults with alopecia reported heightened symptoms of anxiety or depression. The same study also reported that 34.1% did not experience any symptoms of anxiety or depression. In the other study without a control group 89.0% of people with alopecia reported little to no symptoms of anxiety (38). Around 8% of people with AA reported moderate symptoms of anxiety.

Children

Of the papers investigating anxiety disorders, one study (46) reported that over half of the children had an anxiety disorder. However, this study included only 12 children and used the DSM-III-R, which was published in 1987. Two other studies reported that 7.1–16% had a generalized anxiety disorder, 7.1–8% had a separation anxiety disorder and 28.6% had a specific phobia (40, 44). However, none of the studies specified the number of patients with more than one anxiety disorder. It remains unclear from this data how many children with AA are diagnosed with an anxiety disorder. In a study by Altunisik et al. (39), 51.8% of the children was diagnosed with at least one anxiety disorder. This did not differ significantly from children with another dermatological condition.

When looking at symptoms of anxiety, studies comparing children with AA to healthy controls found mixed results. On the one hand, Bilgiç et al. (41) reported more state and trait anxiety in children aged 8–12 with AA. They did not find any differences for adolescents aged 12–18. On the other hand, Díaz-Atienza et al. (42) did not find significant differences when comparing children with AA to their siblings. Erdoğan et al. (43) found no difference on the Beck Anxiety Inventory (BAI), but found more child-reported separation anxiety and total anxiety and parent-reported panic disorder and total anxiety than healthy controls on the Revised Child Anxiety and Depression Scales (RCADS).

Studies comparing children with AA to children with other (dermatological) conditions found no differences in symptoms of anxiety when comparing to other dermatological conditions (39), epilepsy (42) and vitiligo (43). Liakopoulou et al. (45) found that children scored higher on worry, oversensitivity, and concentration than other patients.

Adults

Eight papers studied the prevalence of anxiety disorders in adults with AA (n = 86,014). These studies reported point prevalence rates of 3.24% (64), 4% (17), 8.4% (71), and 13.70% (58). Several papers also reported that people with AA have...
a higher chance of being diagnosed with an anxiety disorder in comparison to healthy controls (13, 15, 17, 64). Prevalence rates of specific anxiety disorders in people with AA range from 7.4% for specific phobias and 22.2–39% for generalized anxiety disorders (57, 66). The lifetime prevalence of specific phobia and panic disorder was estimated at 23 and 13%, respectively (57).

When looking at symptoms of anxiety, 15 studies compared people with AA (n = 749) to healthy controls (n = 733). These results were combined in a meta-analysis, shown in Figure 2. The results showed that adults with AA reported significantly more symptoms of anxiety than people without AA (g = 0.61, 95% CI [0.48, 0.75], p < 0.001), with a medium to large effect. There was little heterogeneity (I² = 33.1%, 95% CI [<0.01, 64.0], τ² = 0.02, 95% CI [<0.01, 0.12]) and visual inspection of the funnel plot showed no indication for publication bias. Egger’s test also did not show indications for a publication bias [t(13) = 0.94, p = 0.363]. Thirteen studies without missing data were included in a meta-regression. The model did not explain any variance in the effect sizes (R² = <0.01%), with a residual heterogeneity of I² = 46.59%. Mean age (g = 0.01, p = 0.802, 95% CI [−0.04 to 0.05]), percentage male (g = <1.01, p = 0.858, 95% CI [−0.01 to 0.01]) and quality score (g = <0.01, p = 0.583, 95% CI [−0.01 to 0.01]) did not influence study effect sizes.

Studies comparing people with AA to people with other (dermatological) conditions showed mixed results. For the majority of studies, no significant differences were found. For instance, no differences were found when comparing to people with chronic urticaria (49), vitiligo (19, 17), seborrhoeic dermatitis (58), tinea versicolor (60), alopecia androgenetica and telogen effluvium (67), and psoriasis (68, 14). A smaller number of studies reported that adults with AA experienced more symptoms of anxiety than patients with benign skin lesions (54) and alopecia androgenetica (22, 76), but less than people with psoriasis (17), acne, vitiligo, chronic urticaria, and atopic dermatitis (14).

Three studies compared adults with AA (n = 61) to a norm group. These studies all reported more symptoms of anxiety in adults with AA (73, 74, 77).

### Depression

The results for depression are shown in Table 2.

#### Children and adults

In terms of diagnoses of depression, 4.3% of the visits to a psychologist by people with AA were related to depression (79). The point prevalence varied from 2.9% (37) to 3.98% (81). Different studies reported that people with AA were diagnosed with depressive disorders (37, 84) and mood disorders in general (34) significantly more often than healthy controls. When looking at depressive symptoms, results concerning comparisons to healthy controls are mixed. Two studies, with a combined sample size of 60, reported more depressive symptoms in people with AA (32, 33), while one study did not find any significant differences (n = 24) (35).

Two studies compared people with AA to people with another (dermatological) condition. They did not find significant differences concerning the amount of depressive symptoms when comparing to people with psoriasis or vitiligo (78) or people with acne vulgaris, psoriasis or vitiligo (80).

Four studies (n = 657) did not use a control group. They found little to no depressive symptoms in 31.5% (82), 33.3% (38), and 34.1% (36) of people with AA. According to these studies around 60–65% of people with AA experience at least moderate depressive symptoms.
**TABLE 2 Results for depression.**

| References                  | Country        | Year                | N       | % male | Age (M, SD) | % AA, AT, AU | Controls                  | Measures                | Conclusions                                       | Quality score (%) |
|-----------------------------|----------------|---------------------|---------|--------|-------------|--------------|---------------------------|-----------------------|---------------------------------------------------|-------------------|
| **Pediatric and adult samples** |                |                     |         |        |             |              |                           |                       |                                                   |                   |
| Ataseven et al. (32)        | Turkey         | NR                  | 43      | 72.1   | 23.42 (11.41) | NR           | 30 healthy controls      | HAM-D, CDI            | More symptoms of depression in AA compared to controls | 30^1              |
| Chu et al. (37)             | Taiwan         | 2000–2009           | 5,117   | 49.2   | NR         | NR           | 20,468 healthy controls  | ICD-9 codes           | 2.9% AA has depression diagnosis, more often than controls | 80^1              |
| Ghajarzadeh et al. (78)     | Iran           | 2009–January 2010  | 100     | 69     | 23.02 (33.4) | NR           | 100 psoriasis, 100 vitiligo | BDI                   | No difference AA and psoriasis/vitiligo          | 55^1              |
| Gutierrez et al. (79)       | USA            | 2006–2016           | 2,298,432 | 35   | 37.8 (18.04) | NR           | No                        | ICD-9 and ICD-10 codes | 4.3% of the visits was related to depression     | 58.33^2           |
| Jagziani et al. (80)        | India          | NR                  | 38      | 65.8   | 25.79 (8.82) | NR           | 80 AV, 56 psoriasis      | BDI                   | AA not significantly different from patients with acne vulgaris or psoriasis | 55^1              |
| Kokcan et al. (33)          | Turkey         | NR                  | 17      | NR     | 26.47 (12.2) | NR           | 11 vitiligo, 20 healthy controls | SCL-90-R, ZSDS       | AA more symptoms of depression than healthy controls, no difference with vitiligo | 20^1              |
| Laitinen et al. (81)        | Finland        | 1987–2016           | 176     | 25     | 29.7 (NR)   | NR           | No                        | ICD-9 and ICD-10 codes | 3.98% was diagnosed with depression                | 54.17^2           |
| Layegh et al. (82)          | Iran           | October 2005–May 2006 | 73     | NR     | NR         | NR           | 78 AV, 62 psoriasis, 87 vitiligo | BDI                   | 31.51% minor depression, 23.29% mild depression, 24.66% moderate depression, 20.55% severe depression | 55^1              |
| Liu et al. (83)             | USA            | NR                  | 91 childen, 292 adults | Child: 34.4%, adult: 27.9% | Child: 10 (2.92), adult: 41 (15.3) | No                        | PHQ-9                  | On average mild symptoms of depression in children and adults | 20.83^2           |
| Marahatta et al. (38)       | Nepal          | August 2015–July 2016 | 75     | 53.3   | 29.40 (9.90) | NR           | No                        | BDI                   | 66.7% depressive complaints. No relation to disease severity | 45.83^2           |
| Singam et al. (34)          | USA            | 2002–2012           | 5,605   | 38.3   | 42.2 (NR)   | NR           | Hospitalized patients without AA (N unknown) | ICD-9 codes           | AA more mood disorders than controls              | 45^1              |
| Talaei et al. (35)          | Iran           | April–July 2005     | 24      | 33.33  | 25.38 (8.32) | NR           | 24 healthy controls      | SCL-90-R              | No difference AA and controls                     | 70^1              |
| Vallerand et al. (84)       | GB             | NR                  | 6,861   | 43.9   | 32.20 (13.50) | NR           | 6,137,342 healthy controls | Read codes            | AA higher chance of depression than controls       | 60^1              |
| Vélez-Muñiz et al. (36)     | Mexico         | March 2017–February 2018 | 32 children, 94 adults | 41           | 92.9% patchy AA, 3.2% AT, 1.6% ophiasis, 1.6% AU | No                        | DRS-R-C, HADS | Children: 6.3% symptoms of depression. Adults: 19.1% subclinical depression or anxiety, 34.1% no symptoms of anxiety or depression. | 50^2              |
| **Pediatric samples**       |                |                     |         |        |             |              |                           |                       |                                                   |                   |
| Altunisik et al. (39)       | Turkey         | NR                  | 27      | 29.6   | 11.9 (3.3)  | 85.19% AA, 14.81% AU | 30 dermatology patients  | K-SADS-PL, CDI        | No difference AA and controls. 14.8% symptoms of depression. | 65^1              |
| Andreoli et al. (40)        | Italy          | 1997–2000           | 176     | NR     | NR         | NR           | No                        | Diagnosis by psychologist | 10% dysthyemia                                      | 25^2              |
| References                  | Country         | Year                      | N  | % male | Age (M, SD) | % AA, AT, AU | Controls              | Measures                              | Conclusions                                      | Quality score (%) |
|-----------------------------|-----------------|---------------------------|----|--------|-------------|---------------|-----------------------|----------------------------------------|--------------------------------------------------|-------------------|
| Bilgiç et al. (41)          | Turkey          | NR                        | 74 | 55.41  | 12.1 (2.8)  | NR            | 65 healthy controls  | CDI                                   | AA more symptoms of depression than controls     | 65                |
| Conic et al. (85)           | USA             | 2019                      | 3,510 | 44.7   | 26.2% <10 years, 73.8% 10–18 years | NR            | 8,310,710 patients without AA | Diagnoses in patient file | AA diagnosed with depression (2.6%) more often than controls (0.6%) | 10                |
| Díaz-Atenza and Gurpegui (42) | Spain          | NR                        | 31 | 52     | 12.2 (3.8)  | 51.61% AA, 48.39% AU/AT | 23 epilepsy, 25 siblings | CDI                                   | No differences AA and epilepsy or siblings        | 65                |
| Erdogan and Gür (43)        | Turkey          | October–December 2018     | 31 | 54.83  | 12.54 (3.56) | 100% AA       | 29 vitiligo, 30 healthy controls | RCADS-C, RCADS-P | AA more depression than healthy controls, no difference vitiligo | 60                |
| Ghanizadeh (44)             | Iran            | August 2004–November 2006 | 14 | NR     | 11.66 (6.08) | NR            | No                    | K-SADS-PL                             | 50% has diagnosis of depression                 | 50                |
| Liakopoulou et al. (45)     | Greece          | NR                        | 33 | 30.3   | 10.5 (0.3)  | NR            | 30 patients from pediatrician | CDI                                   | No difference AA and controls                  | 40                |
| Reeve et al. (46)           | USA             | NR                        | 12 | NR     | 11.5 (2.9)  | NR            | No                    | DICA-R; CDS                           | No heightened group average                     | 37.5               |
| Adult samples               |                 |                           |    |        |             |               |                       |                                       |                                                  |                    |
| Aghaei et al. (47)          | Iran            | NR                        | 40 | 44.8   | 35.2 (9.2)  | NR            | 40 healthy controls  | BDI                                   | AA more symptoms of depression than controls     | 35                |
| Alfani et al. (48)          | Italy           | November 2009–October 2010 | 73 | 45.2   | 25.2 (9.2)  | 61.7% AA, 26.0% AT, 12.3% AU | 73 healthy controls | MMPI-2                               | AA patients score above cut-off for depression more often than controls | 35                |
| Altinoz et al. (49)         | Turkey          | September 2011–October 2012 | 30 | 50     | 33.3 (8.9)  | NR            | 30 urticaria, 39 healthy controls | HADS                                 | AA more symptoms of depression than healthy controls. No difference with urticaria. | 40                |
| Annagur et al. (50)         | Turkey          | NR                        | 73 | 65.75  | 27.66 (7.79) | 100% AA       | 78 healthy controls  | SCL-90                               | AA more symptoms of depression than controls     | 35                |
| Atı et al. (19)             | Turkey          | NR                        | 39 | 59     | 33.5 (11.6) | NR            | 46 vitiligo, 46 healthy controls | HADS                                 | No differences between AA, vitiligo and healthy controls | 20                |
| Baghestani et al. (51)      | Iran            | NR                        | 68 | 72     | 35.4 (7.6)  | 100% AA       | 68 healthy controls  | HAM-D                                | AA more symptoms of depression than controls (OR = 4.48) | 60                |
| Bain et al. (52)            | UK              | NR                        | 39 | 23.07  | 43.15 (12.43) | NR            | 23 PsA; 26 healthy controls | HADS*                                 | Depressive symptoms in 18%. Less severe symptoms with higher SALT scores. | 30                |
| Balieva et al. (53)         | 13 European countries | November 2011–February 2013 | 33 | 33.3   | 42.8 (14.1) | NR            | 1,359 healthy controls | EQ-SD-3L                              | AA 4 times higher chance of anxiety/depression than controls | 65                |
| Bashir et al. (54)          | Pakistan        | January–March 2007        | 3  | NR     | NR          | NR            | No                    | GHQ-12; interview                     | 1 person was diagnosed with depression           | 41.67             |
| Bukharia and Jain (55)      | India           | NR                        | 100| 48     | 54% 15–30 years, 46% 31–50 years | NR            | 100 TE, 100 healthy controls | HAM-D                                | 23.68% AA and 33.33% TE with symptoms of depression | 45                |
| Cakirca et al. (56)         | Turkey          | March–December 2017       | 33 | 75.8   | 26.33 (6.08) | NR            | 33 healthy controls  | HADS                                 | AA more depressive symptoms than controls        | 30                |
| References                     | Country | Year              | N   | % male | Age (M, SD) | % AA, AT, AU | Controls | Measures       | Conclusions                                                                                      | Quality score (%) |
|-------------------------------|---------|------------------|-----|--------|-------------|-------------|----------|----------------|---------------------------------------------------------------------------------------------|-------------------|
| Colon et al. (57)             | USA     | April 1985–October 1987 | 31  | 29     | 35.70 (10.23) | 74% AA, 23% AT, 42% AU² | No       | DIS            | Lifetime prevalence depression 39%, dysthymia 16%                                            | 33.33²            |
| Conic et al. (58)             | USA     | 2005–2014        | 584 | 31.5   | 35.54 (19.28) | 94.7% AA, 2.0% AT, 3.25% AU | 172 SD  | Diagnoses in patient file                      | No difference with control group                                                               | 35³               |
| Cordan Yazici et al. (59)     | Turkey  | NR               | 43  | 60.5   | 33.80 (10.02) | 95.35% AA, 4.65% AT        | 53 healthy controls | HADS            | No difference with controls                                                                   | 25³               |
| Dai et al. (90)               | Taiwan  | NR               | 2,123 | 44.8  | 31.39 (9.02)  | NR           | 2,298 siblings, 9,192 healthy controls | ICD-9 codes | 7.87% of AA with MDD diagnoses, 8.22 times higher chance than healthy control. A total of 2.55 higher chance than siblings. | 85³               |
| Devar (60)                    | India   | NR               | 30  | 100    | NR           | NR           | 30 TV, 30 healthy controls | BDI            | AA more symptoms of depression than healthy controls, no difference with TV                  | 50³               |
| Endo et al. (61)              | Japan   | June 2009–August 2010 | 122 | 33.1   | 38.3 (16.5)  | NR           | No       | CES-D          | AA more symptoms of depression than norm group                                                | 56.25⁴            |
| Gallo et al. (77)             | Italy   | NR               | 16  | 37.5   | 45.95 (13.25) | NR           | No       | BSI            | AA more symptoms of depression than norm group                                                | 39.29⁵            |
| Güleç et al. (62)             | Turkey  | March 2001–January 2002 | 52  | 65.38  | 31.53 (12.61) | 94.23% AA, 3.65% AU, 1.92% AT | 52 healthy controls | BDI            | No differences between AA and controls                                                        | 25³               |
| Gupta and Gupta (16)          | USA     | NR               | 45  | 24.44  | 44.7 (11.6)  | NR           | 72 AV, 146 AD, 217 psoriasis | CRSD           | AA less depressive symptoms than AV and psoriasis, no difference with AD                    | 15¹               |
| Karia et al. (17)             | India   | NR               | 50  | 66.00  | 27.76 (NR)  | NR           | 50 psoriasis, 50 healthy controls | DSM-IV-TR diagnosis | 18% AA depression diagnoses. More often than healthy controls, less often than psoriasis. | 60³               |
| Kim et al. (13)               | South Korea | 2002–2013   | 7,706 | 51.9  | 54.6% 20–39, 39.4% 40–59, 6.1% 60+ | NR           | 30,824 people without AA | ICD-10 codes | AA higher chance of depression than controls                                                   | 65¹               |
| Kose et al. (63)              | Turkey  | NR               | 18  | 100    | 21.3 (NR)   | NR           | No       | BDI            | On average subclinical depressive symptoms                                                    | 50.00⁶            |
| Macbeth et al. (64)           | UK      | January 2009–December 2018 | 5,435 | 45.9  | 38.93 (14.35) | NR           | 21,470 healthy controls | Diagnoses in patient file | AA higher chance of depression than controls                                                  | 80¹               |
| Mirza et al. (87)             | USA     | 2002–2012        | 138 | 0      | NR           | NR           | No       | Diagnoses in patient file                      | 21.74% has depression diagnosis                                                                | 58.33²            |
| Pascual-Sánchez et al. (88)   | Spain   | NR               | 16  | 0      | 45.1 (NR)   | 100% AU      | No       | BDI            | On average subclinical depressive symptoms                                                    | 29.17⁶            |
| Rajoo et al. (65)             | Australia | NR          | 83  | NR     | 40.95 (13.24) | NR           | No       | DASS-21         | 47.0% reported extreme depressive symptoms                                                    | 54.17²            |
| Ruiz-Doblado et al. (66)      | Spain   | NR               | 32  | 15     | NR           | NR           | No       | SCAN            | 7.4% depression diagnosis, 7.4% previously diagnosed, but currently free of symptoms         | 37.5²             |

(continued)
| References       | Country          | Year                          | N   | % male | Age (M, SD) | % AA, AT, AU | Controls                                      | Measures          | Conclusions                                                                 | Quality score (%) |
|------------------|------------------|-------------------------------|-----|--------|-------------|-------------|----------------------------------------------|-------------------|-------------------------------------------------------------------------------|--------------------|
| Sahiner et al. (68) | Turkey           | August 2009–July 2010         | 41  | 49     | 32.9 (10.5) | NR          | 30 psoriasis, 50 healthy controls           | BDI               | AA more depressive symptoms than healthy controls, no difference with psoriasis | 20                 |
| Sayar et al. (69)  | Turkey           | NR                            | 31  | 100    | 23.8 (2.5)  | NR          | 40 healthy controls                         | BDI               | AA more symptoms of depression than controls                                  | 55                 |
| Sellami et al. (70) | Tunisia          | March–July 2010               | 50  | 48     | 32.92 (11.81) | NR         | 50 healthy controls                         | HADS              | AA more symptoms of depression than controls                                   | 45                 |
| Senna et al. (71)  | USA              | January 2011–December 2018    | 68,121 | 39    | 40.3 (17.8) | 98.1% AA, 1.3% AT, 0.6% AU  | No                        | ICD-9 and ICD-10 codes                     | 9.5% had depression diagnosis                                 | 45.83              |
| Sorour et al. (14) | Egypt            | NR                            | 208 | 58.65  | NR          | NR          | 1,042 dermatology patients                  | DSM-5 interview   | 19.71% of AA had diagnosis of depression. 24.33% in psoriasis, 55.34% acne vulgaris, 31.47% vitiligo, 43.64% urticarial, and 43.63% in atopic dermatitis | 55                 |
| Tan et al. (72)    | China            | December 2012–August 2013     | 168 | 50     | 34.5 (11.5) | 88.1% AA, 11.9% AT/AU | 100 healthy controls                       | SCL-90-R          | AA more symptoms of depression than controls                                 | 41.67              |
| Titeca et al. (22) | 13 European      | NR                            | 37  | NR     | NR          | NR          | 1,359 healthy controls, 20 AGA               | HADS              | AA more symptoms of depression than healthy controls                          | 70                 |
| Tzur Bitan et al. (15) | Israel           | 2018                          | 41,055 | 62.9 | 39.97 (13.61) | NR          | 41,055 healthy controls                     | ICD-9 codes       | AA diagnosed with depression more often than controls                         | 80                 |
| Willemsen et al. (73) | Belgium         | September 2006–August 2009    | 21  | 24     | 41.95 (13.79) | 33% patchy AA, 14% ophiasis, 29% AT, 24% AU | No                        | SCL-90             | AA more symptoms of depression than norm group                               | 54.17              |
| Willemsen et al. (74) | Belgium         | April 1999–April 2004         | 28  | 35.71  | 33.4 (NR)   | 21.43% AA, 21.43% ophiasis, 28.57% AU, 3.57% AT | No                        | SCL-90             | AA more symptoms of depression than norm group                               | 50.00              |
| Yoon et al. (75)   | South Korea      | January 2015–February 2016    | 1,203 | 52.12 | 39.45 (12.21) | NR          | No                                           | BDI               | 40.9% depressive symptoms. Women more often than men, more symptoms with more severe AA. | 41.67              |
| Yu et al. (76)     | China            | October 2013–December 2014    | 130 | 41.5   | 31.78 (10.34) | NR          | 212 AGA                                     | ZSDS              | No differences between AA and AGA                                             | 70                 |

*This questionnaire was not administered to the control group.
AD, atopic dermatitis; AGA, alopecia androgenetica; AV, acne vulgaris; PsA, psoriatic arthritis; SD, seborrhoeic dermatitis; TE, telogen effluvium; TV, tinea versicolor.
1 As measured by the NIH Quality Assessment of Case-Control studies.
2 As measured by the NIH Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies.
3 Some patients had multiple episodes, with different forms of alopecia. Hence, the total is higher than 100%.
4 As measured by the NIH Quality Assessment Tool for Before-After (Pre-Post) Studies with no Control Group.
5 As measured by the QAVALS (26).
6 As measured by the NIH Quality Assessment of Controlled Intervention Studies.
7 As measured by the NIH Quality Assessment Tool for Before-After (Pre-Post) Studies with no Control Group.
Children

Three studies \((n = 3,700)\) investigated depressive disorders. A small study of 14 children found 50% of the children to be eligible for a diagnosis of depressive disorder \((44)\). Bigger studies reported that 10% of the children were diagnosed with dysthymia \((40)\) and that children with AA were diagnosed with a depressive disorder more often than other patients \((85)\).

Three studies \((n = 136)\) investigated symptoms of depression in comparison to healthy controls. Two studies found more depressive symptoms in children with AA \((41, 43)\), while one study did not find a significant difference when comparing to unaffected siblings \((42)\).

Four studies compared children with AA to children with a different (dermatological) condition. They did not find a difference in depressive symptoms when comparing children with AA to children with other dermatological conditions \((39)\), epilepsy \((42)\), vitiligo \((43)\), and pediatric patients in general \((45)\).

One study with 14 children with AA did not use a control group. This study did not find a heightened group average for depressive symptoms \((46)\).

Adults

Several studies investigated the prevalence of depressive disorders in adults with AA. One study, conducted in the late 1990s, found a lifetime prevalence of 39% for depression and 16% for dysthymia \((57)\). Estimates for point prevalence range from 7.4% \((66)\), 9.5% \((71)\), 18% \((17)\), 21.7% \((87)\) to 55.29% \((14)\). The largest and most recent study found a point prevalence of 9.5% \((71)\). Furthermore, adults with AA have a higher chance of being diagnosed with a depressive disorder than healthy controls \((13, 15, 17, 64)\). One study did not find any difference in the number of diagnoses \((58)\). There were no differences in the number of diagnoses when comparing to adults with psoriasis or vitiligo \((17)\) or seborrheic dermatitis \((58)\).

Fifteen studies compared adults with AA to healthy controls on the amount of depressive symptoms. These studies were analyzed in a meta-analysis. The results are shown in Figure 3. A total of 749 adults with AA and 724 healthy controls were analyzed. Adults with AA reported significantly more depressive symptoms than the control group \((g = 0.73, 95\% CI [0.47, 0.98], p < 0.001)\), with a medium to large effect. There was considerable heterogeneity \((I^2 = 78.5\%, 95\% CI [65.2, 86.8], \tau^2 = 0.20, 95\% CI [0.08, 0.62])\). Visual inspection of the funnel plot showed no signs of publication bias and Egger’s test was not significant \([t(13) = 0.80, p = 0.438]\). Thirteen studies without missing data were included in a meta-regression. The model explained very little variance in the effect sizes \((R^2 = 1.21\%)\) and residual heterogeneity was high \((I^2 = 77.27\%)\). Mean age \((g = 0.04, p = 0.289, 95\% CI [-0.03 to 0.12])\), percentage male \((g = 0.01, p = 0.168, 95\% CI [-0.01 to 0.03])\) and quality score \((g = 0.01, p = 0.265, 95\% CI [-0.01 to 0.03])\) did not influence study effect sizes.

Nine studies used a control group of adults with a different (dermatological) condition to assess the amount of depressive symptoms. The vast majority of the studies did not find any significant differences. For instance, no differences were found when comparing to chronic urticaria \((49)\), vitiligo \((19)\), telogen effluvium \((55)\), tinea versicolor \((60)\), atopic dermatitis \((16)\), psoriasis \((68)\), and alopecia androgenetica \((22, 76)\). One study found that adults with AA reported less depressive symptoms than adults with acne vulgaris or psoriasis \((16)\).

Studies without a control group found that people with AA \((n = 183)\) reported more symptoms of depression than a norm group \((61, 73, 74, 77)\). On average, they reported subclinical symptoms \((63, 88)\). Estimates of the prevalence rates of people with depressive symptoms were 47.0% \((65)\) and 40.9% \((75)\).

Quality of life

The results for QoL are shown in Table 3.
### TABLE 3 Results for quality of life.

| References          | Country     | Year                  | N     | % male | Age (M, SD) | % AA, AT, AU | Controls | Measures | Conclusions                                                                 | Quality score (%) |
|---------------------|-------------|-----------------------|-------|--------|-------------|--------------|----------|----------|--------------------------------------------------------------------------------|-------------------|
| **Pediatric and adult samples** |             |                       |       |        |             |              |          |          |                                                                                |                   |
| Ghajarzadeh et al. (78) | Iran        | January 2009–January 2010 | 100   | 69     | 23.02 (33.4) | NR           | DLQI; SF-36 | 100 psoriasis, 100 vitiligo | AA better Qol than psoriasis. No difference with vitiligo. On average moderate effect on Qol. | 55 ^1             |
| Liu et al. (83)      | USA         | NR                    | 91    | 34.4%  | 10 (2.92), adult: 41 (15.3) | NR           | CDLQI, DLQI, FDLQI | No | Children, adults, and family members have moderate effect on Qol. Worse Qol related to more depressive symptoms. | 20.83 ^2          |
| Park et al. (92)     | South Korea | NR                    | 40    | 27.5   | 30.0% 10-19 years, 17.5% 20-29, 17.5% 30-39, 17.5% 40-49, 17.5% 50+ | NR           | Skindex-29 | No | Symptoms, emotions, and total score very little impairment. Functioning mild impairment | 37.5 ^2           |
| Vélez-Muñiz et al. (36) | Mexico    | March 2017–February 2018 | 32 children, 94 adults | 41 | NR      | 92.9% patchy AA, 3.2% AT, 1.6% ophiasis, 1.6% AU | No | CDLQI, DLQI | Children small impairment on Qol. Adults moderate effect. No differences for gender, disease duration, and disease severity. | 50 ^2             |
| **Pediatric samples** |             |                       |       |        |             |              |          |          |                                                                                |                   |
| Bilgiç et al. (41)   | Turkey      | NR                    | 74    | 55.41  | 12.1 (2.8) | NR           | Healthy controls | 65 | Less Qol on child and parent reports. Less psychosocial Qol on parent reports. | 65 ^1             |
| Erdogan Gür (43)     | Turkey      | October 2018–December 2019 | 31 | 54.83  | 12.54 (3.56) 100% AA | NR           | Healthy controls; 29 vitiligo | 30 | AA worse Qol than vitiligo | 60 ^1             |
| Putterman et al. (93)| USA         | April 2017–July 2018   | 153   | 43.79  | 11.0 (4.8) | NR           | CDLQI, FDLQI, QLCCDQ | No | On average small effect on child Qols, moderate effect for family members. Worse Qol for more disease severity and worse emotional Qol for higher age. | 50 ^2             |
| **Adult samples**    |             |                       |       |        |             |              |          |          |                                                                                |                   |
| Abedini et al. (94)  | Iran        | October 2013–October 2014 | 176   | 64.23  | 31.39 (9.05) | NR           | DLQI      | No | Patients with mild AA moderate effect on Qol, patients with severe AA very large effect on Qol. Patients with more severe AA reported worse Qol on: symptoms and feelings, daily activities, leisure, personal relationships, work and school, treatment, and the total score. | 50 ^2             |
| Abideen et al. (95)  | India       | NR                    | 60    | 65     | 33.9 (9.3) | NR           | DLQI      | No | 30% no effect on Qol, 55% small effect, 6.7% moderate effect, 8.3% very large effect | 20.83 ^2          |
| Al-Mutaari and Eldin (91) | Kuwait     | August 2002–July 2009 | 2,962 (300 for DLQI) | 65.02 | 58.03% between 21 and 40 years | NR           | Healthy controls | 300 | No difference between males and females or disease duration. Worse QOL for more severe alopecia | 40 ^1             |
| Andersen et al. (20) | Denmark     | NR                    | 1,494 | 33     | 51.3 (16.0) | NR           | DLQI, EQ-SD-5L | No | 75% no effect on Qol. On average small effect. | 41.67 ^2          |

(continued)
| References     | Country          | Year                        | N     | % male | Age (M, SD) | % AA, AT, AU | Controls                          | Measures         | Conclusions                                                                 | Quality score (%) |
|---------------|------------------|-----------------------------|-------|--------|-------------|--------------|-----------------------------------|-------------------|------------------------------------------------------------------------------|--------------------|
| Atoş et al. (19) | Turkey           | NR                          | 39    | 59     | 33.5 (11.6) | NR           | 46 healthy controls, 46 vitiligo  | DLQI              | On average moderate effect, no difference with vitiligo                      | 20^1               |
| Balieva et al. (53) | 13 European countries | November 2011–February 2013 | 33    | 33.3   | 42.8 (14.1) | NR           | 1,359 healthy controls            | EQ-SD-3L          | No significant difference for mobility, self-care, activity, and pain/discomfort | 65^1               |
| de Hollanda et al. (96) | Brazil            | January 2011–October 2012   | 37    | 37.84  | 35.89 (11.59) | NR           | 49 healthy controls               | SF-36             | AA score lower on mental health, role emotional and social functioning. No differences for vitality, bodily pain, general health, physical functioning, and role physical. | 55^1               |
| Dubois et al. (97) | France            | NR                          | 60    | 35.00  | 40.1 (15.2) | NR           | Dermatologic conditions and healthy controls from literature | SF-36, Skindex    | Lower scores on role-physical, general health, vitality, social functioning, role-emotional, and mental health | 41.67^2           |
| Endo et al. (61)   | Japan             | June 2009–August 2010       | 122   | 33.1   | 38.3 (16.5) | NR           | No                               | SF-8              | Average scores on physical and mental functioning                            | 56.25^3           |
| Essa et al. (98)   | Egypt             | January–June 2015           | 17    | NR     | NR          | NR           | 500 healthy controls              | Skindex-16        | No difference AA and dermatological conditions. AA worse QoL than healthy controls. | 41.67^3           |
| Fayed et al. (99)  | Egypt             | February 2015–January 2016 | 41    | 78     | 26.68 (4.49) | NR           | No                               | DLQI              | 0% no effect on QoL, 4.9% small effect, 29.3% mild effect, 29.3% moderate effect, 36.6% very large effect | 50^4               |
| Gonul et al. (21)  | Turkey            | NR                          | 56    | 55.4   | 29.34 (8.13) | 92.86% AA, 7.14% AT | 82 AGA                           | Hairdex, TQL      | AA better QoL than AGA on total, emotions, functions, symptoms, and self-confidence. No difference on stigmatization and TQL. | 60^1               |
| Gölç et al. (62)   | Turkey            | March 2001–January 2002     | 52    | 65.38  | 31.53 (12.61) | 94.23% AA, 3.65% AU, 1.92% AT | 52 healthy controls             | SF-36             | AA worse QoL on vitality and mental health than controls. AA higher QoL than healthy controls on social functioning. | 25^1               |
| Han et al. (100)   | USA               | August 2018–November 2019   | 141   | 26.2   | 43.3 (15.6) | 76.6% AA, 13.5% AU, 9.9% AT | No                               | AASIS             | More stress is related to lower QoL                                         | 41.67^2           |
| Jankovic et al. (101) | Serbia          | April 2012–June 2013        | 60    | 26.7   | 37.35 (14.26) | NR           | 110 psoriasis, 66 AD, 140 OM     | DLQI, SF-36, Skindex-29 | AA better QoL than psoriasis. Partially better QoL than AD and OM.            | 41.67^2           |
| Karia et al. (17)  | India             | NR                          | 50    | 66     | 27.76 (NR) | NR           | 50 psoriasis, 50 healthy controls | WHOQOL-BREF | AA higher QoL than psoriasis and healthy controls                             | 60^1               |
| Lai et al. (102)   | Australia         | NR                          | 36    | 19.4   | 41 (14.5)   | 41.7% patchy, 25.0% AT, 33.3% AT | No                               | AASIS, aQoL-8D    | No difference with norm group                                                 | 75^5               |
| Liu et al. (103)   | USA               | NR                          | 30    | 53.3   | 38.00 (21.80) | NR           | No                               | Skindex-16        | No difference between males and females                                       | 29.11^8           |

(continued)
| References          | Country        | Year                  | N   | % male | Age (M, SD) | % AA, AT, AU | Controls          | Measures    | Conclusions                                                                 | Quality score |
|---------------------|----------------|-----------------------|-----|--------|-------------|---------------|------------------|-------------|------------------------------------------------------------------------------|---------------|
| Masmoudi et al.     | Tunisia        | March–July 2010       | 50  | 48     | 32.92 (11.81) | NR            | 50 healthy controls | SF-36       | AA worse scores on mental health, role emotional, social functioning, general health and total mean score. No significant differences for physical functioning, role physical and bodily pain. No relation QoL and disease severity. | 55            |
| Nasimi et al.       | Iran           | August 2017–August 2018 | 100 | 65     | 29.24 (8.31) | NR            | No               | AA-QLI, DLQI | On average very large effect. Males better QoL than females.                  | 20.83         |
| Nijsten et al.      | Italy          | NR                    | 46  | NR     | NR          | NR            | 151 AV; 76 psoriasis, 54 SD; 27 vitiligo; 100 nevi | Skindex-29   | 17.4% in worst category for total, 21.7% in worst category for emotions     | 55            |
| Öztürkcan et al.    | Turkey         | January–February 2004  | 3   | NR     | NR          | NR            | 16 CD, 6 psoriasis, 3 urticaria, 16 TP, 35 AV | DLQI        | On average small effect                                                      | 41.67         |
| Qi et al.           | China          | January 2010–July 2012 | 698 | 50     | 38.8 (12.0)  | 82.5% patchy, 17.5% AT/AV | No               | DLQI        | On average moderate effect on QoL.                                          | 54.17         |
| Reid et al.         | USA            | March–November 2009   | 23  | 0      | NR          | NR            | 33 TE, 41 AGA, 7 unknown alopecia | Skindex-16   | No differences on QoL for different alopecia types                           | 55            |
| Russo et al.        | Italy          | September 2016–September 2017 | 27  | 33.3   | 37.55 (10.37) | NR            | 80 AGA, 36 TE | DLQI        | Females worse QoL than men. No differences with AGA or TE.                   | 50            |
| Sampogna et al.     | Italy          | NR                    | 5   | NR     | NR          | NR            | Dermatological conditions | Scalpdex; Skindex-29 | Average impact on symptoms, emotions, and functioning                       | 55            |
| Sanclemente et al.  | Colombia       | NR                    | 11  | NR     | NR          | NR            | Dermatological conditions | Skindex-29   | Median score indicates moderate effect on total score, symptoms, emotions, and functioning | 60            |
| Senna et al.        | USA            | 2019                  | 259 | 49.4   | 39.1 (13.6) | NR            | No               | Skindex-16   | Worse QoL for longer disease duration, higher disease severity, and females | 41.67         |
| Temel et al.        | Turkey         | NR                    | 50  | 46     | 30.92 (10.92) | 84% AA, 6% AT, 10% AU | 50 AV; 50 vitiligo | DLQI        | On average moderate effect on QoL. No difference with AV or vitiligo.       | 40            |
| Titeca et al.       | 13 European countries | 37                  | NR  | NR     | NR          | NR            | 1,359 healthy controls, 20 AGA | DLQI        | Worse QoL than AGA                                                          | 70            |
| Willemsen et al.    | Multiple countries | NR                    | 243 | 11     | 37.9 (13.0) | NR            | No               | DLQI        | On average no effect on QoL. No differences for gender or disease severity. Worse QoL for shorter disease duration. | 54.17         |
| Willemsen et al.    | Belgium        | September 2006–August 2009 | 21  | 24     | 41.95 (13.79) | 33% patchy, 14% ophiasis, 29% AT, 24% AU | No       | SF-36, Skindex-17 | SF-36: average physical functioning, below average mental functioning in comparison to norm group Skindex: moderate effect on psychosocial functioning, less physical symptoms in comparison to norm group | 54.17         |
Children and adults

People with AA reported worse QoL than people with psoriasis, but there was no difference with vitiligo (78). On average, people reported a small (36, 92) or moderate (36, 78, 83) impact on their QoL.

Children

Children with AA reported more impaired QoL than healthy controls (41, 43). In a study without a control group children with AA reported a small effect on their QoL (93).

Adults

Fourteen studies used the Dermatology Life Quality Index (DLQI) to assess disease-specific QoL in 3,978 adults with AA (19, 20, 36, 67, 76, 78, 83, 94, 105, 107, 108, 112ñ114). These studies were included in a meta-analysis, shown in Figure 4. The total scores of the DLQI can be interpreted as follows: 0–1 = no effect on patient's life, 2–5 = small effect, 6–10 = moderate effect, 11–20 = very large effect, 21–30 extremely large effect (115). Results from the meta-analysis showed that people with AA reported a weighted average of 6.67 (95% CI [5.54, 7.81]), which is a moderate effect. However, there was very high heterogeneity amongst studies ($I^2 = 98.9\%$, 95% CI [98.5, 99.0], $\tau^2 = 4.25$, 95% CI [2.07, 12.29], $p < 0.001$). Results should thus be interpreted with extreme caution. Meta-regressions were run on 11 studies without missing data. The model explained 62.89% of the variance in the data, but still included a substantial amount of heterogeneity ($I^2 = 89.56\%$). Mean age was negatively related to DLQI scores ($g = −0.28$, $p < 0.001$, 95% CI [−0.44 to −0.12]). Studies with a higher mean age had lower DLQI scores and thus less impaired QoL. The same was true for the quality ratings of studies ($g = −0.08$, $p = 0.009$, 95% CI [−0.13 to −0.02]), where studies with a lower quality rating reported higher DLQI levels. The percentage male ($g = −0.04$, $p = 0.200$, 95% CI [−0.11 to 0.02]) was not significantly related to DLQI scores.

As two studies did not provide clear data on their sample and may have included children (78, 114), we conducted a sensitivity analysis to assess whether this influenced the results. Twelve studies (19, 20, 36, 67, 76, 83, 105, 107, 108, 112ñ113) with 3,346 people were included. The mean DLQI was unchanged ($M = 6.68$, 95% CI [5.33, 8.02]) and heterogeneity remained high ($I^2 = 98.8\%$, 95% CI [98.4, 99.0], $\tau^2 = 5.14$, 95% [2.38, 16.35]).

Five studies compared 188 adults with AA to healthy controls (53, 62, 96, 98, 104). There seemed to be no difference on physical functioning (53, 96, 104). However, adults with AA had more impaired mental (62, 96, 104) and overall (98) functioning.

Thirteen studies compared adults with AA to adults with another (dermatological) diagnosis (17, 20–22, 67, 76, 97, 101, 106, 109–112) and found very mixed results. On the one hand, no differences were found when comparing to adults with vitiligo (20, 112), alopecia areata and telogen effluvium (67) and acne vulgaris (112). On the other hand, people with...
AA reported better QoL than people with psoriasis (101) or alopecia androgenetica (21). In yet other studies, people with AA reported worse QoL than people with alopecia androgenetica (22, 76).

**Unknown samples**

Two studies did not report whether they studied children or adults (114, 116). They found a moderate impact on QoL (114). When comparing to alopecia androgenetica, people with AA scored higher on subscales functioning and lower on symptoms (116). No differences were found for emotions and total score.

**Discussion**

In this systematic review and meta-analysis we aimed to provide an overview of the current literature on anxiety, depression and QoL in people with AA. Results showed that people with AA experienced adverse psychosocial consequences in all three domains. Results also point to more diagnoses of anxiety and depression, as well as more symptoms of anxiety and depression, compared to healthy controls.

Meta-analytic results showed that people with AA experience more symptoms of anxiety and depression than healthy controls. With a medium to large effect for both meta-analyses, we can conclude that this constitutes a clinically relevant effect. Our results were unable to shed light on which patients are at risk for experiencing symptoms of anxiety or depression as average age, percentage male and quality of the studies did not explain variance in the effect sizes. While the same studies were included in both meta-analyses, we found high heterogeneity for depression but not for anxiety. The range for effect sizes is much larger in depression than anxiety, however it is unclear where this originates from.

Meta-analytic results also showed that people with AA experience a moderate impact on their QoL. We were able to include around 3,800 patients in this meta-analysis, which makes it likely that our results generalize to other adults with AA. However, as we found very high heterogeneity, the moderate impact of AA on QoL is unlikely to be true for everyone with AA. Subgroups may exist based on variables that were not studied in the current meta-analysis, such as severity of disease, medication use, duration of disease or other variables.

Results concerning people with AA compared to people with other dermatological diagnoses were mixed for anxiety, depression, and QoL. However, the majority of the studies seems to point to people with AA experiencing the same amount of anxiety, depression, and impairment of QoL as people with other diagnoses. So, even though patients with AA do not experience physical symptoms that people with other dermatological diagnoses may experience, such as pain or itching (117), their QoL is comparable.

While we did not directly compare age groups, some observations can be noted. Firstly, for all three domains more studies were included for adults than for children. Hence, conclusions for adults can be made with more certainty. Both for anxiety and depression results of children with AA compared to healthy controls were mixed, while results for adults showed that adults with AA experienced more symptoms of anxiety and depression than healthy controls. As the mean age of the studies with children was 11.85, it is possible that symptoms of anxiety do not develop before puberty or adulthood, when appearance and peer relations become more important. This is corroborated by other studies showing more appearance-related...
distress in puberty (118). For QoL only three studies were found for children, so direct comparisons are hard to make.

Overall, our results are in line with a previous meta-analysis finding positive associations between AA and experiencing symptoms of anxiety or depression (12). In addition, we have shown that adults with AA experience more symptoms of anxiety and depression than healthy controls. Our results concerning QoL are also in line with Toussi et al. (23), who found diminished QoL in children and adults with AA. More specifically, we found diminished QoL in mental wellbeing but not necessarily in physical wellbeing. This is slightly unsurprising, as AA is associated with little physical impairment. Despite this, qualitative studies have shown that losing one’s hair has a considerable impact on mental health (7, 8).

It is also noteworthy that many studies included patients that were referred to a dermatologist. This could introduce a selection bias, where those who experience less psychological complaints are less likely to visit a dermatologist. However, large studies on primary care databases also reiterate that patients with alopecia are diagnosed with anxiety and depression more often than patients without alopecia (64, 84), with a diagnosis of depression preceding the diagnosis of AA for some patients (84).

This systematic review also has some strengths and limitations. A particular strength is the thorough literature search conducted. A formal search was created by a librarian, yielding 1,249 unique records. With this thorough search it is highly likely that no relevant articles were missed in the search process.

Despite the thorough literature search, we could only include a limited amount of studies in a quantitative analysis. For instance, we did not have enough data to disentangle psychological wellbeing in separate forms of AA (i.e., areata, universalis, or totalis) or how psychological wellbeing was related to disease severity or disease duration. Another limitation is that the included studies did not look at the remitting and relapsing course of AA specifically. Most studies were cross-sectional and longitudinal studies were often designed to look at a medical or psychological intervention. Qualitative research has highlighted that the unpredictable nature of AA can lead to feelings of anger or stress (119), but this has not been studied quantitatively. Hence, it remains unclear how the remitting and relapsing course of AA influences psychological wellbeing. A third limitation is that the included studies did not provide data on medication use. Inclusion criteria were often unclear when it came to participants’ medication use and medication use was often omitted from reporting in the outcome data. We do know that medical treatments often fail to provide sustained hair regrowth and may lead to substantial side effects (3). Hence, it remains unclear whether the pros of medication use outweigh the cons.

Another limitation is that the goal of the included studies did not always line up with the goal of the current systematic review.

For instance, this review also included questionnaire validation studies (107) and baseline data of randomized controlled trials (88). The data was therefore approached in a different manner than the original authors intended. This may impede the strength of the current conclusions. However, as the intention of this review was to provide a thorough overview of the current literature, minimal limitations were set for the inclusion of different types of papers.

Based on these limitations, future studies should aim to study AA longitudinally and investigate the influence of disease severity, disease duration, disease status (inactive, remission, or relapse) and medication use on psychological wellbeing. These results would provide useful insights on potential at-risk groups in need of referral to psychological care.

The results of the current study highlight the impact of AA on psychological wellbeing. Clinicians treating people with AA should therefore be aware of the impact and refer to psychological care if needed. This could be accomplished through regular screening, for instance as part of value-based healthcare (120), or through the physician checking in on people’s mental health during outpatient clinic appointments.

Conclusion

In summary, we have shown that living with AA has important consequences for psychological wellbeing. People with AA experienced worse psychological outcomes than healthy controls and comparable psychological outcomes compared to people with other dermatological diagnoses. Important challenges lay ahead on how to treat AA, both psychologically as well as medically.

Data availability statement

The datasets analyzed as well as analysis scripts for this study can be found on the Open Science Framework (OSF): https://osf.io/fxt7p/.

Author contributions

MD: conceptualization, methodology, formal analysis, writing—original draft, visualization, and project administration. KM: formal analysis and writing—review and editing. JK-O, JO, and SP: writing—review and editing. All authors contributed to the article and approved the submitted version.
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Conflict of interest

Author JK-O is a board member of the Dutch Alopecia Association (volunteer position).

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fmed.2022.1054898/full#supplementary-material

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