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Anxiety and depression in adolescents with a visible difference: A systematic review and meta-analysis

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ABSTRACT

Living with a visible difference can entail challenging social situations, associated with psychosocial symptoms. However, it is not clear whether adolescents with a visible difference experience more anxiety and depression than unaffected peers. We aim to determine whether adolescents with a visible difference experience more symptoms of anxiety and depression than unaffected peers. A literature search was conducted in Embase, Medline Ovid, Web of Science, Cochrane CENTRAL, PsycINFO Ovid, and Google Scholar. Meta-analyses were done using random-effects models to calculate a standardised mean difference. Analyses for subgroups were used to study causes of visible difference. Eleven studies were identified ($n = 1075$, weighted mean age = 15.80). Compared to unaffected peers, adolescents with a visible difference experience more symptoms of anxiety (SMD = 0.253, 95 % CI [0.024, 0.482], $p = .030$), but not depression (SMD = 0.236, 95 % CI [−0.126, 0.599], $p = .202$). Adolescents with a skin condition did not experience more symptoms of anxiety (SMD = 0.149, 95 % CI [−0.070, 0.369], $p = .182$) or depression (SMD = 0.090, 95 % CI [−0.082, 0.262], $p = .305$) when compared to unaffected peers. Overall, more symptoms of anxiety are found in adolescents with a visible difference compared to peers. No differences in anxiety or depression were found for skin differences. Screening for anxiety is recommended.

1. Introduction

Approximately 1 in 44 people have a condition or injury that results in a socially undesirable impact on their physical appearance (Changing Faces, 2010). These appearance altering conditions are often referred to as a visible difference or disfigurement and can result from congenital conditions (e.g., cleft lip and palate, craniofacial conditions), skin conditions (e.g., vitiligo, psoriasis and acne), trauma (e.g., burns, scars), disease (e.g., cancer, meningitis and alopecia areata) or medical treatment (e.g., surgery or radiotherapy). The term visible difference is a relatively new term, with the first mention in the literature occurring in 2004 (Rumsey et al., 2004).

One important aspect in visible differences is negative observer responses. Having a visible difference can lead to challenging social situations and negative observer responses, such as staring, teasing, and receiving unwanted comments (Jewett et al., 2018; Masnari et al., 2012). These experiences can be distressing, and individuals often develop a fear of being negatively evaluated based on their appearance (Kent & Keohane, 2001). This can result in avoidance of social activities such as going to parties, participating in sports and appearing in photos (Rumsey, Clarke, White, Wyn-Williams,

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& Garlick, 2004). Concerns around developing romantic relationships can also greatly impact self-esteem in adolescents and adults with a visible difference (Griffiths, Williamson, & Rumsey, 2012). Furthermore, a study by Moss (2005) shows that the severity of the visible difference is not directly related to the amount of psychological distress. Rather, the subjective severity of the visible difference predicts psychological distress.

A possible consequence of negative observer responses are symptoms of anxiety and depression. In the general population, anxiety and depression are the second and third most common disorders in adolescence (Costello, Copeland, & Angold, 2011) and are thus considered a major cause for mental health-related disability. A review of prevalence rates shows a mean prevalence of 10.7 % for anxiety and 6.1 % for depressive disorders in adolescence (Costello et al., 2011). However, 12-month prevalence rates as high as 8.2 % for depression and 24.9 % for anxiety in adolescence have been reported (Kessler et al., 2012). Also, prevalence rates of depression and anxiety disorders seem to increase throughout childhood and adolescence (Copeland, Angold, Shanahan, & Costello, 2014; Ford, Goodman, & Meltzer, 2003), with girls experiencing more anxiety and depression (Wesselhoeft, Sørensen, Heiervang, & Bilenberg, 2013). Being diagnosed with an anxiety or depressive disorder in childhood can also have implications for adulthood. For instance, studies show that depression in adolescence predicts depression in adulthood, as do some types of anxiety disorders (Copeland, Shanahan, Costello, & Angold, 2009).

Another important aspect of visible differences in adolescence is body image. Body dissatisfaction, the discrepancy between the perceived body shape and the ideal body shape, is very common in adolescence (Dion et al., 2015). In their study, Dion et al. (2015) found that in underweight girls, 62.5 % of girls were satisfied with their body shape. For all other weight categories, the proportion of adolescents satisfied with their body shape ranged from 39.2 % to 0%. So, the majority of adolescents experience body dissatisfaction. Body dissatisfaction has been shown to be related to negative psychosocial outcomes, such as (social) anxiety in adolescents (Vannucci & Ohannessian, 2017) and college women (Fitzsimmons-Craft & Bardone-Cone, 2012). Furthermore, a greater body image disturbance, body dissatisfaction, body importance, and body change strategies to increase muscularity, sex, and stress have all been linked to depressive symptoms in adolescence (Flores-Cornejo, Kamego-Tome, Zapata-Pachas, & Alvarado, 2017; Murray, Rieger, & Byrne, 2018).

Literature assessing body image in visible differences is mixed. For adolescents with craniofacial conditions, body image seems to be similar to non-affected peers (Crerand, Sarwer, Kazak, Clarke, & Rumsey, 2017). On the other hand, adolescents with acne experience a poorer body image when compared to peers (Dalgard, Gieler, Holm, Bjertness, & Hauser, 2008). When adults with a visible difference are compared to adults with an invisible mental illness, the former group experiences a more positive body image (Shpigelman & HaGani, 2019), indicating that a nonvisible condition might be associated with a poorer body image than a visible condition. In sum, a poor body image is related to anxiety and depression. However, it remains debatable whether the body image of adolescents with a visible difference is negatively affected by their appearance.

In a European survey concerning visible difference, 116 psychosocial specialists from 15 countries reported that up to 83 % of their referrals for adolescents with a visible difference were related to social anxiety and up to 79 % of referrals were related to depressed mood (Harcourt et al., 2018). In an adult sample of 458 persons with a visible difference from 15 outpatient clinics in the United Kingdom, 48 % experienced subclinical or clinical symptoms of anxiety and up to 27.5 % experienced subclinical or clinical symptoms of depression (Rumsey et al., 2004). In this study, persons attending burns, eye, and hand clinics had the lowest anxiety scores, while persons seeking elective plastic surgery had the highest anxiety scores. Furthermore, hand patients had the lowest depression scores, while persons seeking elective plastic surgery had the highest depression scores.

When looking at symptoms of anxiety and depression in adolescents, studies are inconsistent. Studies have either reported no significant differences between adolescents with a visible difference and unaffected peers (e.g., Aktan, Özmen, & Şanli, 2000; Pope, Solomons, Done, Cohn, & Possamai, 2007) or significantly more anxiety and depressive symptoms in adolescents with a visible difference when compared to unaffected peers (e.g., Hon et al., 2015; Rivlin & Faragher, 2007).

In sum, depression and anxiety are common psychological disorders. However, due to inconsistent findings, the question of whether adolescents with a visible difference experience more anxiety and depressive symptoms than unaffected peers has not been systematically explored. Therefore, the aim of the current meta-analysis is (1) to determine whether adolescents (12–18 years old) with a visible difference suffer more symptoms of anxiety and depression than unaffected peers and (2) to determine the influence of the cause of visible difference on anxiety and depression in these adolescents.

This meta-analysis can contribute to the knowledge regarding the psychosocial impact of having a visible difference. To date, it is not known whether adolescents with a visible difference resulting from a wide variety of conditions and injuries, present with the same psychosocial symptoms, or whether this differs by cause of visible difference.

2. Method

This meta-analysis was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, & Altman, 2009). The meta-analysis was registered prospectively in the international prospective register of systematic reviews, PROSPERO, registration number CRD42018110201.

2.1. Eligibility criteria

Studies were included if they met the following eligibility criteria: (a) sample with a mean age between 12 and 18, (b) sample with a visible difference, (c) quantitative data on anxiety and/or depression from a validated questionnaire, (d) data reported by adolescents or parents, and (e) a control group of unaffected peers. Studies were excluded if (a) they were published in a non-English language, (b) they reported on a sample with cognitive developmental delay, (c) they reported on a traumatic event less than three months before the study (e.g., studies on psychological well-being in burn victims with burns sustained less than three months before were excluded),[1] (d) the visible difference was caused by self-harming, and (e) they described case reports, case series, qualitative studies, dissertations or review papers, and conference abstracts.

2.2. Information sources and search

As there was no clear picture on how many articles a search solely on anxiety and depression would yield, a broader search focusing on social and emotional aspects of visible differences in adolescence was done. A research librarian conducted a search using Embase, Medline Ovid, Web of Science, Cochrane CENTRAL, PsycINFO Ovid, and Google Scholar. The search was conducted in

[1] After this period, potential post-traumatic stress symptoms will have declined (Hiller et al., 2016).

June 2018 and updated in February and April 2019. The search included terms relating to visible difference or disfigurement and the following relevant medical conditions: neurofibromatosis, limb malformation, eczema, psoriasis, epidermolysis bullosa, vitiligo, skin haemangioma, albinism, port-wine stains, ectodermal dysplasia, scars, stoma, wheelchair, amputation, burns, paralysis, hirsutism, cerebral palsy, craniofacial malformations, and cleft lip. These terms were combined with terms relating to anxiety and depression, and adolescence. The search excluded conference abstracts, letters and editorials, and was limited to articles written in English. The full search is displayed in the Supplementary Material.

2.3. Study selection

Studies were selected if they met the inclusion criteria. First, two reviewers (MvD and YK or FH) independently assessed title and abstract. The reviewers agreed on 88.6 % of the references. Discrepancies were resolved using consensus. Second, two reviewers (MvD and YK or FH) independently assessed the full text for eligibility. Reviewer agreement was 90.0 % for the second step. Discrepancies were again resolved using consensus. Third, MvD 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 X9 was used to manage references.

2.4. Data collection process and data items

Data collection was completed independently by two reviewers (MvD and YK), using a data extraction form. The following data were extracted: year of publication, medical condition involved, sample size, percentage male, mean age of the sample, age range, mean score, and standard deviation.

2.5. Quality and risk of bias

Quality and risk of bias were assessed using the NIH Quality Assessment for Observational Cohort and Cross-sectional studies (National Heart Lung & Blood Institute (NIH), 2018). This checklist includes 14 questions with *yes*, *no* or *cannot determine/not reported/not applicable* responses. For cross-sectional studies, only 7 questions are applicable. Hence, we rated 5.5–7 (>80 %) points as good, 4.5 or 5 (60–80 %) points as fair and 4 points or less (<60 %) as poor quality. Quality assessment was performed independently by two reviewers (MvD and YK). Discrepancies were resolved by consensus.

2.6. Data synthesis and statistical analyses

Comprehensive Meta-Analysis (CMA), version 2 was used for meta-analysis. Because of the high likelihood of between-study heterogeneity, a random-effects model was employed. Means and standard deviations of the samples were used to compute an effect size, the standardized mean difference (SMD). When means and standard deviations were not available, medians were transformed to means and *SD*s using the interquartile range, as described by Wan, Wang, Liu, and Tong (2014).

Separate meta-analyses were conducted for anxiety and depression, using the SMD as effect measure. Heterogeneity was assessed using the I^2-statistic, with values $\geq$75 % indicating considerable heterogeneity (Melsen, Bootsma, Rovers, & Bonten, 2014). Publication bias was assessed by visual inspection of a funnel plot and Egger's regression. To assess whether cause of visible difference influenced the results (Aim 2), analyses for subgroups were performed. Subgroups were defined based on the cause of visible difference: (1) congenital conditions, (2) skin conditions, (3) trauma, (4) disease, or (5) medical treatment. When two or more studies were present in a subgroup, a meta-analysis for the subgroup was conducted.

3. Results

3.1. Study selection

After removing duplicate articles, the database search yielded 4764 records. One additional record was identified through the reference lists of included articles. The title/abstract was screened in all 4765 records, 4098 articles did not meet the inclusion criteria. Thereafter 676 full-text articles were assessed for eligibility, of which 147 records met the inclusion criteria and focussed on social and emotional aspects of a visible difference. Of the 147 articles focusing on social and emotional aspects of a visible difference, 11 were included in the meta-analyses. Of the 136 articles excluded, most did not focus on anxiety and/or depression (n = 91). Fig. 1 details the selection process.

3.2. Study characteristics

Eleven studies were included in the meta-analyses, as displayed in Table 1. These studies included a total of 1075 adolescents with a visible difference and 2375 unaffected peers. Of the adolescents with a visible difference, 47.61 % were male. Of the unaffected peers, 44.82 % percent were male. One study included females only (Drosdzol, Skrzypulec, & Plinta, 2010). The number of adolescents with a visible difference per study ranged from 15 to 385, with a median sample size of 44. The weighted mean age was 15.80. One study did not report a mean age (Turan et al., 2015). The youngest participants were 7 years old, the oldest 20 years old. Six studies investigated a skin condition (acne, vitiligo, alopecia, hirsutism, and atopic eczema), two investigated a congenital condition (cleft lip or cleft lip and palate [CL/P] and neurofibromatosis type 1 [NF1]), two investigated a visible difference due to trauma (burns), and one investigated a visible difference due to disease (cutaneous leishmaniasis). All studies included self-report measures, and none included parent or proxy reports.

3.3. Study quality/risk of bias

The quality assessment is shown in Table 2. The mean quality score was 3.59 (range 1.0–6.0), which can be considered poor quality. Overall, eight studies were considered to be of poor quality (Aktan et al., 2000; Bilgiç et al., 2014; Díaz-Atienza & Gurpegui, 2011; Feragen, Stock, Sharratt, & Kvalem, 2016; Hon et al., 2015; Pasini et al., 2012; Pope et al., 2007; Rivlin & Faragher, 2007). Two studies were of fair quality (Bilgiç, Bilgiç, Akiş, Eskioğlu, & Kiliç, 2011; Turan et al., 2015) and one study was of good quality (Drosdzol et al., 2010). None of the studies achieved a maximum score of seven points.

3.4. Anxiety symptoms

A meta-analysis was run to estimate whether adolescents with a visible difference experience more symptoms of anxiety than unaffected peers. Nine studies reported on symptoms of anxiety (Aktan et al., 2000; Bilgiç et al., 2011, 2014; Díaz-Atienza & Gurpegui, 2011; Drosdzol et al., 2010; Hon et al., 2015; Pasini et al., 2012; Rivlin & Faragher, 2007; Turan et al., 2015), with five different instruments. The studies included 653 participants, with a weighted mean age of 15.45, and 526 controls. One study did not report a mean age (Turan et al., 2015).

Table 1
Overview of study characteristics.

Study	Type of condition	Condition	% male	Mean age (range)	Quality score	Outcome	Instrument	Visible difference			Healthy controls		
								Sample size	Mean	*SD*	Sample size	Mean	*SD*
Aktan et al. (2000)	Skin condition	Acne vulgaris	67.6	16.1 (14–20)	2.5	Anxiety	HADS	308	8.00	4.05	308	7.62	4.34
						Depression	HADS		4.54	2.82		4.73	2.82
Bilgiç et al. (2011)	Skin condition	Vitiligo	44.0	15.72 (13–18)	6.0	Anxiety	STAI-C: trait anxiety	25	37.16	6.93	26	36.46	5.83
						Depression	CDI		12.76	7.99		12.04	7.33
Bilgiç et al. (2014)	Skin condition	Alopecia areata	61.8	14.6 (13–18)	4.5	Anxiety	STAI-C: trait anxiety	34	35.60	6.80	32	35.20	6.00
						Depression	CDI		11.50	7.00		10.50	7.20
Díaz-Atienza and Gurpegui (2011)	Skin condition	Alopecia areata	52.0	12.2 (7–19)	3.0	Anxiety	STAI-C: trait anxiety	31	12.20	6.90	25	15.00	7.50
						Depression	CDI		9.80	5.30		9.70	4.70
Drosdzol et al. (2010)	Skin condition	Hirsutism	0	16.44 (13–18)	5.0	Anxiety	HADS	50	5.00*	3.82*	50	3.00*	3.05*
						Depression	HADS		2.17*	3.82*		1.50*	2.29*
Feragen et al. (2016)	Congenital	Cleft lip (and palate)	60.2	16 (16)	4.0	Depression	HSCL-7	385	1.46	0.43	1808	1.75	.57
Hon et al. (2015)	Skin condition	Atopic eczema	58.0	16.0 (14.4–18.2)	1.0	Anxiety	DASS-42	120	4.67*	4.50*	26	3.33*	2.35*
						Depression	DASS-42		3.67*	5.25*		1.33*	3.14*
Pasini et al. (2012)	Congenital	NF1	33.3	13.4 (9–18)	3.0	Anxiety	MASC	15	48.90	7.00	15	40.70	6.40
Pope et al. (2007)	Trauma	Burns	36.1	15.1 (11–19)	2.5	Depression	BDI-II	36	10.37	9.73	41	10.10	7.92
Rivlin and Faragher (2007)	Trauma	Burns	50.0	13.5 (9–16)	3.5	Anxiety	Short form - MAS	44	6.55	3.35	24	4.55	3.30
Turan et al. (2015)	Disease	Cutaneous leishmaniasis	53.7	NR (13–18)	4.5	Anxiety	STAI-C: trait anxiety	54	36.41	40.50	20	33.90	10.87
						Depression	CDI		14.25	4.76		4.50	2.46

Note. NR, Not reported; NF1, Neurofibromatosis type 1; BDI, Beck Depression Inventory; CDI, Children's Depression Inventory; DASS-42, Depression Anxiety Stress Scale - 42; HADS, Hospital Anxiety and Depression Scale; HSCL-7, the Hopkins Symptoms Checklist - 7; MASC, Multidimensional Anxiety Scale for Children; short form-MAS, short form Manifest Anxiety Scale; STAI-C, State Trait Anxiety Inventory for Children. * Scores calculated using the method described by Wan et al. (2014).

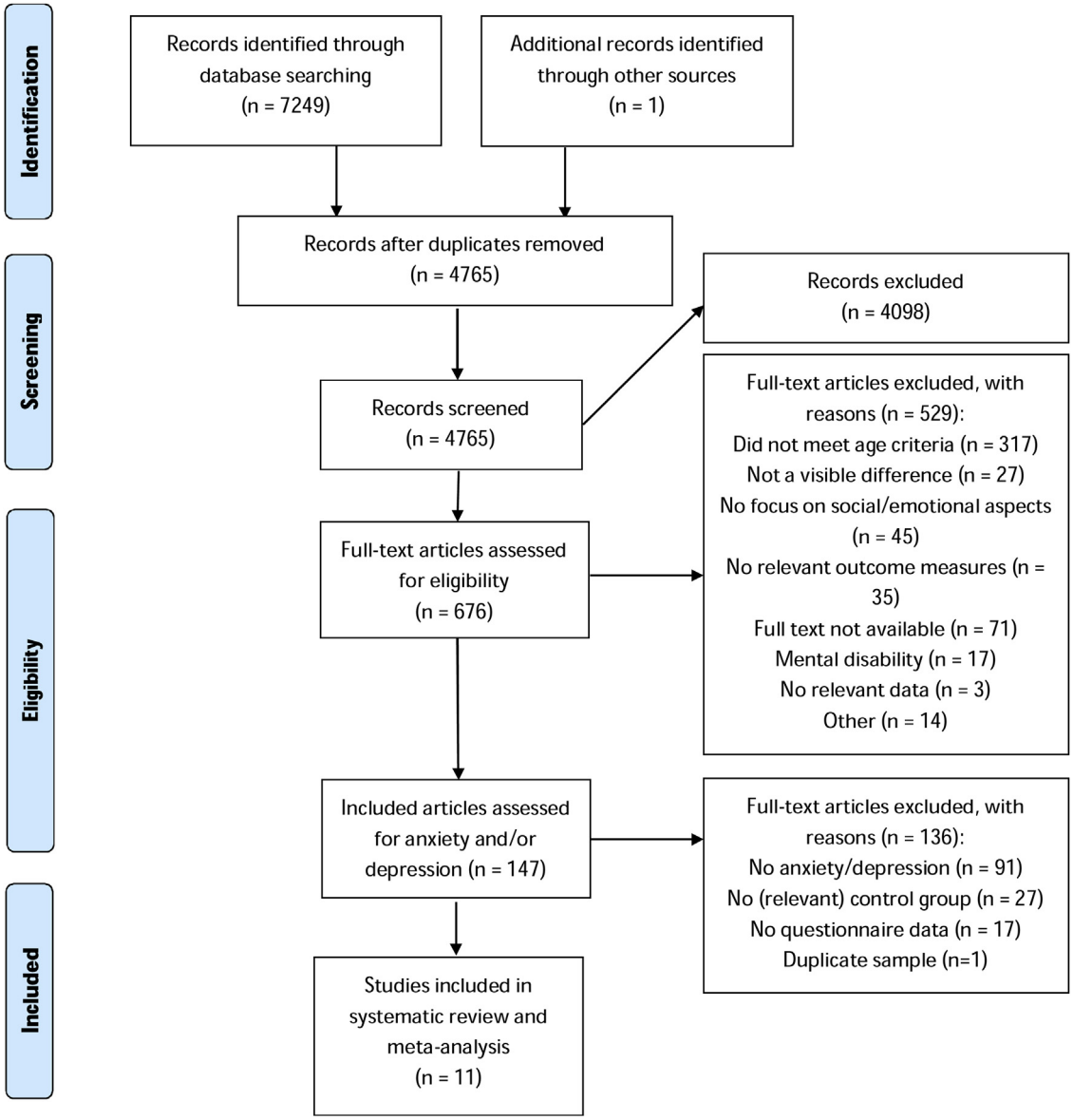

Fig. 1. Flow chart displaying the selection process.

Table 2
Quality assessment of included studies.

	1. Research question	2. Study population	3. Participation rate	4. Recruitment	5. Power	6. Outcome measures	7. Confounders	Total score
Aktan et al. (2000)	1	0.5	CD	0	0	1	NR	2.5
Bilgiç et al. (2011)	1	1	1	1	0	1	NR	5
Bilgiç et al. (2014)	1	0.5	CD	0.5	0	1	1	4
Díaz-Atienza and Gurpegui (2011)	1	1	CD	0.5	0	1	NR	3.5
Drosdzol et al. (2010)	1	1	1	1	0	1	NR	6
Feragen et al. (2016)	1	1	1	0	0	1	NR	4
Hon et al. (2015)	0.5	0	CD	CD	0	0.5	NR	1
Pasini et al. (2012)	1	0.5	CD	0	0	1	NR	2.5
Pope et al. (2007)	1	0.5	1	CD	0	1	0.5	4
Rivlin and Faragher (2007)	0.5	0.5	0	1	0	1	0.5	3.5
Turan et al. (2015)	1	1	CD	0.5	0	1	1	4.5

Note. CD: Cannot Determine; NR: Not Reported. 1. Was the research question or objective in this paper clearly stated? 2. Was the study population clearly specified and defined? 3. Was the participation rate of eligible persons at least 50 %? 4. Were all subjects selected or recruited from the same or similar populations? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants? 5. Was a sample size justification, power description, or variance and effect estimates provided? 6. Were the exposure outcome measures clearly defined, valid, reliable and implemented consistently across all study participants? 7. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure and outcome?

Study name	Condition	SMD	95% CI		p-value
			Lower limit	Upper limit	
Aktan et al. (2000)	Acne vulgaris[1]	0.091	-0.067	0.249	0.261
Bilgiç et al (2011)	Vitiligo[1]	0.110	-0.440	0.659	0.696
Bilgiç et al. (2014)	Alopecia areata[1]	0.062	-0.421	0.545	0.800
Díaz-Atienza & Gurpegui (2011)	Alopecia areata[1]	-0.390	-0.922	0.141	0.150
Drosdzol et al. (2010)	Hirsutism[1]	0.579	0.179	0.979	0.005
Hon et al. (2015)	Atopic Eczema[1]	0.317	-0.109	0.742	0.144
Pasini et al. (2012)	NF1[2]	1.223	0.443	2.002	0.002
Rivlin & Faragher (2007)	Burns[3]	0.600	0.093	1.108	0.020
Turan et al. (2015)	Cutaneous Leishmaniasis[4]	0.079	-0.495	0.653	0.788
Total random effect		0.253	0.024	0.482	0.030

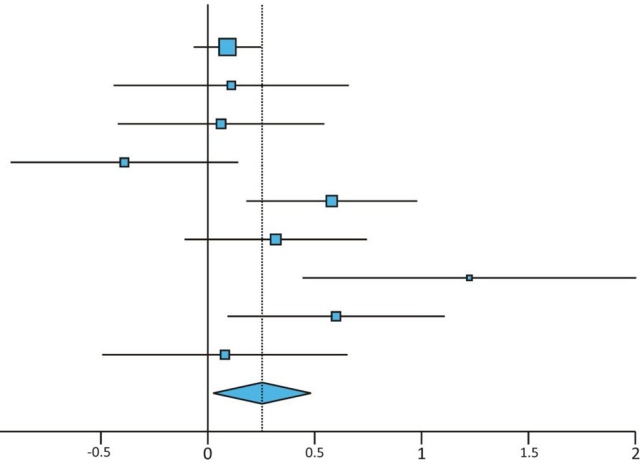

Fig. 2. Meta-analysis for anxiety.
Note. 1. Visible difference due to skin disease; 2. Congenital visible difference; 3. Visible difference due to trauma; 4. Visible difference due to disease; NF1, Neurofibromatosis type 1.

Fig. 2 shows the meta-analysis for anxiety. Results show that adolescents with a visible difference experience significantly more anxiety than unaffected peers (SMD = 0.253, 95 % CI [0.024, 0.482], p = .030), with a small effect size. Some level of heterogeneity was observed (I^2 = 59.55 %, p = .011). Inspection of the funnel plot indicated a symmetric funnel plot, with Egger's regression being non-significant, $t(7) = 1.10$, p = .307. This indicates an absence of publication bias.

Meta-analysis for subgroups of visible differences showed that adolescents with a skin condition did not differ significantly from unaffected peers (SMD = 0.149, 95 % CI [−0.070, 0.369], p = .182). There was no significant heterogeneity (I^2 = 47.76 %, p = .088). The funnel plot showed a symmetric shape.

Meta-analyses for subgroups could only be run for skin conditions, as only one study investigated a congenital condition (NF1; Pasini et al., 2012), one study investigated trauma (burns; Rivlin & Faragher, 2007) and one study investigated a disease (cutaneous leishmaniasis; Turan et al., 2015). These studies showed that adolescents with a congenital visible difference (SMD = 1.223, 95 % CI [0.443, 2.002], p = .002) and a visible difference due to trauma (SMD = 0.600, 95 % CI [0.093, 1.108], p = .020) experienced more anxiety than unaffected peers. Adolescents with a visible difference due to disease did not experience more anxiety (SMD = 0.079, 95 % CI [−0.495, 0.653], p = .788).

3.5. Depressive symptoms

A meta-analysis was run to estimate whether adolescents with a visible difference experience more depressive symptoms than peers. Nine studies reported on depressive symptoms (Aktan et al., 2000; Bilgiç et al., 2011, 2014; Díaz-Atienza & Gurpegui, 2011; Drosdzol et al., 2010; Feragen et al., 2016; Hon et al., 2015; Pope et al., 2007; Turan et al., 2015), with five different instruments. The studies included 1017 participants, with a weighted mean age of 15.84, and 2336 controls.

Fig. 3 shows the meta-analysis for depression. Results showed that adolescents with a visible difference did not experience significantly more depressive symptoms than unaffected peers (SMD = 0.236, 95 % CI [−0.126, 0.599], p = .202). A high level of heterogeneity was observed (I^2 = 92.19 %, p < .001). The funnel plot was asymmetric, with more studies reporting a positive result. Egger's regression was significant, indicating publication bias, $t(7) = 3.51$, p = .010. The funnel plot showed one outlier (Turan et al., 2015). Removal of this outlier resulted in a considerable decrease of the effect size (SMD = 0.018, 95 % CI [−0.267, 0.303], p = .902). Heterogeneity was still high (I^2 = 86.78 %, p < .001).

Meta-analysis for subgroups based on cause of visible difference showed that adolescents with a skin condition did not experience significantly more depressive symptoms than unaffected peers (SMD = 0.090, 95 % CI [−0.082, 0.262], p = .305). There was no significant heterogeneity (I^2 = 23.79 %, p = .255).

Meta-analyses for subgroups were not run for visible difference due to disease (cutaneous leishmaniasis), congenital conditions (CL/P) or trauma (burns), as these categories included only one study each. These studies show that adolescents with a visible difference due to disease (SMD = 2.453, 95 % CI [1.698, 3.208], p < .001) experience more depressive symptoms than unaffected peers. Adolescents with a congenital condition experience fewer depressive symptoms than unaffected peers (SMD = −0.535, 95 % CI [−0.646, −0.424], p < .001). Adolescents with a visible difference due to trauma do not differ from unaffected peers concerning depressive symptoms (SMD = 0.031, 95 % CI [−.417, .478], p = .893).

4. Discussion

In this meta-analysis we compared adolescents with a visible difference to unaffected peers and looked at different causes of visible difference.

Our first research question asked whether adolescents with a visible difference experience more symptoms of anxiety and depression than unaffected peers. Results showed that this was true for anxiety but not for depression. For anxiety a small effect size was found, indicating slightly elevated anxiety for adolescents with a visible difference. For depression, a non-significant result was found.

The results found for depression seem to be largely driven by Turan et al. (2015), reporting an extraordinary effect size of 2.453. As anxiety and depression are often seen as comorbid conditions

Study name	Condition	SMD	95% CI		p-value
			Lower limit	Upper limit	
Aktan et al. (2000)	Acne vulgaris[1]	.065	-0.223	0.093	0.418
Bilgiç et al. (2011)	Vitiligo[1]	094	-0.455	0.643	0.737
Bilgiç et al. (2014)	Alopecia Areata[1]	141	-0.342	0.624	0.568
Díaz-Atienza & Gurpegui (2011)	Alopecia Areata[1]	020	-0.507	0.547	0.941
Drosdzol et al. (2010)	Hirsutism[1]	212	-0.181	0.605	0.291
Feragen et al. (2016)	CL/P[2]	.535	-0.646	-0.424	<0.001
Hon et al. (2015)	Atopic eczema[1]	471	0.044	0.899	0.031
Pope et al. (2007)	Burns[3]	031	-0.417	0.478	0.893
Turan et al. (2015)	Cutaneous leishmaniasis[4]	453	1.698	3.208	<0.001
Total random effect		236	-0.126	0.599	0.202

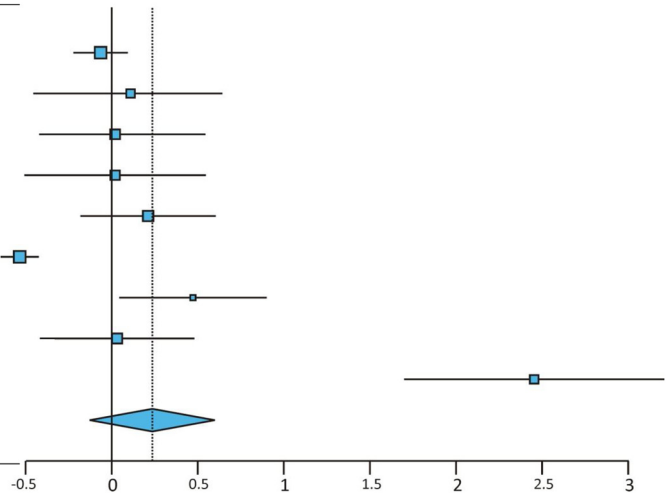

Fig. 3. Meta-analysis for depression.
Note. 1. Visible difference due to skin disease; 2. Congenital visible difference; 3. Visible difference due to trauma; 4. Visible difference due to disease; CL/P, Cleft lip and/or palate.

(Cummings, Caporino, & Kendall, 2014), it is noteworthy that when looking at symptoms of anxiety, the same study does not seem to find any effect, with an effect size of 0.079. However, in their study they note a mean of 36.41 with a standard deviation of 40.50 for adolescents with cutaneous leishmaniasis, and a mean of 33.90 with a standard deviation of 10.87 for controls. Given that the possible range of the STAI-C is 20–80, these results seem highly unlikely. Furthermore, Turan et al. (2015) have reported a *p*-value of .143, while the same results in our meta-analysis yield a *p*-value of .788. This is a striking and remarkable difference. Without this outlier, the effect for depression is not significant (SMD = 0.018, $p = .902$).

Our second research question concerned the effect of the cause of visible difference on symptoms of anxiety and depression. Due to the small number of studies found, we were only able to determine the effects of skin conditions on anxiety and depression. Results showed that adolescents with a skin condition did not differ in symptoms of anxiety and depression when compared to unaffected peers. Both analyses included 568 adolescents with a visible difference, gathered from six different studies and five different skin conditions. A retrospective power calculation following guidelines as proposed by Valentine, Pigott, and Rothstein (2010) shows that both analyses were underpowered. Hence, we cannot firmly say that the lack of a significant finding is free of type II errors.

The finding that adolescents with a skin difference do not experience more anxiety than unaffected peers, while the overall group of adolescents with a visible difference does experience more anxiety than unaffected peers is striking. A direct comparison of the different causes of visible differences is not possible, due to the low amount of studies available. However, a possible explanation may be that a selection bias has influenced the results. Most participants with skin conditions included in the current meta-analysis experience acne or eczema. These are conditions that often have a mild presentation. For instance, only 6.5 % of adolescents with eczema have severe eczema (Silverberg & Simpson, 2014) and moderate to severe acne vulgaris is reported in only 15–20 % of young people with acne (Bhate & Williams, 2013). Similarly, articles included in the current meta-analysis reported few participants with a severe condition. For example, severe acne was found in only 2.1 % of adolescents with acne (Aktan et al., 2000). It could be that the relatively mild symptoms of the condition have a low impact on the psychosocial well-being of the adolescents studied.

When looking at the different subgroups, it is notable that the results for congenital visible difference are divergent. The congenital condition NF1 shows a big effect (SMD = 1.223) with adolescents with NF1 experiencing more symptoms of anxiety than unaffected peers. The congenital condition CL/P shows the opposite effect (SMD = – 0.535), with unaffected peers experiencing more depression than adolescents with CL/P. Conclusions pertaining congenital visible difference are hard to make. More research on psychological problems in congenital visible difference is needed to examine how this group compares to unaffected peers.

The current results provide insight into symptoms of anxiety and depression in adolescents with a visible difference. However, this meta-analysis does not provide insight into the cause of these findings. One possible explanation might lie in the social situations experienced by adolescents with a visible difference. Different studies show that people with a visible difference commonly experience adverse social experiences (Jewett et al., 2018; Masnari et al., 2012). These social situations might be experienced as stigmatising. Stigmatisation, in turn, has been shown to affect quality of life and psychological adjustment in children with a facial difference (Masnari et al., 2013). Furthermore, a relation exists between stigmatisation and poorer mental health (Mak, Poon, Pun, & Cheung, 2007). Following this line of reasoning, adverse social experiences might lead to psychological problems. In support of this, studies have found higher levels of social anxiety in adults with a visible difference (Clarke, Newell, Thompson, Harcourt, & Lindenmeyer, 2014), but more research is needed to warrant a definite conclusion.

Another possible explanation is that adolescents with a visible difference often have a chronic medical condition. Anxiety and depression are reported to occur regularly in chronically-ill children and adolescents (Jones et al., 2017; Pao & Bosk, 2011). In adults, chronic medical conditions are also associated with occurrence of major depressive disorder and anxiety disorders (Vancampfort, Koyanagi, Hallgren, Probst, & Stubbs, 2017). The increased symptoms of anxiety we found might thus be related to the underlying medical condition instead of the visible difference itself.

For medical practitioners, we recommend them to pay attention to the psychological aspects of dealing with a visible difference. More specifically, questions should be asked as to whether the adolescent experiences anxiety. Furthermore, it could be beneficial to screen all adolescents with a visible difference on symptoms of anxiety prior to their medical appointment, using computerised questionnaires. During the appointment, the medical practitioner could then enquire about the anxiety symptoms. In this way, adolescents that are in need of extra psychological care may be identified. Early intervention would then be possible and later adverse outcomes may be reduced. For those delivering psychological care, we recommend focusing on anxiety when determining the psychological burden of dealing with a visible difference. More research is needed to establish the cause of anxiety in adolescents with a visible difference, but treatment could focus on the role of negative observer responses and body image in the aetiology of the psychological complaints.

This study also has some strengths and limitations. A particular strength of this study is the thorough literature search conducted. As it was a broad literature search, articles that were not indexed by the terms anxiety or depression might still have been found in the search.

However, despite the extensive literature search conducted, only 11 articles could be included in this meta-analysis. In combination with the relatively high heterogeneity, interpretation of current results should be made with caution. The results that have been found in this study might not generalise to the entire population of adolescents with a visible difference. Another limitation is that the studies included in the meta-analyses did not focus specifically on visible difference, with the exception of Feragen et al. (2016). We included medical conditions that are presumed to be associated with a visible difference, but it was impossible to check whether a visible difference existed. Hence, confounders may have influenced the results.

Following these limitations, future research should study anxiety and depression in adolescents with a visible difference more extensively. To provide a clear picture on the symptoms of anxiety and depression, future studies should include a bigger sample size and use questionnaires as well as clinical interviews. Furthermore, to directly compare the causes of visible differences, efforts should be made to study all causes of visible differences in one sample. These results could help to gain insight into whether the clinical presentation of symptoms differs depending on the cause.

In conclusion, this meta-analysis shows that adolescents with a visible difference experience more symptoms of anxiety, but not depression when compared to unaffected peers. It is not yet clear how different causes of visible difference influence symptoms of anxiety and depression. Future research is needed to further examine anxiety and depression in adolescents with a visible difference.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Declaration of Competing Interest

None.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.bodyim.2020.02.006.

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