ORIGINAL ARTICLE

Prevalence of depression among children, adolescents, and adults with hidradenitis suppurativa

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Background: Information on prevalence of depression among children, adolescents, and adults with hidradenitis suppurativa (HS) is limited.

Objective: To compare prevalence of depression in HS patients with that of controls.

Methods: Cross-sectional analysis of 38,140 adult and 1162 pediatric HS patients and controls identified using data from electronic health records. Primary outcome was prevalent depression.

Results: Prevalence of depression among adults with HS was 30.0% (95% Confidence interval [CI], 29.6-30.5), compared with 16.9% (95% CI, 16.7-17.1) among controls. Among children and adolescents with HS, prevalence of depression was 11.7% (95% CI, 10.0-13.7), compared with 4.1% (95% CI, 3.6-4.7) among controls. In adjusted analyses, adults and children/adolescents with HS had 1.26 (95% CI, 1.25-1.28; $P < .001$) and 1.42 (95% CI, 0.999-2.01; $P = .051$) times the odds of having depression relative to controls, respectively.

Limitations: We could not evaluate the influence of disease severity on the outcome.

Conclusion: Depression is prevalent among children, adolescents, and adults with HS. Periodic screening for depression may be warranted. (J Am Acad Dermatol https://doi.org/10.1016/j.jaad.2021.06.843.)

Keywords: hidradenitis suppurativa; depression; mood; adults; children; adolescents; prevalence; Explorys.

INTRODUCTION

Hidradenitis suppurativa (HS) is a chronic inflammatory disease of the pilosebaceous unit, which results in painful nodules and draining abscesses and the formation of fistulas, sinus tracts, and scarring, commonly affecting the axillae, breasts, groin, and perineum.[1] The association between the physical symptoms of HS and psychosocial impairment, decreased health, and skin-specific quality of life is well established.[2-4] Recent data suggest that patients with HS are at an increased risk of developing new-onset depression.[5] Prevalence estimates for depression among HS cohorts and strength of association analyses are highly variable, with few studies reporting population-based data for the United States or data for the pediatric subpopulation. The purpose of this study was to compare prevalence of depression among children, adolescents, and adults with HS with that of control patients without HS.

METHODS

This cross-sectional study used Explorys (Watson Health, IBM Corporation), a multi-health system data analytics and research platform.[6] Clinical information from electronic medical records, laboratories, practice management systems, and claims systems

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was matched using the single set of Unified Medical Language System ontologies to create longitudinal records for unique patients. Data were standardized and curated according to common controlled vocabularies and classifications systems, including International Classification of Diseases (ICD), Systemized Nomenclature of Medicine—Clinical Terms,[7] Logical Observation Identifiers Names and Codes,[8] and RxNorm.[9]

The database comprised of 26 integrated health care networks, 360 hospitals, and over 920,000 providers, spanning the continuum of care from ambulatory to inpatient to specialty settings. More than 64 million unique lives, representing approximately 15% of the population across all 4 census regions of the United States, are captured. Patients with all types of insurance as well as those who self pay are represented. All patient data are deidentified.

CAPSULE SUMMARY

- Information on the prevalence of depression among children, adolescents, and adults with hidradenitis suppurativa is limited.
- Pediatric and adult patients with hidradenitis suppurativa have a higher prevalence of depression compared with controls and are at an increased risk for depression. Periodic screening for depression may be warranted.

The study population was limited to patients 10 to89 years of age having at least 1 encounter in the database between January 1, 2019 and December 31, 2019 and at least 90 days of observable time[10] in the database within this period. Patients were also required to be observable in the database between January 1, 2018 and December 31, 2018. Patients were excluded if data were missing on age, zip code, or date information for HS diagnosis, depression diagnosis, or covariates. HS patients were identified by at least 1 ICD-9 (705.83) or ICD-10 (L73.2) diagnosis code for HS on or prior to December 31, 2019. In an independent validation study, we observed a positive predictive value (PPV) of 79.3% and an accuracy of 90% for diagnosis of HS using this algorithm.[11]

The control cohort consisted of patients in the database who never had a diagnosis code for HS. The primary outcome was a current diagnosis of depression in 2019 (period of interest) or 2018 (lookback period), defined as at least 1 of the ICD codes listed in Supplemental Table I (available via Mendeley at http://doi.org/10.17632/g7bstyfpp5.1). This method had been validated previously, with a PPV of approximately 92%.[12] Controls were matched to HS patients based on zip code at a ratio of 4:1. Separate analyses were performed for patients 10 to17 years of age and patients 18 to 89 years of age.

Prevalence of depression between HS patients and controls was compared using a conditional logistic regression model, adjusting for age, sex, race, number of health care encounters within the study period, smoking status (ever, never), alcohol use disorder, substance use disorder, body mass index, and Charlson comorbidity index score. In the pediatric analysis, body mass index was categorized as underweight, healthy weight, overweight, and obese according to patients' age- and sex-specific body mass index percentile. Alcohol use disorder and Charlson comorbidity index score were not included as covariates in the pediatric regression analysis. Unadjusted and demographic-adjusted logistic regression models were also performed to assess the influence of covariates on the relationship between HS and depression. Missing data were imputed using multivariate imputation by chained equations[13] with m = 10 imputations for the adult analysis and m = 20 imputations for the pediatric analysis.

RESULTS

The number of patients meeting each stage of study eligibility is provided in Supplemental Table II. We identified 38,140 adult and 1162 pediatric patients with HS whose demographic and clinical characteristics are described in Table I. Compared to control patients, adults with HS were younger (mean age, 43.8 years) and were more often female (77%), African American (36%), and tobacco smokers (48.5%). Compared to control patients, pediatric HS patients were older (mean age, 15.2 years) and were more often female (81%), African American (38%), and obese (59%).

Prevalence of depression among adults with HS was 30.0% (95% confidence interval [CI], 29.6-30.5) compared with 16.9% (95% CI, 16.7-17.1) among controls (Table II). Among pediatric patients with HS, prevalence of depression was 11.7% (95% CI, 10.0-13.7) compared with 4.1% (95% CI, 3.6-4.7) among controls. In unadjusted analysis, adults and children/adolescents with HS had 2.14 (95% CI, 2.08-2.20) and 3.17 (95% CI, 2.51-4.02) times the odds of having depression relative to control patients, respectively. After adjusting for demographic and clinical covariates, adults and children/adolescents with HS had 1.26 (95% CI, 1.25-1.28; $P < .001$) and 1.42 (95% CI, 0.999-2.01; $P = .051$) times the odds of having depression relative to controls, respectively.

Abbreviations used:

CI: confidence interval
HS: hidradenitis suppurativa
ICD: International Classification of Diseases
OR: odds ratio

Odds ratios (ORs) for all covariates in the adjusted regression models for adult and pediatric patients are provided in Supplemental Table III.

DISCUSSION

In this study, we have observed the prevalence of depression among adult and pediatric patients with HS to be 30% and 11.7%, respectively. Adults with HS were 26% more likely to have depression compared to patients without HS. Pediatric patients with HS were 42% more likely to have depression relative to controls, although the level of evidence was just shy of the conventional 5% significance level.

Data suggest that HS and depression may share common pathogenic mechanisms, including increased expression of proinflammatory cytokines, such as IL-6 and tumor necrosis factor alpha, which have been observed at higher levels in the serum of patients with HS[14-17] and major depression.[18] Moreover, in a recent study, we observed that adult and pediatric HS patients had an increased risk of developing depression, which further supports the findings of the present study.[5]

Several cross-sectional survey studies conducted in North America and Europe have reported prevalence estimates for depression among HS patients ranging from 9% to as high as 41.6%.[19-27] However, these studies are limited by small sample sizes, lack of control cohorts, and the self-reported and/or self-administered nature of the study designs. Furthermore, comparison of results in these studies is challenging because different depression measurement instruments, some of which are screening tools and not diagnostic tests, were used across these studies. Among these studies, only one reported an association between HS and depression in a population-based cohort. In a Danish study of 500 HS patients, odds of moderate depression were more than 4 times those of patients without HS and no associations were observed for mild or severe depression.[19] However, only 2.2% of the patients in the HS cohort had physician-diagnosed HS, which limits interpretation these data.

Other cross-sectional analyses evaluating association of depression with HS within population-based samples did not control for potential confounders, including obesity,[28,29] tobacco smoking,[30] and alcohol/substance use.[31,32] In a single-center analysis in the United States of HS patients residing in Olmsted County, Minnesota, prevalence of depression was 42.9%.[33] However, this study did not include a control group or strength of association analysis. In another analysis of adult and pediatric patients in the United States, the prevalence of depression was significantly higher among HS patients compared to control patients (11.83% vs 6.89%).[34] The odds of having depression was 2.14 (95% CI, 2.03-2.25) times as high among HS patients. However, this study was limited to inpatient HS patients who may suffer from more severe disease and may not be representative of most HS patients. Because separate analyses were not conducted for pediatric and adult patients, results cannot be compared with those of our analysis.

Four European studies estimated prevalence of depression among patients with HS within national samples from Denmark, the United Kingdom, and Finland. However, it is unclear whether results from these studies are generalizable to the population of the United States, given differences in racial/ethnic composition and prevalence of depression across these countries.[35-38] In a Danish study, prevalence of depression among 7732 patients with HS was 1.6% compared with 0.8% among control patients.[39] The odds of depression was similar between HS patients and controls (OR, 1.13; 95% CI, 0.87-1.47). In the United Kingdom analysis, prevalence of depression was 24.3% among HS patients and odds of depression were nearly 70% (OR, 1.69; 95% CI, 1.62-1.77) higher among HS patients.[40] In a Finnish study of 4372 adult HS patients, prevalence of depression was higher among HS patients than among controls (15.3% vs 8.3%).[41] Patients with HS were twice as likely to have depression compared to controls (OR, 2.00; 95% CI, 1.81-2.22). A similar Finnish study of 153 pediatric HS patients found the prevalence of depression to be 8.5%.[42] Odds of depression was 2.68 (95% CI; 1.29-5.58) times as high among pediatric patients compared with control patients.

There are limitations to the present study that warrant consideration when interpreting the results. We could not capture patients who did not seek care in health systems included in the database. There is potential for misclassification of HS diagnosis, depression diagnosis, or covariates due to erroneous documentation or misdiagnosis. To mitigate any influence of possible misclassification bias, we used validated case definitions to identify patients with HS and depression. Data on potentially relevant covariates, such as socioeconomic status, that are not typically collected in the course of routine health care, are generally unavailable in electronic medical

Table I. Pediatric and adult patient characteristics

Demographic and clinical characteristics	Pediatric analysis (ages 10-17 years)		Adult analysis (ages 18-89 years)	
	HS patients (n = 1162)	Control patients (n = 4648)	HS patients (n = 38,140)	Control patients (n = 152,560)
Age, mean (SD)	15.2 (1.8)	13.6 (2.3)	43.8 (15.1)	51.7 (18.4)
Female, n (%)	941 (81)	2308 (50)	29,399 (77)	90,154 (59)
Missing	0	0	0	16 (0.01%)
Race, n (%)				
White	348 (47)	1861 (64)	19,347 (53)	99,866 (70)
Black	283 (38)	623 (21)	13,163 (36)	28,193 (20)
Hispanic	75 (10)	223 (8)	1962 (5)	6647 (5)
Asian	4 (0.5)	51 (2)	170 (0.5)	1798 (1)
Other/multiracial	34 (5)	163 (6)	1545 (4)	5809 (4)
Missing race, n (%)	418 (36)	1727 (37)	1953 (5)	10,247 (7)
Body mass index, mean (SD)	NA	NA	34.5 (9.1)	29.7 (7.4)
Body mass index category*				
Underweight	12 (2)	111 (4)	NA	NA
Healthy weight	158 (22)	1560 (57)	NA	NA
Overweight	130 (18)	451 (17)	NA	NA
Obese	427 (59)	608 (22)	NA	NA
Missing BMI, n (%)	435 (37)	1918 (41)	2023 (5)	15,823 (10)
Smoker (ever), n (%)	9 (0.8)	20 (0.4)	18,485 (48.5)	42,849 (28.1)
Alcohol use disorder, n (%)	0 (0)	0 (0)	1499 (4)	4202 (3)
Substance use disorder, n (%)	7 (0.6)	8 (0.2)	3428 (9)	6221 (4)
Health care encounters,† median (IQR)	5 (2.25, 9)	2 (1, 5)	9 (4, 17)	5 (2, 11)
Charlson comorbidity index, n (%)				
0	NA	NA	12,956 (34)	69,811 (46)
1-2	NA	NA	14,954 (39)	48,886 (32)
3-4	NA	NA	4569 (12)	15,184 (10)
≥5	NA	NA	5661 (15)	18,679 (12)

For categorical variables, percentages refer to the percentage of patients in each category among those who were not missing data for that variable. Percentages may not sum to 100 due to rounding.

BMI, Body mass index; *IQR*, interquartile range; *n*, number of patients; *NA*, not applicable; *SD*, standard deviation.

*BMI categories are based on percentiles relative to children and teens of the same sex and age. Underweight = less than the 5th percentile; healthy weight = 5th percentile to less than the 85th percentile; overweight = 85th to less than the 95th percentile; obese = equal to or greater than the 95th percentile.

†Number of encounters during the study period.

Table II. Prevalence of depression in patients with and without hidradenitis suppurativa

Outcomes and measures of association	Pediatric analysis		Adult analysis	
	HS patients (n = 1162)	Control patients (n = 4648)	HS patients (n = 38,140)	Control patients (n = 152,560)
Number of prevalent depression diagnoses	136	190	11,446	25,811
Prevalence % (95% CI)	11.7 (10.0-13.7)	4.1 (3.6-4.7)	30.0 (29.6-30.5)	16.9 (16.7-17.1)
Crude odds ratio (95% CI)	3.17 (2.51-4.02)	Ref.	2.14 (2.08-2.20)	Ref.
Demographics-adjusted odds ratio* (95% CI)	2.05 (1.55-2.71)	Ref.	2.08 (2.02-2.14)	Ref.
Fully adjusted odds ratio† (95% CI)	1.42 (0.999-2.01)	Ref.	1.26 (1.25-1.28)	Ref.
P value (fully adjusted odds ratio)	.051	-	<.001	-

CI, Confidence interval; *HS*, hidradenitis suppurativa; *n*, number of patients.

*Adjusted for age, sex, and race.

†Adjusted for age, sex, race, body mass index, smoking status, substance use disorder, alcohol use disorder (adults), Charlson comorbidity index (adults), and number of health care encounters during the study period.

records. We could not evaluate the influence of disease severity on the outcome. The analysis does not determine a temporal relationship or causal link between HS and depression.

Despite these limitations, this population-based analysis reports important data on the prevalence of depression among pediatric and adult HS patients in the Unites States. A strength of this study is the

rigorous inclusion of relevant comorbidities that may confound the relationship between HS and depression. Moreover, we believe these results may be generalized to the health care-seeking population in the United States, given the robust size and demographic heterogeneity of the HS cohort.

CONCLUSION

Prevalence of depression among pediatric and adult patients with HS is high. Additionally, our data suggest that adult and pediatric patients with HS more commonly suffer from depression. Health care providers should be attentive to signs and symptoms of depression among children, adolescents, and adult patients with HS. Periodic screening for depression may be considered.[43]

Conflicts of interest

Dr. Garg has served as an advisor for AbbVie, Amgen, Boehringer Ingelheim, Janssen, Pfizer, Incyte, InfalRx, Viela Bio, UCB, and has received honoraria. Authors Wright and Strunk have no conflicts of interest to disclose.

REFERENCES

1. Hoffman LK, Ghias MH, Garg A, Hamzavi IH, Alavi A, Lowes MA. Major gaps in understanding and treatment of hidradenitis suppurativa. *Semin Cutan Med Surg*. 2017;36(2):86-92.
2. Garg A, Neuren E, Cha D, et al. Evaluating patients' unmet needs in hidradenitis suppurativa: results from the Global Survey of Impact and Healthcare Needs (VOICE) project. *J Am Acad Dermatol*. 2020;82(2):366-376.
3. Gooderham M, Papp K. The psychosocial impact of hidradenitis suppurativa. *J Am Acad Dermatol*. 2015;73(5 suppl 1):S19-S22.
4. MacMahon J, Kirthi S, Byrne N, O'Grady C, Tobin AM. An update on health-related quality of life and patient-reported outcomes in hidradenitis suppurativa. *Patient Relat Outcome Meas*. 2020;11:21-26.
5. Wright S, Strunk A, Garg A. New-onset depression among children, adolescents, and adults with hidradenitis suppurativa. *J Am Acad Dermatol*. 2020;83(5):1360-1366.
6. IBM Explorys Platform: liberate your healthcare data. IBM.com, 2016. Accessed February 1, 2021. http://ibm.com/downloads/cas/4P0QB9JN
7. SNOMED CT. nlm.nih.gov, 2019. Accessed February 1, 2021. https://www.nlm.nih.gov/healthit/snomedct/index.html
8. McDonald CJ, Huff SM, Suico JG, et al. LOINC, a universal standard for identifying laboratory observations: a 5-year update. *Clin Chem*. 2003;49(4):624-633.
9. Nelson SJ, Zeng K, Kilbourne J, Powell T, Moore R. Normalized names for clinical drugs: RxNorm at 6 years. *J Am Med Inform Assoc*. 2011;18(4):441-448.
10. Rassen JA, Bartels DB, Schneeweiss S, Patrick AR, Murk W. Measuring prevalence and incidence of chronic conditions in claims and electronic health record databases. *Clin Epidemiol*. 2019;11:1-15.
11. Strunk A, Midura M, Papagermanos V, Alloo A, Garg A. Validation of a case-finding algorithm for hidradenitis suppurativa using administrative coding from a clinical database. *Dermatology*. 2017;233(1):53-57.
12. Fiest KM, Jette N, Quan H, et al. Systematic review and assessment of validated case definitions for depression in administrative data. *BMC Psychiatry*. 2014;14:289.
13. Van Buuren S, Groothuis-Oudshoorn K. mice: multivariate imputation by chained equations in R. *J Stat Softw*. 2011;45:1-67.
14. Matusiak L, Bieniek A, Szepietowski JC. Increased serum tumour necrosis factor-α in hidradenitis suppurativa patients: is there a basis for treatment with anti-tumour necrosis factor-α agents? *Acta Derm Venereol*. 2009;89(6):601-603.
15. Matusiak Ł, Szczęch J, Bieniek A, Nowicka-Suszko D, Szepietowski JC. Increased interleukin (IL)-17 serum levels in patients with hidradenitis suppurativa: implications for treatment with anti-IL-17 agents. *J Am Acad Dermatol*. 2017;76(4):670-675.
16. Xu H, Xiao X, He Y, et al. Increased serum interleukin-6 levels in patients with hidradenitis suppurativa. *Postepy Dermatol Alergol*. 2017;34(1):82-84.
17. Jiménez-Gallo D, de la Varga-Martínez R, Ossorio-García L, Albarrán-Planelles C, Rodríguez C, Linares-Barrios M. The clinical significance of increased serum proinflammatory cytokines, C-reactive protein, and erythrocyte sedimentation rate in patients with hidradenitis suppurativa. *Mediators Inflamm*. 2017;2017:2450401.
18. Farzanfar D, Dowlati Y, French LE, Lowes MA, Alavi A. Inflammation: a contributor to depressive comorbidity in inflammatory skin disease. *Skin Pharmacol Physiol*. 2018;31(5):246-251.
19. Theut Riis P, Pedersen OB, Sigsgaard V, et al. Prevalence of patients with self-reported hidradenitis suppurativa in a cohort of Danish blood donors: a cross-sectional study. *Br J Dematol*. 2019;180(4):774-781.
20. Pavon Blanco A, Turner MA, Petrof G, Weinman J. To what extent do disease severity and illness perceptions explain depression, anxiety and quality of life in hidradenitis suppurativa? *Br J Dermatol*. 2019;180(2):338-345.
21. Butt M, Sisic M, Silva C, et al. The associations of depression and coping methods on health-related quality of life for those with hidradenitis suppurativa. *J Am Acad Dermatol*. 2019;80(4):1137-1139.
22. Kirby JS, Butt M, Esmann S, Jemec GBE. Association of resilience with depression and health-related quality of life for patients with hidradenitis suppurativa. *JAMA Dermatol*. 2017;153(12):1263-1269.
23. Onderdijk AJ, van der Zee HH, Esmann S, et al. Depression in patients with hidradenitis suppurativa. *J Eur Acad Dermatol Venereol*. 2013;27(4):473-478.
24. Senthilnathan A, Kolli SS, Cardwell LA, Richardson IM, Feldman SR, Pichardo RO. Depression in hidradenitis suppurativa. *Br J Dermatol*. 2019;181(5):1087-1088.
25. Crowley JJ, Mekkes JR, Zouboulis CC, et al. Association of hidradenitis suppurativa disease severity with increased risk for systemic comorbidities. *Br J Dermatol*. 2014;171(6):1561-1565.
26. Kurek A, Johanne Peters EM, Sabat R, Sterry W, Schneider-Burrus S. Depression is a frequent co-morbidity in patients with acne inversa. *J Dtsch Dermatol Ges*. 2013;11(8):743-750.
27. Matusiak L, Bieniek A, Szepietowski JC. Psychophysical aspects of hidradenitis suppurativa. *Acta Derm Venerol*. 2010;90(3):264-268.
28. Wright S, Strunk A, Garg A. Trends in body mass index before and after diagnosis of hidradenitis suppurativa. *Br J Dermatol*. 2020. https://doi.org/10.1111/bjd.19713.
29. Balgobind A, Finelt N, Strunk A, Garg A. Association between obesity and hidradenitis suppurativa among children and

adolescents: a population-based analysis in the United States. *J Am Acad Dermatol*. 2020;82(2):502-504.
30. Garg A, Papagermanos V, Midura M, Strunk A. Incidence of hidradenitis suppurativa among tobacco smokers: a population-based retrospective analysis in the U.S.A. *Br J Dermatol*. 2018;178(3):709-714.
31. Garg A, Papagermanos V, Midura M, Strunk A, Merson J. Opioid, alcohol, and cannabis misuse among patients with hidradenitis suppurativa: a population-based analysis in the United States. *J Am Acad Dermatol*. 2018;79(3):495-500.e1.
32. Reddy S, Orenstein LAV, Strunk A, Garg A. Incidence of long-term opioid use among opioid-naive patients with hidradenitis suppurativa in the United States. *JAMA Dermatol*. 2019;155(11):1284-1290.
33. Vazquez BG, Alikhan A, Weaver AL, Wetter DA, Davis MD. Incidence of hidradenitis suppurativa and associated factors: a population-based study of Olmsted County, Minnesota. *J Invest Dermatol*. 2013;133(1):97-103.
34. Patel KR, Rastogi S, Singam V, Lee HH, Amin AZ, Silverberg JI. Association between hidradenitis suppurativa and hospitalization for psychiatric disorders: a cross-sectional analysis of the National Inpatient Sample. *Br J Dermatol*. 2019;181(2):275-281.
35. Brody DJ, Pratt LA, Hughes J. Prevalence of depression among adults aged 20 and over: United States, 2013-2016. *NCHS Data Brief*. 2018;303(303):1-8.
36. Ellervik C, Kvetny J, Christensen KS, Vestergaard M, Bech P. Prevalence of depression, quality of life and antidepressant treatment in the Danish General Suburban Population Study. *Nord J Psychiatry*. 2014;68(7):507-512.
37. Smith DJ, Nicholl BI, Cullen B, et al. Prevalence and characteristics of probable major depression and bipolar disorder within UK Biobank: cross-sectional study of 172,751 participants. *PLoS One*. 2013;8(11):e75362.
38. Markkula N, Suvisaari J, Saarni S, et al. Prevalence and correlates of major depressive disorder and dysthymia in an eleven-year follow-up - results from the Finnish Health 2011 Survey. *J Affect Disord*. 2015;173:73-80.
39. Thorlacius L, Cohen AD, Gislason GH, Jemec GBE, Egeberg A. Increased suicide risk in patients with hidradenitis suppurativa. *J Invest Dermatol*. 2018;138(1):52-57.
40. Ingram JR, Jenkins-Jones AS, Knipe DW, Morgan CLI, Cannings-John R, Piguet V. Population-based clinical practice research datalink study using algorithm modelling to identify the true burden of hidradenitis suppurativa. *Br J Dermatol*. 2018;178(4):917-924.
41. Huilaja L, Tiri H, Jokelainen J, Timonen M, Tasanen K. Patients with hidradenitis suppurativa have a high psychiatric disease burden: a Finnish nationwide registry study. *J Invest Dermatol*. 2018;138(1):46-51.
42. Tiri H, Jokelainen J, Timonen M, Tasanen K, Huilaja L. Somatic and psychiatric comorbidities of hidradenitis suppurativa in children and adolescents. *J Am Acad Dermatol*. 2018;79(3):514-519.
43. Garg A, Malviya N, Strunk A, et al. Comorbidity screening in hidradenitis suppurativa: evidence-based recommendations from the US and Canadian Hidradenitis Suppurativa Foundations. *J Am Acad Dermatol*. 2021. https://doi.org/10.1016/j.jaad.2021.01.059.