

SUPPLEMENTARY MATERIAL

Risk of Cancer in Patients with Hidradenitis Suppurativa: A Systematic Review and Meta-Analysis

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Supplementary Table 1. Characteristics of the included studies													
Study characteristics				Hidradenitis suppurativa					Healthy controls				
Study	Country	Study design	Reported ancestry and /or ethnicity (%)	Patients [n.]	Males [n. (%)]	Age [mean ±SD]	BMI [mean±SD]	Current or former smoker [n. (%)]	People [n.]	Males [n. (%)]	Age [mean ±SD]	BMI [mean ±SD]	Current or former smoker [n. (%)]
Lapins (2001) ¹	Sweden	Cohort study (Registry)	NA	2,119	624 (29.4)	36.3	NA	NA	12,045,957 ^a	NA	NA	NA	NA
Shlyankevich (2014) ²	USA	Retrospective case-control	NA	1,776	480 (27.0)	43.8 ±15.1	NA	551 (29.5)	1,730	460 (26.6)	43.7 ±15.3	NA	16 (0.92)
Rastogi (2019) ³	USA	Population study	NA	716	0 (0)	39 ±12.4	NA	30 (4.2)	133,220	0 (0)	42 ±15.5	NA	6453 (4.8)
Tannenbaum (2019) ⁴	USA	Cross-sectional	NA	62,690	16,030 (25.6)	NA	NA	NA	28,937,880	12,557,910 (43.4)	NA	NA	NA
Jung (2020) ⁵	Korea	Population-based cohort study	NA	22,468	14,307 (63.7)	33.6 ±18.4	NA	NA	179,734	114,446 (63.7)	33.6 ±17.35	NA	NA
Sokumbi (2022) ⁶	USA	Population-based (Case-control)	NA	1,160	313 (27.0)	35.4 ±13.8	NA	207 (17.8)	1,160	313 (27.0)	35.5 ±13.7	NA	78 (6.7)
Brown (2023) ⁷	USA	Cohort study (Registry)	HS: Asian (1.0); Black or African American (47.5); Hispanic (9.3); White (38.9); Other (3.4).	62,785	24,800 (39.5)	NA	NA	NA	90,753,991	39,596,114 (43.6)	NA	NA	NA

			Healthy controls: Asian (3.1); Black (15.2); Hispanic (12.5); White (64.9); Other (4.3)										
Andersen (2024) ⁸	Denmark	Prospective	NA	13,919	4,210 (30.2)	35	NA	NA	9,595,951 ^b	NA	NA	NA	NA
Roster (2024) ⁹	USA	Cross-sectional	Asian (4.4); Black or African American (25); Hispanic (2.6); Not Hispanic (97); White (71.0)	1,802	371 (20.6)	NA	NA	NA	317,296	122,693 (38.7)	NA	NA	NA
Brydges (2024) ¹⁰	USA	Cross-sectional	American Indian or Alaska Native (38.31); Asian (11.79); Black or African American (50.78); Native Hawaiian or other Pacific Islander (21.71); White (19.62) ^c	390,522	91,100 (23.3)	NA	NA	NA	144,824,717	NA	NA	NA	NA

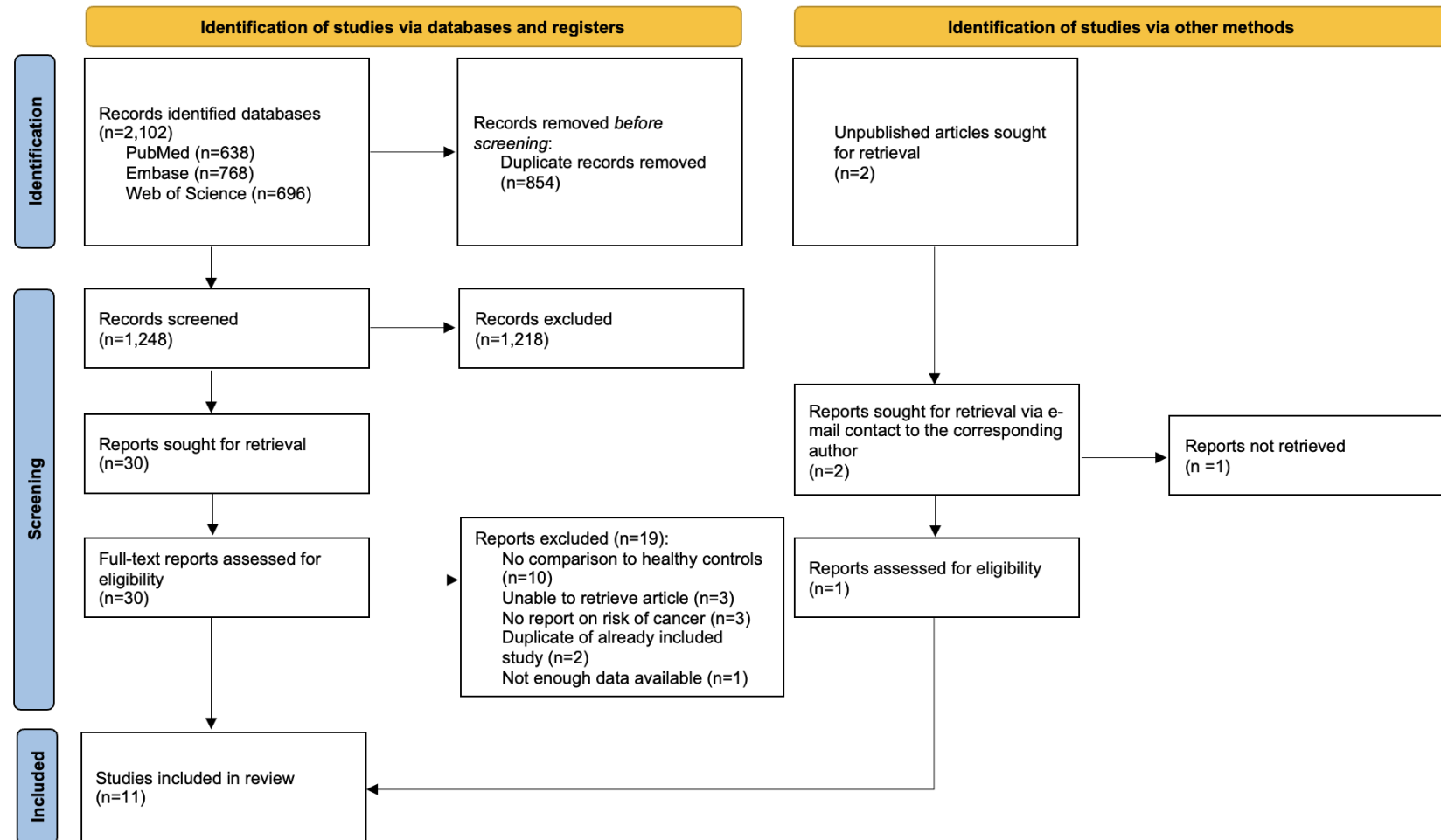
Supplementary Table 2: Newcastle-Ottawa Scale

	Selection (Maximum one point per item)				Comparability (Maximum two points)	Outcome (Maximum one point per item)			Points (Maximum nine points)
Reference	Representativeness of the exposed cohort	Selection of the non- exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts based on the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur	Adequacy of follow up of cohorts	Total
Lapins (2001) ¹	1	1	1	1	2	1	1	1	9
Shlyankevich (2014) ²	1	1	1	1	2	1	1	1	9
Rastogi (2019) ³	1	1	1	1	2	1	1	1	9
Tannenbaum (2019) ⁴	1	1	1	1	2	1	1	1	9
Jung (2020) ⁵	1	1	1	1	2	1	1	0	8
Sokumbi (2022) ⁶	1	1	1	1	2	1	1	1	9
Andersen (2023) ⁸	1	1	1	1	2	1	1	1	9
Brown (2023) ⁷	1	1	1	1	2	1	1	1	9
Brydges (2024) ¹⁰	1	1	1	1	2	1	1	1	9
Roster (2024) ⁹	1	1	1	1	2	1	1	1	9
Thakker (2024) ^{11 a}	0	1	0	1	0	1	1	1	5

Legend: A maximum of 9 points could be given. Scores ≥ 7 were considered good quality, and scores < 7 were considered lower study quality.

a=Unpublished data was retrieved through corresponding author. The low score is attributable to the fact that demographic data was not available.

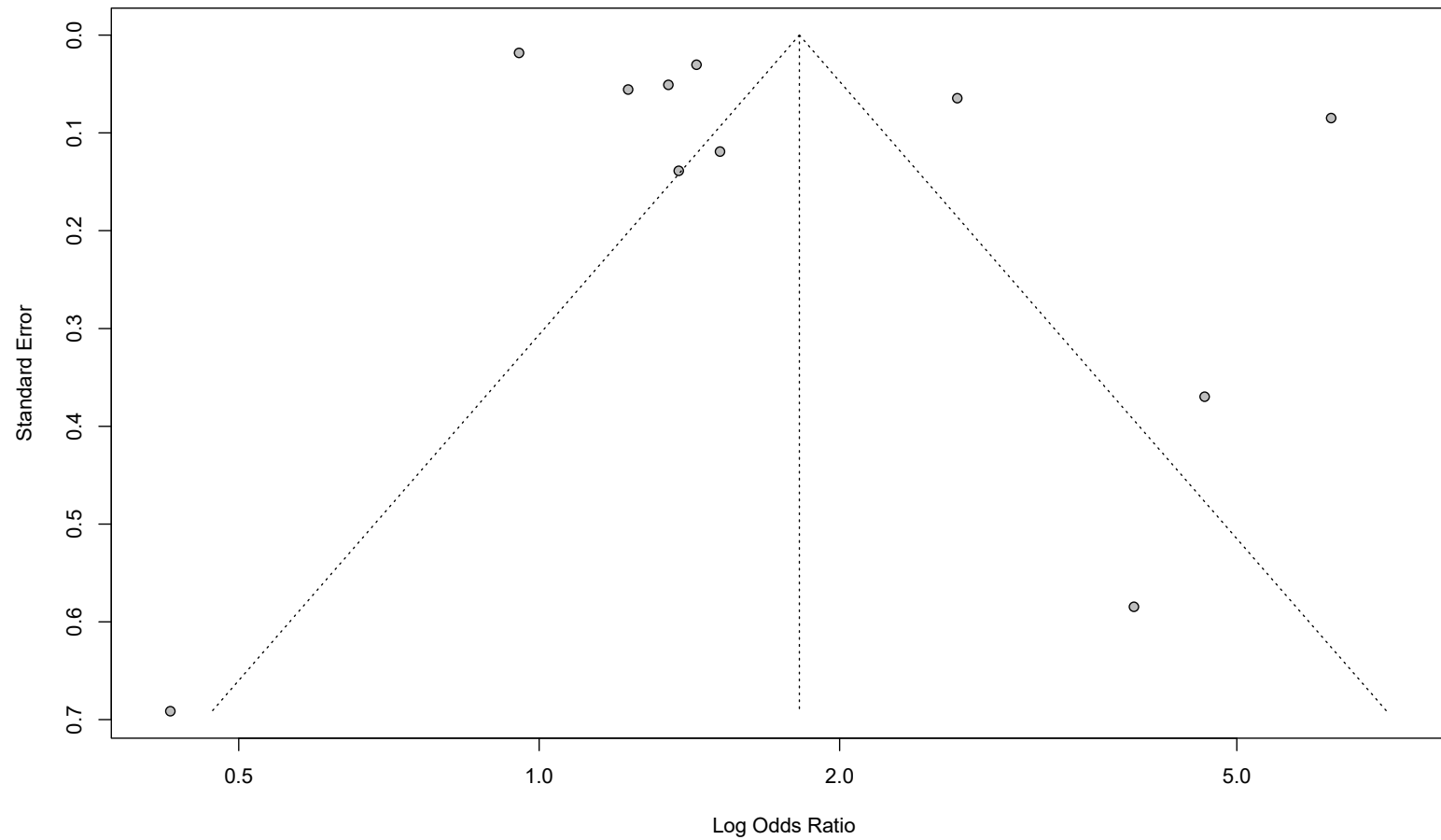
Supplementary Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram



Legend: The two conference abstracts that were sought for retrieval via e-mail contact to the corresponding author were originally revealed through the systematic review of the three databases.

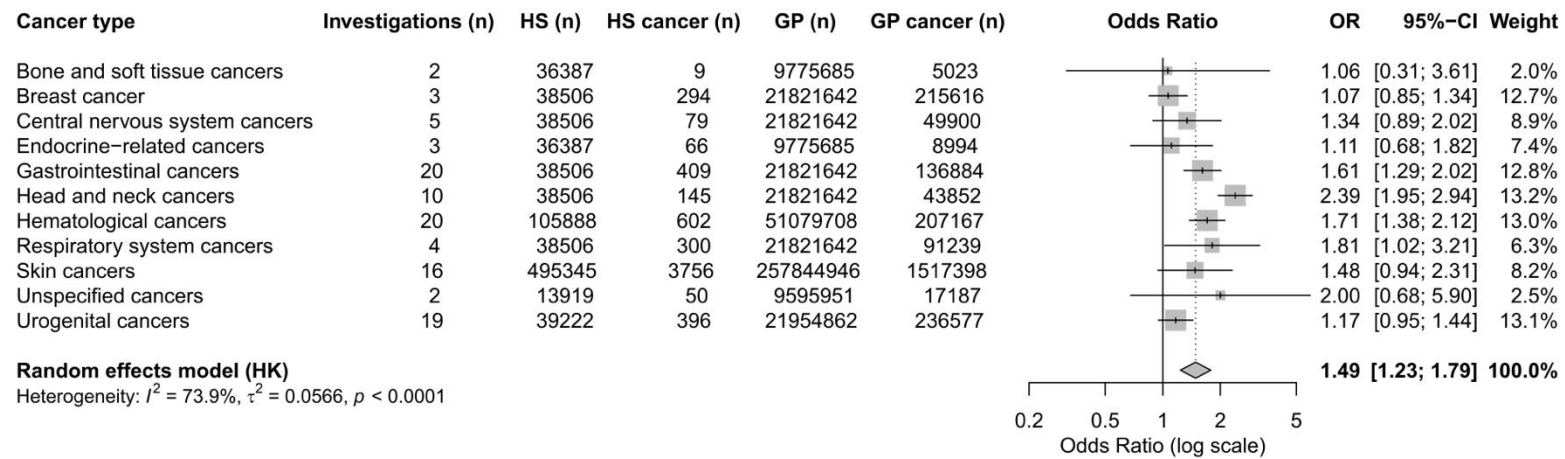
Abbreviation: number (n).

Supplementary figure 2: Funnel plot of cancer overall



Legend: Funnel plot assessing publication bias for cancer overall in patients with hidradenitis suppurativa compared to controls.

Supplementary figure 3: Overview of subgroups of cancer



Legend: Overview of crude ORs of different subgroups of cancer in patients with HS compared to controls derived from meta-analysis. The “Investigations (n)” signifies the number of times this outcome has been investigated across scientific publications.

Abbreviations: confidence interval (CI), hidradenitis suppurativa (HS), number (n), odds ratio (OR).

References

1. Lapins J, Ye W, Nyrén O, et al. Incidence of Cancer Among Patients With Hidradenitis Suppurativa. *Arch Dermatol* 2001;137(6):730–734; doi: 10-1001/pubs.Arch Dermatol.-ISSN-0003-987x-137-6-dst00132.
2. Shlyankevich J, Chen AJ, Kim GE, et al. Hidradenitis suppurativa is a systemic disease with substantial comorbidity burden: A chart-verified case-control analysis. *J Am Acad Dermatol* 2014;71(6):1144–1150; doi: 10.1016/j.jaad.2014.09.012.
3. Rastogi S, Patel KR, Singam V, et al. Vulvar cancer association with groin hidradenitis suppurativa: A large, urban, midwestern US patient population study. *J Am Acad Dermatol* 2019;80(3):808–810; doi: 10.1016/j.jaad.2018.10.008.
4. Tannenbaum R, Strunk A, Garg A. Association Between Hidradenitis Suppurativa and Lymphoma. *JAMA Dermatol* 2019;155(5):624–625; doi: 10.1001/JAMADERMATOL.2018.5230.
5. Jung JM, Lee KH, Kim YJ, et al. Assessment of Overall and Specific Cancer Risks in Patients with Hidradenitis Suppurativa. *JAMA Dermatol* 2020;156(8):844–853; doi: 10.1001/JAMADERMATOL.2020.1422,.
6. Sokumbi O, Hodge DO, Ederaine SA, et al. Comorbid diseases of hidradenitis suppurativa: a 15-year population-based study in Olmsted County, Minnesota, USA. *Int J Dermatol* 2022;61(11):1372–1379; doi: 10.1111/IJD.16228.
7. Brown ID, Adawi W, Saal R, et al. Associations between hidradenitis suppurativa and dermatological conditions in adults: a national cross-sectional study. *Clin Exp Dermatol* 2023;48(5):524–527; doi: 10.1093/CED/LLAD034,.
8. Andersen RK, Rostgaard K, Pedersen O, et al. Increased cancer incidence among patients with hidradenitis suppurativa – a Danish nationwide register study 1977–2017. *Acta Oncol (Madr)* 2024;63:220–228; doi: 10.2340/1651-226X.2024.26182,.
9. Roster K, Fleshner L, Farabi B, et al. Social Determinants of Health and Comorbidities in Hidradenitis Suppurativa Using an Inclusive Database. 2024. Available from: <https://www.pagny.org/uploads/images/headshots/Social-Determinants-of-Health-and-Comorbidities-in-Hidradenitis-Suppurativa-Using-an-Inclusive-Database.pdf> [Last accessed: 5/8/2025].
10. Brydges HT, Onuh OC, Friedman R, et al. Autoimmune, Autoinflammatory Disease and Cutaneous Malignancy Associations with Hidradenitis Suppurativa: A Cross-Sectional Study. *Am J Clin Dermatol* 2024;25(3):473–484; doi: 10.1007/S40257-024-00844-5,.
11. Thakker S, Samynathan A, Bakhshi P, et al. 48782 Hidradenitis Suppurativa-Associated Cutaneous Squamous Cell Carcinoma: A Cross-Sectional Analysis of the National Inpatient Sample. *J Am Acad Dermatol* 2024;91(3):AB50; doi: 10.1016/j.jaad.2024.07.205.