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Tinea corporis and tinea cruris incidence, risk factors, and treatments in a cohort of 6.8 million patients with Medicaid, United States

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Abstract

Tinea corporis and tinea cruris are common dermatophyte infections of increasing public health concern, yet national US data are limited. We estimated incidence, risk factors, and diagnostic and treatment practices among a large Medicaid-insured outpatient cohort. Among ~6 800 000 enrollees, 54 108 were diagnosed with tinea corporis (79.1/10 000 person-years) and 8386 with tinea cruris (12.2/10 000 person-years). Tinea corporis primarily affected young children and Black patients, while tinea cruris was prevalent among middle-aged men. Overall, <10% received diagnostic testing, and 7%–10% were treated with combination antifungal-corticosteroid products, highlighting the opportunities to increase testing and promote judicious antifungal use amid emerging resistance.

Lay summary

Tinea corporis and tinea cruris are common fungal skin infections. Among Medicaid patients, tinea corporis was mostly in young children and Black patients, while tinea cruris was mostly in middle-aged men. Improved diagnostic testing and careful antifungal use are important for these infections.

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Keywords

antifungal treatment; diagnostic testing; ringworm; tinea corporis; tinea cruris

Introduction

Superficial fungal skin infections are among the most prevalent infectious diseases worldwide, estimated to affect approximately 20%–25% of the global population during their lifetime.^{1,2} The most common cause of these conditions is dermatophyte fungi (e.g., *Trichophyton*, *Epidermophyton*, and *Microsporum*).^{2,3} Tinea corporis (ringworm of the trunk, arms, or legs) and tinea cruris (jock itch) are common clinical presentations of dermatophytosis, characterized by pruritic, erythematous, annular skin lesions that can spread easily among humans and animals or by fomites.^{3,4} While historically considered minor conditions, tinea corporis, and tinea cruris pose public health concerns due to their impact on quality of life, associated stigma, potential for large outbreaks in communal settings, substantial healthcare burden, and risk of bacterial superinfections in immunocompromised populations.^{2,5,6} Public health concern is increasing due to emerging antifungal resistance, particularly with recalcitrant, extensive dermatophyte infections caused by *Trichophyton indotineae* spreading globally.^{7,8}

However, recent national baseline data on tinea corporis and tinea cruris incidence and risk factors are limited and could inform US public health efforts and clinical practice. National studies on these conditions are outdated or solely laboratory-based.^{9–11} In this study, we analyzed incidence, risk factors, and treatments of tinea cruris and tinea corporis in a large US Medicaid-insured patient cohort.

Materials and methods

We identified patients with ≥ 1 outpatient visit during July 1, 2016–June 30, 2023, in the Merative™ MarketScan® Multi-State Medicaid Database. We required patients to be continuously enrolled in health insurance from 180 days before to 365 days after their first outpatient visit. We ascertained tinea cruris and tinea corporis diagnoses, underlying conditions, diagnostic testing, and outpatient prescriptions using International Classification of Diseases, Tenth Revision (ICD-10) codes and Current Procedural Terminology codes (Supplementary Table). Underlying conditions included immunosuppressing conditions and atopy. Immunosuppressing conditions included HIV, immune-mediated inflammatory disease, diabetes, cancer, and solid organ transplant and hematopoietic stem cell transplant. Atopic conditions included allergic dermatitis, allergic rhinitis, food allergy, and asthma. To capture incident tinea corporis or tinea cruris diagnoses, we excluded patients with a diagnosis of the condition in the 180 days before or on their first outpatient visit. Patients were followed for 365 days to ascertain whether they received a diagnosis of tinea corporis or tinea cruris. We estimated incidence rates and assessed potential risk factors by calculating adjusted incident rate ratios (aIRR) using multivariable Poisson regression, controlling for age, sex, race/ethnicity, immunosuppressing conditions, and atopy. We described diagnosis and treatment practices.

Results

Among ~6 800 000 enrollees, 54 108 received a tinea corporis diagnosis (incidence: 79.1/10 000 person-years, 95% confidence interval [CI]: 78.7–79.6). Incidence was highest among those who were aged <5 years (129.9, CI: 127.8–132.1) and Black (99.5, CI: 98.2–100.8) (Table 1). Overall, 8386 enrollees received a tinea cruris diagnosis (12.2, CI: 12.0–12.4). Incidence was highest among those who were aged 45–64 years (25.8, CI: 24.7–27.0), male (18.6, CI: 18.1–19.1), and unknown race/ethnicity (14.9, CI: 14.0–15.9) or White (12.7, CI: 12.3–13.1).

In multivariable analyses, factors associated with higher tinea corporis incidence included age <5 (aIRR: 3.1, CI: 3.0–3.2; referent: 18–44 years), female sex (1.1, CI: 1.1–1.1), Black race (1.3, CI: 1.3–1.4; referent: White), and having an immunocompromising (1.5, CI: 1.4–1.6) or atopic (1.6, CI: 1.5–1.6) condition. For tinea cruris, 45–64-year-olds had the highest aIRR (1.2, CI: 1.1–1.3) and those aged <5 years had the lowest (0.3, CI: 0.3–0.4). Female sex was associated with a lower incidence (0.3, CI: 0.3–0.3). Across racial/ethnic groups, aIRRs were generally similar. Immunocompromising (1.9, CI: 1.7–2.0) and atopic (1.7, CI: 1.6–1.8) conditions were associated with a higher incidence of tinea cruris.

Overall, <10% of patients received diagnostic testing (Table 2). Among patients diagnosed with tinea corporis, direct microscopy was the most common diagnostic test (42.4% of those receiving any diagnostic testing, 2.6% of patients with tinea corporis diagnoses overall). Among those diagnosed with tinea cruris, the most common diagnostic tests included direct microscopy (38.7% of those receiving diagnostic testing, 3.5% of patients with tinea cruris diagnoses overall) and susceptibility testing (39.6% of those receiving diagnostic testing, 3.6% of tinea cruris diagnoses overall). Most were prescribed antifungal therapy, 69.2% for tinea corporis (6.8% oral only, 55.9% topical only, and 6.4% both oral and topical) and 59.4% for tinea cruris (7.5% oral only, 45.6% topical only, 6.2% both oral and topical); 6.9% of tinea corporis and 10.1% of tinea cruris patients received a combination antifungal-corticosteroid product.

Discussion

Tinea corporis primarily affected young children, Black patients, and those with atopic or immunocompromising conditions, whereas tinea cruris most commonly occurred in middle-aged men and was associated with immunocompromise and atopy but not race/ethnicity. Comparison with previous literature is limited by differing study designs; however, the age and sex differences observed between the tinea cruris and corporis cohorts are broadly similar to an analysis of a large commercial laboratory dataset.¹¹ The disproportionately high rates of tinea corporis among Black patients align with findings from a 1995–2004 cross-sectional study.¹⁰ This racial disparity is also observed with tinea capitis, with higher incidence among Black children compared with other racial groups.¹² Additional research is needed to investigate factors influencing differing infection rates across demographic groups and to support targeted public health interventions to address this disparity.

Treatments observed included antifungal-corticosteroid topical use, which is generally discouraged and has been linked to persistent or recurrent tinea corporis infections in children. While these combination creams may provide quick symptomatic relief, they lower clinical cure rates in the management of dermatophytosis and have been linked to persistent and recurrent tinea corporis infections.^{13,14,15}

A major study limitation was the lack of diagnostic testing in the majority of cases (>90%), and therefore misdiagnosis is possible. Diagnostic testing and laboratory confirmation are important to support accurate and prompt diagnosis, appropriate treatment, and antifungal stewardship efforts.¹⁶ These low testing rates may indicate challenges regarding Clinical Laboratory Improvement Amendments (CLIA) restrictions limiting potassium hydroxide and microscopy testing, limited patient encounter time, low reimbursement rates for diagnostic testing, lack of physician education on the importance of mycological testing, or lack of clinician confidence in their ability to perform or interpret direct microscopy testing. These challenges could be addressed through clinician education on appropriate diagnostic testing techniques and interpretation and incentivization of diagnostic testing for the purpose of improving patient care and antifungal utilization.

The dataset lacked information on disease severity and over-the-counter treatments, possibly underestimating antifungal use. Misdiagnosis could have occurred given infrequent testing. Nonetheless, we update benchmark data on tinea corporis and cruris and emphasize a continued need for diagnostic testing and judicious antifungal use in an era of emerging resistance.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Conflict of interest

Dr Lipner has served as a consultant for Moberg Pharmaceuticals and Belle Torus Corporation. Dr Caplan received research support and consulting fees from Priovant Therapeutics, Inc., unrelated to this work.

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Table 1.

One-year incidence rates of tinea corporis and tinea cruris among a cohort of Medicaid-insured patients with outpatient visits during July 1, 2016–June 30, 2023, United States.

Characteristic	Tinea corporis		Tinea cruris		Adjusted IRR (95% CI) *	Incidence per 10 000 (95% CI)	Adjusted IRR (95% CI) *	Incidence per 10 000 (95% CI)	Adjusted IRR (95% CI) *
	No. cases/pop. at risk		No. cases/pop. at risk						
Overall	54 108/6 836 507	79.1 (78.7–79.6)	n/a	8386/6 863 589	n/a	12.2 (12.0–12.4)	n/a		
Age (years)									
<5	14 022/1 079 452	129.9 (127.8–132.1)	3.1 (3.0–3.2)	742/1 086 887		6.8 (6.3–7.3)	0.3 (0.3–0.4)		
5–12	21 934/2 113 415	103.8 (102.4–105.2)	2.4 (2.4–2.5)	1560/2 126 191		7.3 (7.0–7.7)	0.4 (0.3–0.4)		
13–18	7113/1 092 970	65.1 (63.6–66.6)	1.5 (1.5–1.6)	1254/1 096 419		11.4 (10.8–12.1)	0.6 (0.5–0.6)		
18–44	7914/1 820 789	43.5 (42.5–44.4)	ref	2960/1 823 633		16.2 (15.7–16.8)	ref		
45–64	3013/692 798	43.5 (41.9–45.0)	0.9 (0.9–1.0)	1792/693 356		25.8 (24.7–27.0)	1.2 (1.1–1.3)		
≥65	112/37 083	30.2 (24.6–35.8)	0.6 (0.5–0.8)	78/37 103		21.0 (16.4–25.7)	1.0 (0.8–1.3)		
Sex									
Female	29 700/3 762 772	78.9 (78.0–79.8)	1.1 (1.1–1.1)	2648/3 778 921		7.0 (6.7–7.3)	0.3 (0.3–0.3)		
Male	24 408/3 073 735	79.4 (78.4–80.4)	ref	5738/3 084 668		18.6 (18.1–19.1)	ref		
Race/Ethnicity									
Black, NH	21 415/2 152 529	99.5 (98.2–100.8)	1.3 (1.3–1.4)	2544/2 164 742		11.8 (11.3–12.2)	1.0 (0.9–1.0)		
White, NH	22 565/3 242 923	69.6 (68.7–70.5)	ref	4130/3 252 996		12.7 (12.3–13.1)	ref		
Hispanic or Latino	3279/515 658	63.6 (61.4–65.8)	0.8 (0.8–0.8)	468/517 250		9.0 (8.2–9.9)	0.9 (0.8–0.9)		
Other race, NH	1803/268 628	67.1 (64.0–70.2)	0.9 (0.9–1.0)	261/269 527		9.7 (8.5–10.9)	0.8 (0.7–0.9)		
Unknown	5046/656 769	76.8 (74.7–79.0)	1.1 (1.0–1.1)	983/659 074		14.9 (14.0–15.9)	1.0 (1.0–1.1)		
Possible risk factors listed in the 180 days before date of outpatient visit									
Any IC	2189/323 980	67.6 (64.7–70.4)	1.5 (1.4–1.6)	1101/324 675		33.9 (31.9–35.9)	1.9 (1.7–2.0)		
HIV	113/16 669	67.8 (55.3–80.3)	1.4 (1.1–1.7)	78/16 683		46.8 (36.4–57.1)	1.8 (1.4–2.3)		
IMID	380/49 547	76.7 (69.0–84.4)	1.5 (1.4–1.7)	152/49 752		30.6 (25.7–35.4)	1.7 (1.5–2.1)		
Diabetes	1588/234 185	67.8 (64.5–71.1)	1.5 (1.4–1.6)	854/234 640		36.4 (34.0–38.8)	1.9 (1.8–2.0)		
Cancer	221/39 362	56.1 (48.7–63.6)	1.1 (1.0–1.3)	93/39 420		23.6 (18.8–28.4)	1.1 (0.9–1.4)		
SOT or HSCT	36/4279	84.1 (56.7–111.6)	1.3 (1.0–1.8)	6/4303		13.9 (2.8–25.1)	0.7 (0.3–1.6)		
Atopic conditions in the 180 days before date of outpatient visit									
Atopy	11 755/931 835	126.1 (123.9–128.4)	1.6 (1.5–1.6)	1609/939 220		17.1 (16.3–18.0)	1.7 (1.6–1.8)		

Characteristic	Tinea corporis		Tinea cruris		Incidence per 10 000 (95% CI)	Adjusted IRR (95% CI) *	Incidence per 10 000 (95% CI)	Adjusted IRR (95% CI) *
	No. cases/pop. at risk	No. cases/pop. at risk	No. cases/pop. at risk	No. cases/pop. at risk				
Allergic dermatitis	2010/106 509	188.7 (180.5–197.0)	1.7 (1.6–1.8)	149/108 563	13.7 (11.5–15.9)	1.7 (1.4–2.0)	1.7 (1.4–2.0)	
Allergic rhinitis	6651/497 375	133.7 (130.5–136.9)	1.6 (1.5–1.6)	835/501 427	16.7 (15.5–17.8)	1.7 (1.5–1.8)	1.7 (1.5–1.8)	
Food allergy	473/35 442	133.5 (121.4–145.5)	1.4 (1.3–1.5)	42/35 713	11.8 (8.2–15.3)	1.1 (0.8–1.5)	1.1 (0.8–1.5)	
Asthma	5694/486 217	117.1 (114.1–120.2)	1.5 (1.4–1.5)	929/489 253	19.0 (17.8–20.2)	1.6 (1.5–1.7)	1.6 (1.5–1.7)	

IRR, incidence rate ratio; CI, confidence interval; NH, not Hispanic or Latino; IC, immunocompromising condition; IMID, immune-mediated inflammatory disease; SOT, solid organ transplant; HSCT, hematopoietic stem cell transplant; ref, referent.

* IRRs were adjusted for age group, sex, race/ethnicity, immunocompromising conditions, and atopic conditions. We required patients to be continuously enrolled in health insurance from 180 days before to 365 days after their first outpatient visit. To capture incident tinea corporis or tinea cruris diagnoses, we excluded patients with a diagnosis of either condition in the 180 days before or on their first outpatient visit. Patients were followed for 365 days to ascertain whether they received a diagnosis of tinea corporis or tinea cruris. Among enrolled patients, 237 patients were diagnosed with both tinea corporis (0.4%) and tinea cruris (2.8%). Among those with tinea corporis, 6.3% also had a non-corporis tinea diagnosis (mostly tinea corporis [2.8%] or tinea pedis [1.7%]). Among those with tinea cruris, 5.6% had a non-cruris tinea diagnosis (mostly tinea corporis [4.9%]; 0.4% had tinea cruris. Among those with tinea cruris, 5.6% had a non-cruris tinea diagnosis (mostly tinea corporis [2.8%] or tinea pedis [1.7%]).

Table 2.

Diagnostic and treatment practices for tinea corporis and tinea cruris among a cohort of Medicaid-insured patients, United States. *

Characteristic	Tinea corporis (N = 54 108)	Tinea cruris (N = 8386)
Diagnostic testing		
Any diagnostic testing	3315 (6.1)	758 (9.0)
Direct microscopy	1405 (2.6)	293 (3.5)
Fungal culture	931 (1.7)	42 (0.5)
Susceptibility testing	882 (1.6)	300 (3.6)
Biopsy	256 (0.5)	51 (0.6)
Polymerase chain reaction	419 (0.8)	156 (1.9)
Antifungal treatment		
Any antifungal treatment	37 420 (69.2)	4978 (59.4)
Combination antifungal steroid treatment	3723 (6.9)	849 (10.1)
Oral antifungal treatment		
Any oral antifungal	7171 (13.3)	1153 (13.7)
Oral antifungal only	3692 (6.8)	629 (7.5)
Terbinafine	1264 (2.3)	220 (2.6)
Griseofulvin	3778 (7.0)	78 (0.9)
Fluconazole	2143 (4.0)	853 (10.2)
Itraconazole	29 (0.1)	4 (0.0)
Topical antifungal treatment		
Any topical antifungal	33 728 (62.3)	4349 (51.9)
Topical antifungal only	30 249 (55.9)	3825 (45.6)
Ketoconazole	14 710 (27.2)	1386 (16.5)
Selenium sulfide	343 (0.6)	16 (0.2)
Clotrimazole	16 305 (30.1)	2269 (27.1)
Econazole	857 (1.6)	81 (1.0)
Other topical antifungal	2354 (4.4)	718 (8.6)

* Data are shown as no. (col. %).