# Retrospective Analysis of Prevalence and Treatment Patterns of Skin and Nail Candidiasis From US Health Insurance Claims Data

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## PRACTICE POINTS
- Candidiasis of the skin or nails is a common outpatient condition that is most frequently diagnosed in infants, toddlers, and adults aged 65 years or older.
- Most cases are diagnosed clinically without diagnostic testing and treated with topical antifungals, but increased attention to formal diagnosis and treatment may be warranted given the emergence of antifungal-resistant *Candida* species.

Candidiasis of the skin and nails is caused by overgrowth of *Candida* species due to excess skin moisture, skin barrier disruption, or immunosuppression. Data on the prevalence of candidiasis of the skin and nails in the United States are scarce. In this study, we evaluated the prevalence, characteristics, and treatment practices of candidiasis of the skin and nails using data from 2 large US health insurance claims databases.

C*andida* is a common commensal organism of human skin and mucous membranes. Candidiasis of the skin and nails is caused by overgrowth of *Candida* species due to excess skin moisture, skin barrier disruption, or immunosuppression. Candidiasis of the skin manifests as red, moist, itchy patches that develop particularly in skin folds. Nail involvement is associated with onycholysis (separation of the nail plate from the nail bed) and subungual debris.[1] Data on the prevalence of candidiasis of the skin and nails in the United States are scarce. In this study, we evaluated the prevalence, characteristics, and treatment practices of candidiasis of the skin and nails using data from 2 large US health insurance claims databases.

## Methods
We used the 2023 Merative MarketScan Commercial, Medicare Supplemental, and Multi-State Medicaid Databases (https://www.merative.com/documents/merative-marketscan-research-databases) to identify outpatients with the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM) code B37.2 for candidiasis of the skin and nails. The Commercial and Medicare Supplemental databases include health insurance claims data submitted by large employers and health plans for more than 19 million patients throughout the United States, and the Multi-State Medicaid database includes similar data from more than 5 million patients across several geographically dispersed states.

The index date for each patient corresponded with their first qualifying diagnosis of skin and nail candidiasis during January 1, 2023, to December 31, 2023. Inclusion in the study required continuous insurance enrollment from 30 days prior to 7 days after the index date, resulting in exclusion of 7% of commercial/Medicare patients and 8% of Medicaid patients. Prevalence per 1000 outpatients was calculated, with stratification by demographic characteristics.

We examined selected diagnoses made on or within 30 days before the index date, diagnostic testing performed within the 7 days before or after the index date after using specific Current Procedural Terminology codes, and outpatient antifungal and combination antifungal-corticosteroid prescriptions made within 7 days before or after the index date (Table). Race/ethnicity data are unavailable in the commercial/Medicare database, and geographic data are unavailable in the Medicaid database.

## Results

The prevalence of skin and nail candidiasis was 3.7 per 1000 commercial/Medicare outpatients and 7.8 per 1000 Medicaid outpatients (eTable 1). Prevalence was highest among patients aged 0 to 3 years (commercial/Medicare, 30.3 per 1000; Medicaid, 43.6 per 1000), followed by patients 65 years or older (commercial/Medicare, 7.4 per 1000; Medicaid, 7.5 per 1000). Prevalence was higher among females compared with males (commercial/Medicare, 4.8 vs 2.4 per 1000, respectively; Medicaid, 8.8 vs 6.4 per 1000, respectively). Among Medicaid patients, prevalence was highest among those of other race, non-Hispanic (8.9 per 1000) and White non-Hispanic patients (7.5 per 1000). In the commercial/Medicare dataset, prevalence was highest in patients residing in the Midwest (4.4 per 1000) and the South (4.0 per 1000).

Diaper dermatitis was listed as a concurrent diagnosis among 51% of patients aged 0 to 3 years in both datasets (eTable 2). Diabetes (commercial/Medicare, 32%; Medicaid, 36%) and immunosuppressive conditions (commercial/Medicare, 10%; Medicaid, 7%) were most frequent among patients aged 65 years or older. Obesity was most commonly listed as a concurrent diagnosis among patients aged 35 to 64 years (commercial/Medicare, 17%; Medicaid, 23%).

**TABLE. Codes Used to Identify Characteristics of Interest**

| Diagnosis or procedure | ICD-10-CM/CPT code(s) |
| --- | --- |
| Candidiasis of skin or nails | B37.2 |
| Cellulitis | L03 |
| Dermatophytosis | B35 |
| Diabetes | E08-E13 |
| Diaper dermatitis | L22 |
| Erythema intertrigo | L30.4 |
| Immune-mediated inflammatory disease | G35, G70, K50, K51, L40, L93, M05, M06, M08, M33, M35.2, M45 |
| Immunosuppressive conditions | |
|   Cancer | C00-C96, excluding C44 |
|   HIV | B20, Z21 |
|   Solid organ or stem cell transplantation | T86, Z94, excluding Z94.7 |
| Overweight or obesity | E66 |
| Pregnancy | Z33.1, Z33.3, Z34, O09 |
| Microscopy | 87205, 87206, 87210, 87220 |
| Culture | 87101, 87102, 87106, 87107 |
| Biopsy | 11100, 11101, 11102, 11103, 11104, 11105, 11106, 11107 |
| Polymerase chain reaction | 87481, 87798, 87800, 87801 |
| Histopathology | 88300, 88302, 88304, 88305, 88307, 88309, 88311, 88312, 88313, 88314, 88319, 88321, 88323, 88325, 88342 |
| *Candida* nucleic acid test | 87480, 87481, 87482 |

Abbreviations: CPT, Current Procedural Terminology; ICD-10-CM, International Classification of Diseases, 10th Revision, Clinical Mofification.

Patients aged 18 to 34 years had the highest rates of diagnostic testing in the 7 days before or after the index date (commercial/Medicare, 9%; Medicaid, 10%). Topical antifungal medications (primarily nystatin) were most frequently prescribed for patients aged 0 to 3 years (commercial/Medicare, 67%; Medicaid, 70%). Topical combination antifungal-corticosteroid medications were most frequently prescribed for patients aged 35 to 64 years in the commercial/Medicare dataset (16%) and for patients aged 18 to 34 years in the Medicaid dataset (8%). Topical onychomycosis treatments were prescribed for fewer than 1% of patients in both datasets. Oral antifungal medications were most frequently prescribed for patients aged 35 to 64 years in the commercial/Medicare dataset (26%) and for patients aged 18 to 34 years in the Medicaid dataset (24%). Fewer than 11% of patients across all age groups in both datasets were prescribed both topical and oral antifungal medications.

## Comment

Our analysis provides preliminary insight into the prevalence of skin and nail candidiasis in the United States based on health insurance claims data. Higher prevalence of skin and nail candidiasis among patients with Medicaid compared with those with commercial/Medicare health insurance is consistent with previous studies showing increased rates of other superficial fungal infections (eg, dermatophytosis) among patients of lower socioeconomic status.[2] This finding could reflect differences in underlying health status or reduced access to health care, which could delay treatment or follow-up care and potentially lead to prolonged exposure to conditions favoring the development of candidiasis.

In both the commercial/Medicare health insurance and Medicaid datasets, prevalence of diagnosis codes for candidiasis of the skin and nails was highest among infants and toddlers. Diaper dermatitis also was observed in more than half of patients aged 0 to 3 years; this is a well-established risk factor for cutaneous candidiasis, as immature skin barrier function and prolonged exposure to moisture and occlusion facilitate fungal overgrowth.[3] In adults, diabetes and obesity were among the most frequent comorbidities observed; both conditions are recognized risk factors for superficial candidiasis due to their impact on immune function and skin integrity.[4]

In both study cohorts, diagnostic testing in the 7 days before or after the index date was infrequent (≤10%), consistent with most cases being diagnosed clinically.[5] Topical antifungals, especially nystatin, were most frequently prescribed for young children, while oral antifungals were more frequently prescribed for adults; nystatin is one of the most well-studied topical treatments for cutaneous candidiasis, and oral fluconazole is the primary systemic treatment for cutaneous candidiasis.[1] In our study, the ICD-10-CM code B37.2 appeared to be used primarily for diagnosis of skin rather than nail infections based on the low proportions of patients who received treatment that was onychomycosis specific.

Our study was limited by potential misclassification inherent to data based on diagnosis codes; incomplete capture of underlying conditions given the short continuous enrollment criteria; and lack of information about affected body site(s) and laboratory results, including data identifying the *Candida* species. A previous study found that *Candida parapsilosis* and *Candida albicans* were the most common species involved in candidiasis of the skin and nails and that one-third of isolates exhibited low sensitivity to commonly used antifungals.[6] For nails, *Candida* species are sometimes contaminants rather than pathogens.

## Conclusion

Our findings provide a baseline understanding of the epidemiology of candidiasis of the skin and nails in the United States. The growing threat of antifungal resistance, particularly among non-*albicans Candida* species, underscores the need for appropriate use of antifungals.[7] Future epidemiologic studies about laboratory-confirmed candidiasis of the skin and nails to understand causative species and drug resistance would be useful, as would further investigation into disparities.

## REFERENCES

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## APPENDIX

### eTABLE 1. Characteristics of Outpatients With Candidiasis of the Skin and Nails and Prevalence in US Health Insurance Claims Data

| Characteristic | Commercial/Medicare | | | | Medicaid | | | |
|---|---|---|---|---|---|---|---|---|
| | n | % | Denominator | Prevalence per 1000 | n | % | Denominator | Prevalence per 1000 |
| Total | 59,045 | | 15,950,193 | 3.7 | 38,867 | | 5,003,112 | 7.8 |
| Sex | | | | | | | | |
| Male | 17,603 | 30 | 7,292,224 | 2.4 | 13,867 | 36 | 2,177,625 | 6.4 |
| Female | 41,442 | 70 | 8,657,969 | 4.8 | 25,000 | 64 | 2,825,487 | 8.8 |
| Age range, y | | | | | | | | |
| 0-3 | 20,340 | 34 | 670,639 | 30.3 | 27,230 | 70 | 624,846 | 43.6 |
| 4-17 | 2537 | 4 | 2,770,611 | 0.9 | 2789 | 7 | 2,144,933 | 1.3 |
| 18-34 | 6381 | 11 | 3,675,605 | 1.7 | 3040 | 8 | 1,110,263 | 2.7 |
| 35-44 | 5425 | 9 | 2,446,590 | 2.2 | 1888 | 5 | 467,572 | 4.0 |
| 45-54 | 6849 | 12 | 2,541,813 | 2.7 | 1639 | 4 | 300,073 | 5.5 |
| 55-64 | 8247 | 14 | 2,586,664 | 3.2 | 1687 | 4 | 276,193 | 6.1 |
| 65+ | 9266 | 16 | 1,258,271 | 7.4 | 594 | 2 | 79,232 | 7.5 |
| Race/ethnicity[a] | | | | | | | | |
| Black, non-Hispanic | N/A | N/A | N/A | N/A | 6938 | 23 | 1,206,508 | 5.8 |
| Hispanic or Latino | N/A | N/A | N/A | N/A | 2582 | 9 | 491,056 | 5.3 |
| Other race, non-Hispanic | N/A | N/A | N/A | N/A | 3303 | 11 | 373,015 | 8.9 |
| White, non-Hispanic | N/A | N/A | N/A | N/A | 16,732 | 57 | 2,234,407 | 7.5 |
| US census region of primary beneficiary's residence[b] | | | | | | | | |
| Northeast | 7459 | 13 | 2,408,816 | 3.1 | N/A | N/A | N/A | N/A |
| South | 28,216 | 48 | 6,998,475 | 4.0 | N/A | N/A | N/A | N/A |
| West | 6865 | 12 | 2,794,257 | 2.5 | N/A | N/A | N/A | N/A |
| Midwest | 16,131 | 27 | 3,684,429 | 4.4 | N/A | N/A | N/A | N/A |
| Urban-rural classification[c] | | | | | | | | |
| Nonrural | 35,354 | 81 | 10,653,472 | 3.3 | N/A | N/A | N/A | N/A |
| Rural | 8462 | 19 | 1,757,319 | 4.8 | N/A | N/A | N/A | N/A |

Abbreviation: N/A, not applicable.

[a]Total number of patients with race/ethnicity available in the Medicaid dataset was 29,555.

[b]Total number of patients with region available in the commercial/Medicare dataset was 58,671.

[c]Total number of patients with urban-rural classification available in the commercial/Medicare dataset was 43,816.

**eTABLE 2.** Clinical Characteristics of Outpatients With Candidiasis of the Skin or Nails by Age Group and Insurance Type

| | Age group, n (%) | | | | | | | | | |
| | Commercial/Medicare | | | | | Medicaid | | | | |
| Characteristic | 0-3 y (n=20,340) | 4-17 y (n=2537) | 18-34 y (n=6228) | 35-64 y (n=19,950) | 65+ y (n=8847) | 0-3 y (n=27,230) | 4-17 y (n=2789) | 18-34 y (n=3040) | 35-64 y (n=5214) | 65+ y (n=594) |
|---|---|---|---|---|---|---|---|---|---|---|
| Other diagnoses on or within 30 d before index date | | | | | | | | | | |
| Cellulitis | 142 (1) | 65 (3) | 153 (2) | 571 (3) | 419 (5) | 233 (1) | 68 (2) | 969 (3) | 249 (5) | 34 (6) |
| Dermatophytosis | 85 (0) | 51 (2) | 187 (3) | 750 (4) | 820 (9) | 106 (0) | 42 (2) | 67 (2) | 206 (4) | 31 (5) |
| Diabetes | 8 (0) | 17 (1) | 205 (3) | 3420 (17) | 2798 (32) | 15 (0) | 27 (1) | 187 (6) | 1415 (27) | 215 (36) |
| Diaper dermatitis | 10,473 (51) | 149 (6) | 23 (0) | 19 (0) | 45 (1) | 13,754 (51) | 222 (8) | 19 (1) | 12 (0) | 3 (1) |
| Erythema intertrigo | 85 (0) | 27 (1) | 89 (1) | 385 (2) | 236 (3) | 92 (0) | 17 (1) | 38 (1) | 103 (2) | 5 (1) |
| Immune-mediated inflammatory disease | 5 (0) | 12 (0) | 113 (2) | 752 (4) | 422 (5) | 3 (0) | 17 (1) | 58 (2) | 197 (4) | 43 (7) |
| Immunosuppression[a] | 25 (0) | 21 (1) | 87 (1) | 909 (5) | 862 (10) | 17 (0) | 19 (1) | 38 (1) | 248 (5) | 39 (7) |
| Overweight or obesity | 16 (0) | 64 (3) | 793 (13) | 3297 (17) | 1360 (15) | 60 (0) | 136 (5) | 557 (18) | 1174 (23) | 80 (13) |
| Pregnancy | 0 (0) | 0 (0) | 205 (3) | 98 (0) | 0 (0) | 0 (0) | 7 (0) | 237 (8) | 33 (1) | 0 (0) |
| Provider type(s) on index date | | | | | | | | | | |
| Dermatologist | 94 (0) | 85 (3) | 399 (6) | 1591 (8) | 840 (9) | 9 (0) | 9 (0) | 16 (1) | 45 (1) | 0 (0) |
| General practitioner | 1675 (8) | 350 (14) | 1969 (32) | 7968 (40) | 4430 (50) | 651 (2) | 164 (6) | 308 (10) | 638 (12) | 9 (2) |
| Pediatrician | 13,144 (65) | 1105 (44) | 132 (2) | 88 (0) | 35 (0) | 9624 (35) | 833 (30) | 46 (2) | 6 (0) | 0 (0) |
| NP/PA | 2445 (12) | 489 (19) | 1620 (26) | 4424 (22) | 2003 (23) | 5064 (19) | 607 (22) | 642 (21) | 1094 (21) | 211 (36) |
| OB/GYN | 28 (0) | 22 (1) | 871 (14) | 2340 (12) | 468 (5) | 0 (0) | 7 (0) | 220 (7) | 122 (2) | 0 (0) |
| Other or unknown | 3100 (15) | 504 (20) | 1474 (24) | 4391 (22) | 1619 (18) | 12,007 (44) | 1188 (43) | 1826 (60) | 3331 (64) | 374 (63) |
| Diagnostic testing in the 7 d before or after index date[b] | 154 (1) | 67 (3) | 580 (9) | 1639 (8) | 572 (6) | 263 (1) | 62 (3) | 304 (10) | 388 (7) | 14 (2) |

eTABLE 2. (continued)

| Characteristic | Age group, n (%) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Commercial/Medicare | | | | | Medicaid | | | | |
| | 0-3 y (n=20,340) | 4-17 y (n=2537) | 18-34 y (n=6228) | 35-64 y (n=19,950) | 65+ y (n=8847) | 0-3 y (n=27,230) | 4-17 y (n=2789) | 18-34 y (n=3040) | 35-64 y (n=5214) | 65+ y (n=594) |
| Prescription antifungal medications in the 7 d before or after index date | | | | | | | | | | |
| Any topical antifungal | 13,554 (67) | 1449 (57) | 2844 (46) | 9548 (48) | 4122 (47) | 19,152 (70) | 1866 (67) | 1326 (44) | 2148 (41) | 53 (9) |
| Topical azoles (except efinaconazole)[c] | 1145 (6) | 349 (14) | 895 (14) | 2651 (13) | 1307 (15) | 1704 (6) | 456 (16) | 354 (12) | 630 (12) | 19 (3) |
| Polyenes (nystatin) | 12,229 (60) | 959 (38) | 1107 (18) | 3690 (18) | 1768 (20) | 17,346 (64) | 1303 (47) | 735 (24) | 1163 (22) | 25 (4) |
| Other topical antifungals[d] | 21 (0) | 12 (0) | 34 (1) | 176 (1) | 84 (1) | 24 (0) | 3 (0) | 12 (0) | 21 (0) | 1 (0) |
| Topical antifungal corticosteroids[e] | 370 (2) | 145 (6) | 874 (14) | 3223 (16) | 1058 (12) | 340 (1) | 124 (4) | 250 (8) | 372 (7) | 9 (2) |
| Onychomycosis topical treatments[f] | 0 (0) | 2 (0) | 15 (0) | 68 (0) | 32 (0) | 0 (0) | 0 (0) | 2 (0) | 8 (0) | 0 (0) |
| Any oral antifungal | 542 (3) | 335 (13) | 1574 (25) | 5139 (26) | 1703 (19) | 772 (3) | 375 (13) | 715 (24) | 1203 (23) | 23 (4) |
| Fluconazole | 539 (3) | 325 (13) | 1503 (24) | 4881 (24) | 1636 (18) | 745 (3) | 357 (13) | 697 (23) | 1148 (22) | 22 (4) |
| Griseofulvin | 2 (0) | 1 (0) | 2 (0) | 9 (0) | 5 (0) | 10 (0) | 4 (0) | 1 (0) | 0 (0) | 0 (0) |
| Ketoconazole | 0 (0) | 1 (0) | 9 (0) | 39 (0) | 9 (0) | 0 (0) | 3 (0) | 4 (0) | 5 (0) | 0 (0) |
| Terbinafine | 7 (0) | 9 (0) | 70 (1) | 233 (1) | 59 (1) | 19 (0) | 11 (0) | 16 (1) | 60 (1) | 1 (0) |
| Both topical and antifungal therapy | 325 (2) | 141 (6) | 681 (11) | 2275 (11) | 779 (9) | 539 (2) | 201 (7) | 333 (11) | 463 (9) | 7 (1) |

Abbreviations: GYN, gynecologist; NP, nurse practitioner; OB, obstetrician; PA, physician assistant.

[a]Includes cancer, HIV, solid organ or stem cell transplantation, prednisone ≥21 d supply, tumor necrosis factor α inhibitors, interleukin 17/23 inhibitors, mycophenolate mofetil, and tacrolimus.

[b]Includes histopathology, fungal culture, direct microscopy, polymerase chain reaction, and antifungal susceptibility testing.

[c]Includes ketoconazole, terconazole, clotrimazole, econazole, sulconazole, miconazole, oxiconazole, luliconazole, and sertaconazole.

[d]Includes naftifine, terbinafine, butenafine, ciclopirox (nonlacquer), and tolnaftate.

[e]Commercial dataset: nystatin/triamcinolone 3.7%, clotrimazole-betamethasone 5.9%; Medicaid dataset: nystatin/triamcinolone 0.9%, clotrimazole-betamethasone 2.0%.

[f]Ciclopirox lacquer, efinaconazole, and tavaborole.