Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 05 July 2026
Revised 11 Aug 2026
Accepted 25 Aug 2026

Natural Resources for Human Health 2026, Vol. 6 (19s): 1470–1480

KEYWORDS:
cutaneous melanoma; Breslow thickness; dermoscopy; retrospective cross-sectional study; image archive; lesion identification; metadata completeness.

Beyond the Visible Lesion: Evaluating Dermoscopic Data and Breslow Thickness in Cutaneous Melanoma—A Retrospective Cross-Sectional Study

Hesham Wageh Ezzat Abd Rabbo[1], Abeer Mahmood Shamasneh[2], Doha Ibrahim Rateb[3], Mohammed Sami Jabri[4], Zainab Ali Sayyar[5], Rasha Saeed Awad Saleh[6], Monira El Waseef[7], Shaimaa Farouk[8]

[1]General Surgery Department, Faculty of Medicine, Fayoum University, Fayoum, Egypt
Email: Hwe00@fayoum.edu.eg, ORCID: 0009-0001-1552-3651
[2]MD, Dermatologist, Private Sector, Amman, Jordan
Email: Sqlshamasneh@yahoo.com, ORCID: 0009-0000-3930-0121
[3]Faculty of Nursing, Badr University in Cairo, Cairo, Egypt
Email: Dohaa.Ebrahim@buc.edu.eg, ORCID: 0009-0005-7973-4801
[4]Department of Dermatology, University of Jordan, Jordan University Hospital, Amman, Jordan
Email: Mohammedsamijabri@gmail.com, ORCID: 0000-0002-0806-5816
[5]Dermatology Resident, Egyptian Fellowship, Misr University for Science and Technology (MUST), Egypt
Email: zainab.sayyar@live.com, ORCID: 0009-0006-3574-1978
[6]Department of Dermatology, National Dermatology and Venereology Teaching Institute (Al-Haud Al-Marsoud), Cairo, Egypt. Arab Board of Dermatology, Cairo, Egypt
Email: Dr.rashas2014@gmail.com, ORCID: 0009-0008-3863-4275
[7]Department of Dermatology, National Dermatology and Venereology Teaching Institute (Al-Haud Al-Marsoud), Cairo, Egypt
Email: wmonira@yahoo.com
[8]Dermatology Department, National Dermatology & Venereology Teaching Institute (Al-Haud Al-Marsoud), Cairo, Egypt
Email: dr.shaimaafarouk@gmail.com, ORCID: 0000-0003-2415-2511

ABSTRACT: **Background**: Dermoscopy provides morphological information for the assessment of cutaneous melanoma. However, the reliability of secondary image-based research depends on accurate lesion identification, consistent acquisition characteristics, and the availability of relevant clinical and histopathological metadata.

Objective: To evaluate the distribution of source-reported Breslow thickness, completeness of dermoscopic and clinical metadata, lesion identification, and feasibility of investigating dermoscopic feature–thickness associations using the Early-Stage Melanoma Benchmark (EMB).

Methods: This retrospective cross-sectional descriptive study analyzed a fixed EMB dataset retrieved on October 22, 2026. Image integrity, acquisition modality, thickness labels, lesion identifiers, and metadata completeness were assessed. Dermoscopic records with positive source-reported Breslow thickness were summarized by source.

Natural Resources for Human Health
eISSN: 2583-1194

Records with explicit lesion identifiers were grouped separately. No missing clinical information or dermoscopic feature scores were imputed.

Results: The dataset contained 1,104 images, including 1,017 dermoscopic records. Of 438 dermoscopic records with positive thickness values, median Breslow thickness was 0.50 mm (interquartile range [IQR], 0.30–0.90 mm); 334 (76.3%) had values ≤1.0 mm. ISIC and Dermoscopy Atlas contributed 339 and 99 positive-thickness records, respectively, with medians of 0.40 and 0.70 mm. Explicit identifiers were available for 67 records corresponding to 58 source-defined lesions, of which 57 (98.3%) had values ≤1.0 mm. Polarized acquisition was documented in 208/438 records (47.5%). Dermoscopic feature annotations were unavailable, precluding association analyses.

Conclusion: EMB supports description of the available thickness spectrum and evaluation of methodological feasibility. However, incomplete lesion linkage, uneven thickness representation among identifiable lesions, and missing feature annotations limit its current suitability for lesion-level association analyses. Source reconciliation and standardized expert annotation are required before examining relationships between dermoscopic features and Breslow thickness.

INTRODUCTION

Cutaneous melanoma is a potentially aggressive malignancy for which accurate diagnosis and histopathological assessment are essential for prognosis and clinical management. Breslow thickness is a major component of primary melanoma staging and contributes to risk stratification and treatment decisions, together with ulceration and other clinicopathological factors (1). Although histopathological examination remains the reference standard for determining tumor invasion, increasing attention has been directed toward the potential relationship between dermoscopic morphology and melanoma thickness.

Dermoscopy is a noninvasive diagnostic technique that improves visualization of morphological structures not readily apparent during conventional clinical examination. Previous investigations have reported associations between specific dermoscopic features and Breslow thickness. Rodríguez-Lomba et al. identified blue-white veil, shiny white streaks, irregular vessels, milky-red areas, and other structures as associated with thicker melanomas, whereas atypical pigment networks and regression-related features were more frequently observed in earlier lesions (2). Similarly, Martínez-Piva et al. reported increasing frequencies of blue-white veil, shiny white structures, and milky-red areas with increasing Breslow thickness (3). Such associations do not establish that dermoscopy reliably measures the invasive depth of an individual lesion.

Publicly accessible dermatological image repositories provide opportunities for secondary investigation of melanoma morphology. The Early-Stage Melanoma Benchmark (EMB), developed by Dzieniszewska et al., combines melanoma images from the International Skin Imaging Collaboration (ISIC) archive and the Dermoscopy Atlas, together with source-reported thickness information (4). Although originally developed to benchmark automated melanoma detection methods, EMB may provide a framework for investigating clinically relevant questions concerning tumor morphology and thickness.

However, thickness-labeled images do not necessarily constitute a clinically verified cohort of independent melanoma lesions. Public image collections may contain repeated views, incomplete lesion identifiers, heterogeneous imaging modalities, and missing clinical metadata. Reliable feature assessment also requires standardized terminology and suitable image acquisition, particularly for structures that depend on polarization (5). These considerations may bias apparent feature–thickness relationships if not addressed before analysis.

The present retrospective cross-sectional study aimed to assess the suitability of EMB for investigating dermoscopic feature–thickness relationships. We described source-reported Breslow thickness, image integrity, availability of lesion identifiers, candidate image duplication, acquisition characteristics, and completeness of clinical metadata. We also examined whether explicitly identifier-linked records adequately represented the available thickness spectrum. The study evaluated methodological feasibility; it did not directly estimate associations between dermoscopic structures and thickness.

Natural Resources for Human Health
eISSN: 2583-1194

Literature Review

Previous research has explored dermoscopic morphology and melanoma thickness using different clinical populations, anatomical sites, and thresholds. In a retrospective evaluation of 245 primary cutaneous melanomas on the trunk or extremities, Rodríguez-Lomba et al. identified blue-white veil, shiny white streaks, irregular vessels, milky-red areas, and other structures associated with Breslow thickness ≥0.8 mm; atypical pigment network and regression were more frequently observed in earlier melanomas (2). Its single-center design and exclusion of special-site melanomas limited generalizability.

Martínez-Piva et al. assessed 215 patients with histologically confirmed melanoma, comprising 88 cases of melanoma in situ, 73 thin invasive melanomas, and 54 thicker invasive melanomas. Blue-white veil, shiny white structures, and milky-red areas increased in frequency with increasing Breslow thickness, while angulated lines became less frequent (3). These results support feature-oriented evaluation of invasion but cannot replace histopathological measurement.

Anatomical context and melanoma subtype affect dermoscopic interpretation. Mun et al. reported associations of atypical vascular patterns, blue-white veil, and ulceration with thickness >2 mm in acral melanoma (6). Sgouros et al. studied dermoscopic features in thin (≤2 mm) and thick (>2 mm) nodular melanomas and highlighted differences in nodular-tumor morphology (7). Direct extrapolation across anatomical sites or melanoma subtypes is therefore inappropriate.

The distinction between association and prediction is critical. In an international diagnostic reader study, Polesie et al. identified limitations in the accuracy of melanoma thickness assessment from dermoscopic images alone (8). Cavallo et al. also reported age-related differences in melanoma dermoscopic features, suggesting that demographic case mix may affect observed morphology (9).

The third International Society of Dermoscopy consensus conference established standardized terminology for common structures, including shiny white streaks, shiny white blotches and strands, and regression-related features (5). Polarization-dependent features require acquisition-aware interpretation: unassessability should not be mistaken for absence.

Unlike clinical studies with direct dermoscopic evaluation, secondary analysis of public repositories depends on the completeness of existing records. EMB was designed primarily as an automated-detection benchmark rather than a prospectively assembled clinical cohort with standardized feature annotations (4). Establishing lesion identity, assessability, and adequate thickness coverage is therefore a necessary preliminary step before inferential feature–thickness research.

METHODOLOGY

Study Design and Reporting

This retrospective cross-sectional descriptive study assessed the completeness, consistency, and analytical suitability of dermoscopic image records in EMB for future investigation of melanoma morphology and Breslow thickness. It was conducted as a secondary analysis of publicly accessible image records and associated metadata. The principal analytic unit for the audit was the image record, with a separate descriptive analysis of records grouped by explicit lesion identifiers. Reporting was informed by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) recommendations for cross-sectional studies (10). Data retrieval, technical auditing, and descriptive analyses took place on October 22, 2026. No prospective recruitment, independent histopathological slide review, or direct dermoscopic feature annotation was performed.

Data Sources and Sampling Frame

EMB combines images from the ISIC archive and the Dermoscopy Atlas and was developed as a benchmark for melanoma detection across tumor-thickness categories (4). The repository was frozen at commit 3ec674f43e73cb08682b99b7fb996aca5f8040d8 and retrieved on October 22, 2026. The collection comprised 1,104 image records, including 907 ISIC and 197 Dermoscopy Atlas records. All listed images were retrieved and successfully decoded. Original labels, source identifiers, and available metadata were retained without modifying image pixels. The sampling frame was a fixed archive rather than a consecutive or population-based clinical cohort; consequently, the distributions are descriptive of available records, not patient-population estimates.

Record Selection and Eligibility

All records in the frozen dataset were included in the technical and metadata audit. Descriptive analyses of positive thickness were restricted to images labeled dermoscopic and assigned a positive numerical source-reported Breslow thickness value.

Clinical photographs and zero-coded thickness records were excluded from positive-thickness summaries but retained in archive accounting. A zero-coded thickness value was not automatically treated as histologically confirmed melanoma in situ without explicit diagnostic confirmation.

Positive-thickness labels were regarded as source-reported rather than independently histopathologically verified. Records without lesion identifiers remained in image-level summaries but were not presumed to be independent biological lesions. Comprehensive clinical eligibility and image-quality adjudication, including confirmation of primary cutaneous melanoma and exclusion of recurrent or metastatic lesions, was not completed for the full archive. A definitive clinically eligible lesion-level analytic cohort was therefore not established.

Image Integrity, Duplicate Screening, and Lesion Identification

Image integrity was assessed through file decoding, exact-file comparison, and identical-pixel duplicate detection. No exact-file or identical-pixel duplicate groups were identified. Perceptual-similarity screening flagged 176 candidate image pairs requiring further review; image similarity alone was not considered proof of shared biological identity and flagged pairs were not automatically merged.

Explicit source-provided lesion identifiers were used to group records representing the same source-defined lesion. Within positive-thickness dermoscopic records, 67 images had explicit ISIC lesion identifiers and mapped to 58 source-defined lesions. Potential links among the remaining records were not considered resolved, although some Dermoscopy Atlas records may be linkable after source-level review. Patient identifiers, when available, were used to describe potential clustering rather than to replace lesion identifiers. Counts of image records, source-defined lesions, and recorded patients were kept separate.

Breslow Thickness and Covariate Assessment

Source-reported Breslow thickness was retained in millimeters and summarized continuously. Positive records were categorized for descriptive purposes as >0–1.0 mm, >1.0–2.0 mm, >2.0–4.0 mm, or >4.0 mm. These categories were not interpreted as complete AJCC stage groups. The available metadata were reviewed for age, sex, anatomical location, patient and lesion identifiers, acquisition subtype, clinical lesion diameter, histopathological confirmation method, and histological ulceration. Source documentation of histopathology did not constitute independent histological verification. Clinical information not available in the records, including symptoms, lesion evolution, and skin phototype, was not reconstructed or imputed.

Dermoscopic Acquisition and Feature Availability

Acquisition metadata were used to distinguish documented polarized, documented non-polarized, and undocumented dermoscopic imaging. These categories were not combined because certain shiny white structures are assessable specifically with polarized dermoscopy (5). Availability of standardized annotations for blue-white veil, shiny white structures, milky-red areas, and other previously studied features was examined. No standardized feature scores were included in the extracted data; thus, neither feature prevalence nor reader agreement or feature–thickness associations could be assessed in this completed study.

Statistical Analysis

Analyses were descriptive and conducted at the image-record level, with a separate summary of the identifier-linked lesion subset. Thickness was presented using medians, interquartile ranges (IQRs), and observed ranges; categorical variables were reported as frequencies and percentages. Quartiles were computed using linear interpolation. Results were stratified by image source, with empirical cumulative distribution curves, proportional thickness-band charts, and source-specific metadata-completeness summaries. Lesion identifier availability and acquisition subtype were additionally tabulated across thickness categories.

No inferential comparison, patient-population confidence interval, regression model, interobserver agreement coefficient, or dermoscopic feature–thickness association test was calculated because lesion independence and standardized feature annotation were not established. Descriptive analyses used Python 3.12.14, pandas 2.2.3, NumPy 2.3.5, and Matplotlib 3.10.8.

Missing Data

Missingness was described by variable and image source using explicit denominators. Unavailable clinical characteristics, undocumented imaging subtype, and missing lesion identifiers were retained as missing or undocumented rather than treated as absent. No values were imputed. Variables unavailable in the extracted Dermoscopy Atlas metadata were characterized as unavailable in that source extraction, not as clinically absent characteristics. Records with unresolved lesion identity contributed to record-level summaries but not to the explicitly identifier-linked subset.

Ethical Considerations and Data Access

The analysis used publicly accessible, de-identified secondary image records and associated metadata. No patients were contacted and no attempt at re-identification was made. Original source attribution and applicable image-reuse conditions were retained. Any reproduction or further redistribution of images is subject to the licensing and permissions of the corresponding repositories. The institutional ethics review or exemption status of the present secondary analysis requires confirmation by the responsible authors before journal submission.

RESULTS

Archive Composition and Available Thickness Records

The collection contained 1,104 distinct image identifiers. All files decoded successfully, and no exact-file or identical-pixel duplicate groups were detected. According to modality labels, 1,017 images (92.1%) were dermoscopic and 87 (7.9%) were clinical photographs. Of the dermoscopic records, 438 (43.1%) had positive numerical thickness labels, whereas 579 (56.9%) were zero-coded. These counts reflect image records rather than independent melanoma lesions. Figure 1 summarizes record accounting and the grouping of records with explicit lesion identifiers.

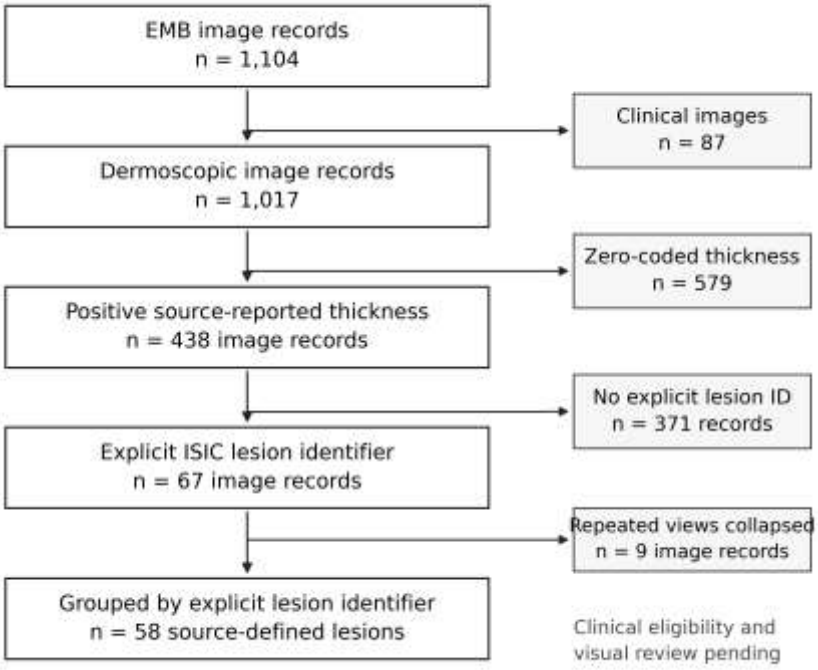


Figure 1. Flow diagram of image record accounting and explicit lesion identification in EMB.

The 58 source-defined lesions comprise a descriptive subset, not a clinically eligible cohort. Images without explicit IDs remain within the record-level descriptive analysis. Image quality and candidate similarities await adjudication.

Distribution of Source-Reported Breslow Thickness

The 438 positive-thickness dermoscopic records comprised 339 ISIC images (77.4%) and 99 Dermoscopy Atlas images (22.6%). Median thickness was 0.50 mm (IQR, 0.30–0.90 mm; range, 0.10–7.30 mm). Thickness was >0–1.0 mm for 334

records (76.3%), >1.0–2.0 mm for 68 (15.5%), >2.0–4.0 mm for 15 (3.4%), and >4.0 mm for 21 (4.8%). Only 36 records (8.2%) exceeded 2.0 mm. Source-specific results are provided in Table 1.

Table 1. Distribution of source-reported Breslow thickness among positive-thickness dermoscopic image records, stratified by source.

Characteristic	ISIC n = 339	Dermoscopy Atlas n = 99	Overall n = 438
Median thickness (IQR), mm	0.40 (0.27–0.90)	0.70 (0.40–1.40)	0.50 (0.30–0.90)
Thickness range, mm	0.10–7.30	0.28–7.00	0.10–7.30
>0–1.0 mm	264 (77.9)	70 (70.7)	334 (76.3)
>1.0–2.0 mm	47 (13.9)	21 (21.2)	68 (15.5)
>2.0–4.0 mm	14 (4.1)	1 (1.0)	15 (3.4)
>4.0 mm	14 (4.1)	7 (7.1)	21 (4.8)

Values are image-record counts (%) unless otherwise indicated. IQR, interquartile range; ISIC, International Skin Imaging Collaboration. Multiple records may correspond to the same lesion; the frequencies are not independent-lesion counts. Zero-coded records are excluded.

Median thickness was 0.40 mm (IQR, 0.27–0.90 mm) among ISIC records and 0.70 mm (IQR, 0.40–1.40 mm) among Atlas records. Thickness exceeded 1.0 mm in 75/339 ISIC records (22.1%) and 29/99 Atlas records (29.3%). Figure 2 presents the empirical cumulative distributions and band proportions. These differences describe archive composition and do not establish differences between independent clinical populations.

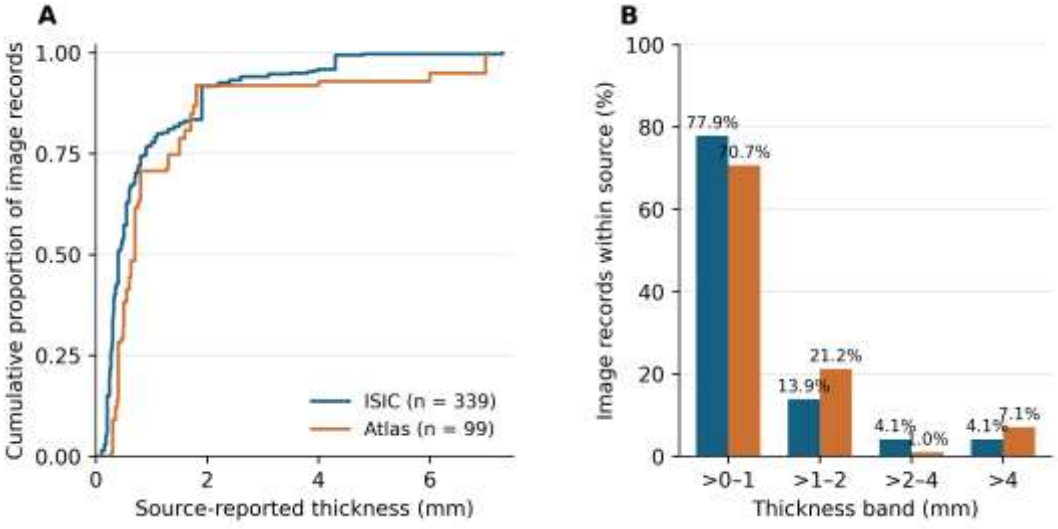


Figure 2. Distribution of positive source-reported Breslow thickness by source: (A) empirical cumulative distributions; (B) proportions by thickness category.

Distributions are based on image records, not independent melanoma lesions. Repeated views have not been reconciled throughout the archive.

Identifier-Linked Lesion Subset

Explicit lesion identifiers were available for 67 of the 438 positive-thickness dermoscopic records (15.3%), all from ISIC. These represented 58 source-defined lesions with concordant thickness values. Fifty-seven lesions contributed one record each, whereas one lesion with thickness 0.20 mm contributed ten views; grouping removed nine repeated records. The remaining 371 positive-thickness records lacked explicit lesion identifiers.

The subset median was 0.40 mm (IQR, 0.30–0.50 mm); 57/58 lesions (98.3%) were ≤1.0 mm, and the other was 7.30 mm. Source metadata categorized all 58 as invasive melanoma and documented histopathology as the confirmation method. Fifty-seven lesions had patient identifiers, mapping to 53 recorded patients: two patients each had two lesions and one had three. One lesion lacked a patient identifier. Descriptive characteristics are shown in Table 2.

Table 2. Demographic, clinical, and acquisition characteristics of source-defined lesions grouped through explicit ISIC lesion identifiers.

Characteristic	Identifier-linked subset
Contributing dermoscopic image records	67
Source-defined lesions after grouping	58
Distinct recorded patients	53
Lesions without a patient identifier	1 (1.7%)
Age available, lesions	57 (98.3%)
Median approximate age (IQR), years	65 (55–75)
Sex, male / female / unreported, n	42 / 15 / 1
Site, trunk / upper limb / lower limb / head and neck / unreported, n	26 / 13 / 13 / 5 / 1
Median thickness (IQR), mm	0.40 (0.30–0.50)
Thickness >0–1.0 mm	57 (98.3%)
Thickness >1.0 mm	1 (1.7%)
Documented polarized acquisition	30 (51.7%)

Unless stated otherwise, percentages are based on 58 source-defined lesions. Age summarizes 57 lesions, not 57 independent patients. Fifty-seven lesions map to 53 recorded patients; one lacks a patient ID. Clinical eligibility and lesion independence require further review.

The similarity screen flagged 49 candidate pairs involving at least one of the 67 identifier-linked records, including three pairs with different explicit lesion identifiers. These were not considered confirmed duplicates or merged on appearance alone. The highly concentrated thickness distribution precludes using the subset as a representative validation sample for thickness-associated morphology.

Clinical and Acquisition Metadata Completeness

Among the 339 positive-thickness ISIC dermoscopic records, age was available for 318 (93.8%), sex for 319 (94.1%), broad anatomical location for 284 (83.8%), patient identifiers for 256 (75.5%), and clinical diameter for 85 (25.1%). Histological ulceration metadata were available for 173 records (51.0%). These variables were not systematically available in the extracted Dermoscopy Atlas records (Figure 3). Atlas zeros indicate absent documentation or extraction rather than absence of the corresponding clinical characteristics.

Natural Resources for Human Health
eISSN: 2583-1194

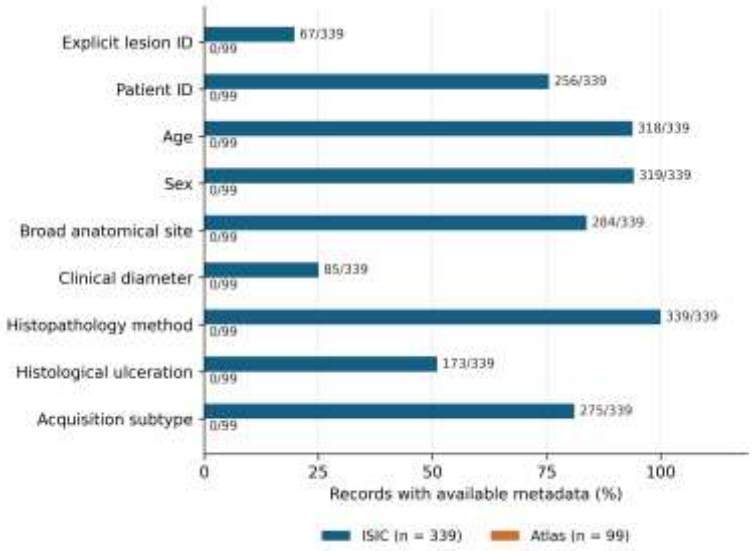


Figure 3. Completeness of selected clinical, lesion-linkage, and acquisition metadata among positive-thickness dermoscopic records, by source.

Fractions reflect source-specific record denominators. Documentation of histopathology is not equivalent to independent slide review. Atlas zeros denote fields unavailable in this extraction.

Across positive-thickness dermoscopic records, polarized acquisition was documented for 208/438 (47.5%), non-polarized acquisition for 67 (15.3%), and no acquisition subtype for 163 (37.2%). Within ISIC, acquisition subtype was documented for 275/339 records (81.1%); within the 58-lesion subset, documented polarization was present for 30 lesions. No standardized dermoscopic feature scores were available; hence feature frequencies, agreement coefficients, and feature–thickness estimates could not be calculated.

Thickness-Specific Availability of Lesion Identifiers

Explicit lesion identifiers were available for 66/264 (25.0%) ISIC records with thickness >0–1.0 mm, for none of the 47 records at >1.0–2.0 mm or 14 records at >2.0–4.0 mm, and for 1/14 (7.1%) records at >4.0 mm. Thus all 61 ISIC records with thickness >1.0–4.0 mm lacked explicit lesion identifiers. An analysis limited to explicit IDs would omit the entire intermediate thickness interval (Figure 4).

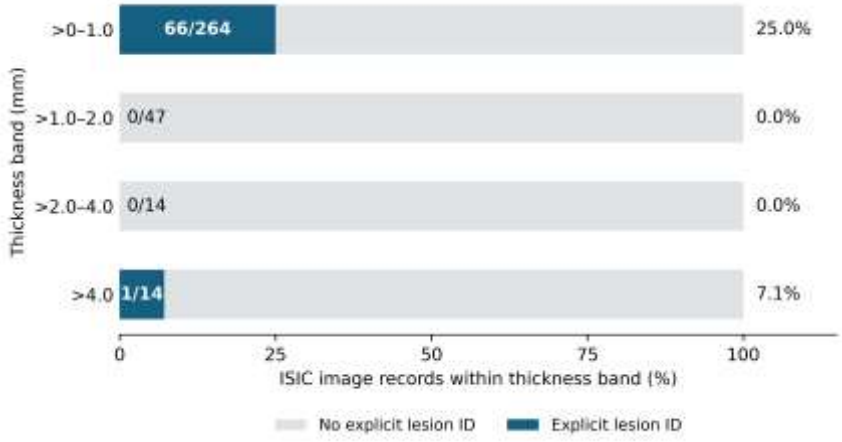


Figure 4. Availability of explicit lesion identifiers across source-reported Breslow thickness categories in ISIC dermoscopic image records.

Fractions and percentages refer to image records. Missing identifiers do not establish unique lesions or their absence.

Acquisition Subtype Across Thickness Categories

Documented polarized acquisition occurred in 152/264 (57.6%) ISIC records at >0–1.0 mm, 33/47 (70.2%) at >1.0–2.0 mm, 13/14 (92.9%) at >2.0–4.0 mm, and 10/14 (71.4%) at >4.0 mm. Figure 5 differentiates polarized, non-polarized, and undocumented subtype within each band. These are imaging conditions, not biological prevalences of polarization-dependent structures.

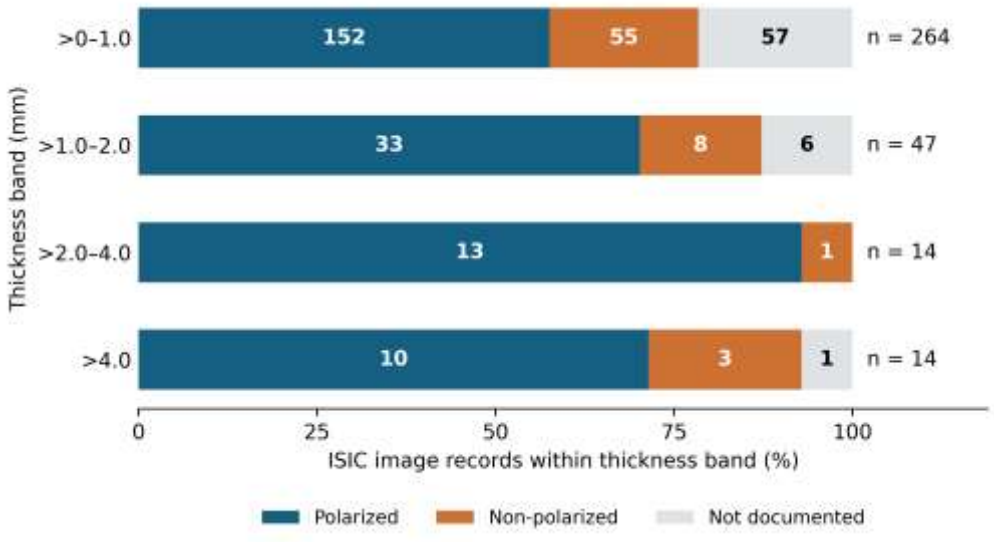


Figure 5. Documented dermoscopic acquisition subtype across source-reported Breslow thickness categories in ISIC records.

Bar segments correspond to polarized, non-polarized, or undocumented acquisition. Undocumented acquisition must not be treated as a negative score for shiny white structures.

DISCUSSION

Principal Findings

This retrospective cross-sectional audit found a substantial discrepancy between the number of thickness-labeled dermoscopic images in EMB and the number of records groupable into source-defined lesions using explicit identifiers. Although 438 positive-thickness dermoscopic records were available, only 67 had explicit identifiers, corresponding to 58 source-defined lesions. Of these, 57 were ≤1.0 mm thick and only one exceeded 1.0 mm. Thus a collection of many images did not produce an adequately distributed lesion-level cohort for evaluating morphology across tumor thickness. Standardized feature annotations were absent, so no associations between blue-white veil, shiny white structures, milky-red areas, or any other pattern and Breslow thickness were estimated.

Comparison With Previous Studies

Clinical investigations by Rodríguez-Lomba et al. and Martínez-Piva et al. reported thickness-associated blue-white, shiny white, and vascular structures after direct assessment of clinically characterized melanoma lesions (2,3). The present audit did not assess these structures and therefore neither confirms nor contradicts their findings. Its contribution is to identify dataset limitations that would complicate analogous research using EMB.

Differences in melanoma subtype and site also warrant caution. Mun et al. examined features in acral melanoma (6), whereas Sgouros et al. studied relatively thin and thick nodular melanoma (7). Such findings cannot simply be transported to a pooled image archive with incompletely described anatomical composition. Moreover, Polesie et al. showed that estimating the thickness of individual melanomas from dermoscopic images remains challenging (8), reinforcing the distinction between a statistical association and clinical estimation of tumor depth.

Lesion Identification and Selection Bias

Incomplete lesion identity was not uniformly distributed across thickness groups. All 61 ISIC image records with thickness >1.0–4.0 mm lacked explicit identifiers. Restricting analysis to the 58 identifier-linked lesions would improve traceability but remove that intermediate interval and drastically change the thickness spectrum. This is a potential selection mechanism rather than merely a reduction in sample size. It could distort any later association with morphology if features themselves vary with thickness. Perceptually similar pairs also warrant source-level adjudication; visual similarity must not be treated as proof of duplication or independence.

Acquisition Characteristics and Feature Assessability

Imaging subtype was incompletely documented and varied across source-reported thickness categories. Of the 438 positive-thickness records, polarized acquisition was documented for 208 (47.5%). Shiny white streaks and related bright white structures are defined within standardized dermoscopic terminology and require polarization-aware assessment (5). Treating undocumented or non-polarized images as negative for these findings could introduce feature misclassification. Any subsequent scoring protocol should define feature-specific assessability and report appropriate denominators. Acquisition imbalance must be considered when comparing groups.

Clinical and Demographic Context

Interpretation was further limited by variable metadata availability across sources. Age, sex, and broad anatomical location were reported for many ISIC records but were not systematically extracted for Atlas records. Cavallo et al. described age-related differences in melanoma dermoscopic morphology (9), illustrating why case mix and clinical context matter in feature-oriented research. Although the Atlas records had a higher median thickness than ISIC records (0.70 versus 0.40 mm), that record-level observation cannot be attributed to differences in tumor biology, diagnosis timing, or source populations.

Strengths and Limitations

Strengths include retrieval of all listed images, successful decoding, preservation of source metadata, separate reporting of record- and lesion-level denominators, and transparent identification of gaps in identifiers and acquisition subtype. The fixed repository commit facilitates repeatable reanalysis of labels and provenance.

Key limitations are dependence on source-reported rather than independently reviewed pathology; unresolved lesion independence across most records; pending clinical eligibility and image-quality adjudication; absent standardized dermoscopic feature scores; incomplete clinical covariates; and the non-consecutive source collection. Similarity-screen candidates were not fully reconciled. Consequently, the results should not be extrapolated to melanoma patient populations or treated as estimates of clinically meaningful features or prognosis.

Research Implications

Before lesion-level associations can be investigated, future work should reconcile original source records, verify clinical diagnosis and eligibility, select an appropriate image per lesion, and conduct standardized blinded assessment by qualified dermoscopists. Interobserver agreement and feature-specific assessability should be evaluated before consensus scores are used. Subsequent analyses should address patient clustering, source heterogeneity, anatomical context, and missingness across thickness bands. If adequate coverage cannot be established, EMB may remain more suitable for reproducible descriptive and methodological investigations than for inference about melanoma morphology and invasion depth.

CONCLUSION

This retrospective cross-sectional analysis characterized dermoscopic image records and source-reported Breslow thickness in EMB and identified major constraints on their use for clinically interpretable lesion-level research. Despite 438 positive-thickness dermoscopic records, explicit lesion identifiers linked only 67 records to 58 source-defined lesions, with marked underrepresentation of thicker lesions in the identifiable subset. Incomplete acquisition information and absent dermoscopic feature annotation further restrict direct analysis. Lesion reconciliation, clinical eligibility verification, and standardized blinded annotation are essential before assessing feature–thickness associations. No such associations or individual thickness predictions can be inferred from the present descriptive results.

Data Availability

The EMB source label data and related repository materials are available from https://github.com/Oichii/EMB. The version cited for this analysis is commit 3ec674f43e73cb08682b99b7fb996aca5f8040d8 (accessed October 22, 2026). Original images are sourced from ISIC and the Dermoscopy Atlas and remain subject to applicable source terms and image-specific reuse permissions.

REFERENCES

[1] Gershenwald JE, Scolyer RA, Hess KR, Sondak VK, Long GV, Ross MI, et al. Melanoma staging: evidence-based changes in the American Joint Committee on Cancer eighth edition cancer staging manual. CA Cancer J Clin. 2017;67(6):472–492. doi:10.3322/caac.21409.

[2] Rodríguez-Lomba E, Lozano-Masdemont B, Nieto-Benito LM, Hernández de la Torre E, Suárez-Fernández R, Avilés-Izquierdo JA. Dermoscopic predictors of tumor thickness in cutaneous melanoma: a retrospective analysis of 245 melanomas. Dermatol Pract Concept. 2021;11(3):e2021059. doi:10.5826/dpc.1103a59.

[3] Martínez-Piva MM, Vacas AS, Rodríguez Kowalczuk MV, Gallo F, Rodrígues Vasconcelos M, Mazzuoccolo LD. Dermoscopy as a tool for estimating Breslow thickness in melanoma. Actas Dermosifiliogr. 2021;112(5):434–440. doi:10.1016/j.ad.2020.11.015.

[4] Dzieniszewska A, Garbat P, Pietkiewicz P, Piramidowicz R. Early-stage melanoma benchmark dataset. Cancers (Basel). 2025;17(15):2476. doi:10.3390/cancers17152476.

[5] Kittler H, Marghoob AA, Argenziano G, Carrera C, Curiel-Lewandrowski C, Hofmann-Wellenhof R, et al. Standardization of terminology in dermoscopy/dermatoscopy: results of the third consensus conference of the International Society of Dermoscopy. J Am Acad Dermatol. 2016;74(6):1093–1106. doi:10.1016/j.jaad.2015.12.038.

[6] Mun JH, Jo G, Darmawan CC, Park J, Bae JM, Jin H, et al. Association between Breslow thickness and dermoscopic findings in acral melanoma. J Am Acad Dermatol. 2018;79(5):831–835. doi:10.1016/j.jaad.2018.06.004.

[7] Sgouros D, Lallas A, Kittler H, Zarras A, Kyrgidis A, Papageorgiou C, et al. Dermatoscopic features of thin (≤2 mm Breslow thickness) vs. thick (>2 mm Breslow thickness) nodular melanoma and predictors of nodular melanoma versus nodular non-melanoma tumours: a multicentric collaborative study by the International Dermoscopy Society. J Eur Acad Dermatol Venereol. 2020;34(11):2541–2547. doi:10.1111/jdv.16815.

[8] Polesie S, Gillstedt M, Kittler H, Rinner C, Tschandl P, Paoli J. Assessment of melanoma thickness based on dermoscopy images: an open, web-based, international diagnostic study. J Eur Acad Dermatol Venereol. 2022;36(11):2002–2007. doi:10.1111/jdv.18436.

[9] Cavallo F, Santaniello U, Bin E, Roccuzzo G, Giordano S, Agostini A, et al. Dermoscopy of melanoma according to age groups: a retrospective monocentric study on 285 patients. Cancers (Basel). 2025;17(15):2597. doi:10.3390/cancers17152597.

[10] von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. PLoS Med. 2007;4(10):e296. doi:10.1371/journal.pmed.0040296.