
Developing an international standard for the classification of surface anatomic location for use in clinical practice and epidemiologic research



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Background: There is currently no universally adopted terminology for defining human surface anatomic location. The lack of precision, accuracy, and reliability of terms used by health care providers, in particular dermatologic surgeons, is unsatisfactory both for epidemiologic research and for high-quality patient care.

Objective: We sought to create a clinically relevant yet concise surface anatomy terminology for international use including the *International Classification of Diseases* and to map it to existing disparate terminologies.

Methods: Widely used surface anatomy terminology data sets and diagrams were reviewed. A Delphi consensus convened to create a novel surface anatomy terminology. The new terminology was hierarchically mapped to Systematized Nomenclature of Medicine terms and New York University numbers and physically mapped to 2-dimensional anatomic diagrams for clarity and reproducibility.

Results: The final terminology data set contains 519 discrete terms arranged in a 9-level hierarchy and has been adopted by the World Health Organization for the *International Classification of Diseases, 11th revision*.

Limitations: Specification of most locations requires linking to laterality qualifiers. Fine granularity for larger sites may require the use of additional qualifiers.

Conclusion: Consistent use of precise and accurate surface anatomy terms is crucial to the practice of dermatology, particularly procedural dermatology. The proposed terminology is designed to form the basis for evolution of a universally adoptable terminology set to improve patient care, interprovider communication, and epidemiologic tracking. (J Am Acad Dermatol 2019;80:1564-84.)

Key words: anatomical nomenclature; dermatology; surface anatomy; surface topography.

There is currently no internationally accepted set of anatomic terms for use by dermatologists and other health care providers to

enable recording of surface anatomy locations on the human body accurately and consistently. This lack of consensus results in errors of accuracy and

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precision that have clinical and research consequences. Clinically, inconsistent anatomic site terminology can lead to obtaining unnecessary biopsy specimens, mistaken clinicopathologic correlation, and wrong-site surgery. These risks grow with the number of providers involved in the care of the patient, the number of biopsy specimens obtained/treatments the patient has had, and the length of follow-up. For research purposes, the detailed and consistent application of surface anatomy terminology provides a key stratification variable for epidemiology research, quality monitoring, recurrence monitoring, and the study of the natural history of cutaneous processes. While digital photography is becoming ubiquitous and presents many advantages for anatomic site documentation, photodocumentation is currently not the norm, and the consequences of inconsistent text-based terminology are magnified in the era of electronic medical records and “big data” analyses.

Even if a consistent set of widely accepted terms were available, rising clinical volumes and increasing regulatory and reimbursement demands for documentation contribute to time pressure for clinicians that can undermine the precision and granularity of anatomic labeling. Lengthy free-text descriptions of precise anatomic labels are both inefficient and prone to errors. As a result, an exhaustive and precise set of anatomic terms would be best applied through automated linkage to anatomic drawings or clinical photographs.

Here we provide a synopsis and comparison of the major extant systems for anatomic labeling along with a proposed system that automatically links a consensus set of terms derived from these systems to a set of anatomic drawings.

CURRENT TERMINOLOGY SYSTEMS

There are several readily available surface anatomy maps and term sets, but each has weaknesses for routine application in dermatology practice and research.

The web-based terminology database Systematized Nomenclature of Medicine—Clinical Terms (SNOMED CT) is a detailed and extensive clinical terminology including but not limited to anatomic, pathologic, procedural, event, and demographic terms. It is owned,

maintained, and distributed by the International Health Terminology Standards Development Organisation.¹ SNOMED CT was originally created by the College of American Pathologists and now contains >320,000 concepts, each with its own SNOMED CT Identifier (SCTID) code. Its weakness, however, lies in its incomplete coverage of detailed surface anatomy,

and the large number of options with many overlapping terms for the same location, each with its own SCTID code. Therefore, 2 lesions occurring in exactly the same location could be coded and later analyzed differently. For example, nape of the neck correlates to “entire posterior portion of neck,” “entire skin of nuchal region,” “entire surface region of back of neck,” and “structure of surface region of back of neck.”

The Foundational Model of Anatomy (FMA) ontology,

created by the Structural Informatics Group at the University of Washington, is a system of internal and surface anatomy that is entirely online.² It was aligned with SNOMED-CT and Galen and adopted by the European Committee for Standardization. Its design is purely ontologic (ie, a conceptual model) with text labels (and associated FMA ID numbers) without a coordinated graphic location, requiring the user to have a fairly detailed anatomic knowledge. Although the system is multiaxial, it is no longer possible to view the full hierarchy satisfactorily since the withdrawal of the Foundational Model Explorer (FME), which previously enabled the hierarchy to be visualized in its entirety through a series of drop-down options. Despite these issues, it is a thorough system and includes laterality.

The third edition of the World Health Organization’s *International Classification of Diseases for Oncology* (ICD-O-3) is another web-based terminology set with associated codes that has historically been used by tumor and cancer registries.³ It uses a dual classification scheme consisting of a morphologic code and a topographic code. Only the morphology component was incorporated into SNOMED. The topography component was derived from the neoplasms chapter of the ICD-10. While the pairing of diagnosis and location and the integration with other systems is desirable, ICD-O is geared more toward internal malignancies rather than disorders of the skin, and the terms and corresponding topography codes are far too broad for finer

CAPSULE SUMMARY

- There is no standardized universal surface topography term set available.
- We propose a hierarchically arranged set of 519 surface anatomy terms as an initial step toward international adoption.
- It is vital that anatomic sites in dermatology are precise and accurate for correct site treatment, epidemiologic tracking, and interprovider communication.

Table I. Proposed hierarchy of 519 surface topography terms

Index	Level	Surface Topography Hierarchical Classification
1	1	Head and Neck
2	2	Head
3	3	Scalp
4	4	Frontal scalp
5	4	Temporal scalp
6	4	Parietal scalp
7	4	Occipital scalp
8	4	Vertex of scalp
9	4	Scalp Margin
10	5	Frontal scalp margin
11	5	Temporal scalp margin
12	5	Parietal scalp margin
13	5	Occipital scalp margin
14	3	External ear
15	4	Pinna
16	5	Helix of pinna
17	6	Crus of helix
18	6	Apex of helix
19	6	Spine of helix
20	6	Tail of helix
21	5	Antihelix of pinna
22	6	Crura of antihelix
23	6	Scaphoid fossa of pinna
24	5	Concha
25	6	Cymba conchae
26	6	Conchal bowl of pinna
27	5	Triangular fossa of pinna
28	5	Tragus of pinna
29	5	Intertragic notch of pinna
30	5	Lobule of pinna
31	5	Antitragus of pinna
32	5	Posterior surface of pinna
33	5	Retroauricular sulcus
34	4	External auditory canal
35	5	External auditory meatus
36	5	Tympanic membrane
37	3	Face
38	4	Forehead
39	5	Central forehead
40	5	Paramedian forehead
41	5	Lateral forehead
42	5	Glabella
43	4	Temple
44	4	Orbital region
45	5	Periorbital region
46	6	Supraorbital region
47	7	Eyebrow
48	6	Infraorbital region
49	5	Eyelid and ocular surface
50	6	Eyelids
51	7	Upper eyelid
52	8	Upper eyelid margin
53	9	Superior lacrimal punctum
54	8	Superior palpebral sulcus
55	7	Lower eyelid
56	8	Lower eyelid margin
57	9	Inferior lacrimal punctum
58	7	Lateral canthus
59	7	Medial canthus
60	6	Conjunctiva
61	7	Palpebral conjunctiva
62	7	Superior conjunctival fornix
63	7	Inferior conjunctival fornix
64	7	Bulbar conjunctiva
65	6	Sclera
66	6	Cornea
67	7	Limbus of cornea

Continued

Table I. Cont'd

Index	Level	Surface Topography Hierarchical Classification
68	4	Cheek
69	5	Upper cheek
70	6	Malar region
71	6	Palpebromalar groove
72	6	Nasojugal groove
73	5	Central cheek
74	5	Paranasal region
75	5	Nasolabial fold
76	5	Lateral Cheek
77	6	Preauricular region
78	6	Angle of jaw
79	6	Mandibular region
80	4	Nose
81	5	Root of nose
82	5	Dorsum of nose
83	6	Supratip of nose
84	5	Lateral side wall of nose
85	5	Tip of nose
86	6	Infratip lobule of nose
87	5	Ala nasi
88	6	Side wall of ala nasi
89	6	Alar groove
90	6	Alar rim
91	5	Nostril
92	6	Sill of nostril
93	6	Columella
94	4	Oral region
95	5	Perioral Region
96	5	Lips
97	6	Upper lip
98	7	Cutaneous upper lip
99	8	Philtrum
100	7	Vermilion border of upper lip
101	7	Vermilion of upper lip
102	6	Labial commissure
103	6	Lower lip
104	7	Cutaneous lower lip
105	7	Vermilion border of lower lip
106	7	Vermilion of lower lip
107	5	Chin
108	3	Mouth
109	4	Vestibule of mouth
110	5	Labial mucosa of upper lip
111	5	Superior labial sulcus
112	5	Superior buccal sulcus
113	5	Labial mucosa of lower lip
114	5	Inferior labial sulcus
115	5	Inferior buccal sulcus
116	5	Buccal mucosa
117	5	Retromolar region
118	4	Gingivae
119	5	Upper Gingiva
120	6	Upper alveolar mucosa
121	6	Upper alveolar ridge mucosa
122	5	Lower Gingiva
123	6	Lower alveolar mucosa
124	6	Lower alveolar ridge mucosa
125	4	Oral cavity
126	5	Palate
127	6	Hard palate
128	6	Soft palate
129	6	Uvula
130	6	Palatal mucosa
131	5	Tongue
132	6	Body of tongue
133	7	Midline of tongue
134	7	Dorsal surface of body of tongue
135	6	Junctional zone of tongue
136	6	Base of tongue
137	7	Dorsal surface of base of tongue

Continued

Table I. Cont'd

Index	Level	Surface Topography Hierarchical Classification
138	6	Ventral surface of tongue
139	7	Lingual frenulum
140	7	Lingual tonsil
141	6	Border of tongue
142	7	Lateral margin of tongue
143	7	Tip of tongue
144	5	Floor of mouth
145	6	Alveololingual sulcus
146	6	Mucosa of floor of mouth
147	5	Tonsillar region
148	6	Glossopalatine arch
149	7	Anterior tonsillar pillar
150	6	Tonsillar fossa
151	7	Palatine tonsil
152	6	Pharyngopalatine arch
153	7	Posterior tonsillar pillar
154	8	Pharyngeal lymphoid ring
155	5	Oropharynx
156	6	Lateral wall of oropharynx
157	6	Posterior wall of oropharynx
158	2	Neck
159	3	Front of neck
160	4	Anterior triangle of neck
161	5	Submental region
162	5	Submandibular region
163	5	Suprasternal notch
164	4	Supraclavicular region
165	3	Side of neck
166	4	Posterior triangle of neck
167	3	Nape of neck
168	1	Trunk
169	2	Upper trunk
170	3	Thorax
171	4	Anterior thoracic region
172	5	Upper anterior thoracic region
173	6	Clavicular region
174	6	Infraclavicular region
175	6	Presternal region
176	5	Lower anterior thoracic region
177	4	Lateral thoracic region
178	5	Upper lateral thoracic region
179	6	Anterolateral upper thoracic region
180	6	Posterolateral upper thoracic region
181	5	Lower lateral thoracic region
182	6	Anterolateral lower thoracic region
183	6	Posterolateral lower thoracic region
184	4	Upper back
185	5	Suprascapular region
186	5	Scapular region
187	5	Interscapular region
188	5	Infrascapular region
189	5	Lower thoracic paraspinal region
190	3	Breast
191	4	Nipple
192	4	Areola
193	4	Upper outer quadrant of breast
194	4	Upper inner quadrant of breast
195	4	Lower outer quadrant of breast
196	4	Lower inner quadrant of breast
197	4	Axillary tail of breast
198	4	Inframammary flexure
199	2	Lower trunk
200	3	Abdomen
201	4	Upper abdomen
202	5	Epigastrium
203	5	Hypochondrium
204	4	Periumbilical region
205	5	Umbilicus

Continued

Table I. Cont'd

Index	Level	Surface Topography Hierarchical Classification
206	4	Lateral lumbar region
207	4	Lower abdomen
208	5	Hypogastrium
209	5	Iliac region
210	3	Lumbosacral region
211	4	Mid back
212	5	Posterior lumbar region
213	5	Lumbar paraspinal region
214	4	Lower back
215	5	Sacral region
216	5	Coccygeal area
217	1	Anogenital region
218	2	Genital region
219	3	Female external genitalia
220	4	Vulva
221	5	Labium majus
222	5	Labium minus
223	5	Clitoris
224	6	Clitoral prepuce
225	5	Vulval vestibule
226	6	External urethral meatus
227	6	Bartholin gland
228	5	Frenulum of labia minora
229	4	Vagina
230	5	Vaginal introitus
231	5	Hymen
232	3	Male external genitalia
233	4	Penis
234	5	Root of penis
235	5	Body of penis
236	6	Dorsal surface of penis
237	6	Ventral surface of penis
238	5	Glans penis
239	6	Penile urethral meatus
240	5	Prepuce
241	6	Outer surface of Prepuce
242	6	Inner surface of Prepuce
243	5	Coronal sulcus of penis
244	6	Frenulum of penis
245	4	Scrotum
246	2	Perigenital region
247	3	Suprapubic area
248	4	Mons pubis
249	3	Inguinocrural fold
250	2	Perianal region
251	3	Anus
252	3	Perianal skin
253	3	Perineum
254	3	Intergluteal cleft
255	1	Upper extremity
256	2	Shoulder
257	3	Anterior surface of shoulder
258	3	Apex of shoulder
259	3	Posterior surface of shoulder
260	2	Axilla
261	3	Anterior axillary fold
262	3	Apex of axilla
263	3	Posterior axillary fold
264	2	Upper arm
265	3	Anterior surface of upper arm
266	3	Lateral surface of upper arm
267	3	Posterior surface of upper arm
268	3	Medial surface of upper arm
269	2	Elbow
270	3	Antecubital fossa
271	3	Lateral condylar surface of elbow
272	3	Elbow tip
273	3	Medial condylar surface of elbow

Continued

Table I. Cont'd

Index	Level	Surface Topography Hierarchical Classification
274	2	Forearm
275	3	Anterior surface of forearm
276	3	Lateral surface of forearm
277	3	Posterior surface of forearm
278	3	Medial surface of forearm
279	2	Wrist
280	3	Volar surface of wrist
281	3	Lateral surface of wrist
282	3	Dorsal surface of wrist
283	3	Medial surface of wrist
284	2	Hand
285	3	Dorsum of hand
286	3	Knuckles
287	4	First metacarpophalangeal joint
288	4	Second metacarpophalangeal joint
289	4	Third metacarpophalangeal joint
290	4	Fourth metacarpophalangeal joint
291	4	Fifth metacarpophalangeal joint
292	3	Interdigital web spaces of hand
293	4	First interdigital web space of hand
294	4	Second interdigital web space of hand
295	4	Third interdigital web space of hand
296	4	Fourth interdigital web space of hand
297	3	Palm of hand
298	4	Proximal palm
299	5	Thenar eminence
300	5	Hypothenar eminence
301	4	Central palm
302	4	Distal palm
303	3	Fingers and thumb
304	4	Thumb
305	5	Proximal phalanx of thumb
306	5	Interphalangeal joint of thumb
307	5	Distal phalanx of thumb
308	5	Perionychium of thumb
309	6	Proximal nail fold of thumb
310	6	Eponychium of thumb
311	6	Lateral nail fold of thumb
312	6	Hyponychium of thumb
313	5	Thumbnail
314	6	Lunula of thumb
315	6	Nail bed of thumb
316	6	Nail plate of thumb
317	5	Pad of thumb
318	4	Index finger
319	5	Proximal phalanx of index finger
320	5	Proximal interphalangeal joint of index finger
321	5	Middle phalanx of index finger
322	5	Distal interphalangeal joint of index finger
323	5	Distal phalanx of index finger
324	5	Perionychium of index finger
325	6	Proximal nail fold of index finger
326	6	Eponychium of index finger
327	6	Lateral nail fold of index finger
328	6	Hyponychium of index finger
329	5	Index fingernail
330	6	Lunula of index finger
331	6	Nail bed of index finger
332	6	Nail plate of index finger
333	5	Pad of index finger
334	4	Middle finger
335	5	Proximal phalanx of middle finger
336	5	Proximal interphalangeal joint of middle finger
337	5	Middle phalanx of middle finger
338	5	Distal interphalangeal joint of middle finger
339	5	Distal phalanx of middle finger
340	5	Perionychium of ring finger
341	6	Proximal nail fold of middle finger

Continued

Table I. Cont'd

Index	Level	Surface Topography Hierarchical Classification
342	6	Eponychium of middle finger
343	6	Lateral nail fold of middle finger
344	6	Hyponychium of middle finger
345	5	Middle fingernail
346	6	Lunula of middle finger
347	6	Nail bed of middle finger
348	6	Nail plate of middle finger
349	5	Pad of middle finger
350	4	Ring finger
351	5	Proximal phalanx of ring finger
352	5	Proximal interphalangeal joint of ring finger
353	5	Middle phalanx of ring finger
354	5	Distal interphalangeal joint of ring finger
355	5	Distal phalanx of ring finger
356	5	Perionychium of ring finger
357	6	Proximal nail fold of ring finger
358	6	Eponychium of ring finger
359	6	Lateral nail fold of ring finger
360	6	Hyponychium of ring finger
361	5	Ring fingernail
362	6	Lunula of ring finger
363	6	Nail bed of ring finger
364	6	Nail plate of ring finger
365	5	Pad of ring finger
366	4	Little finger
367	5	Proximal phalanx of little finger
368	5	Proximal interphalangeal joint of little finger
369	5	Middle phalanx of little finger
370	5	Distal interphalangeal joint of little finger
371	5	Distal phalanx of little finger
372	5	Perionychium of little finger
373	6	Proximal nail fold of little finger
374	6	Eponychium of little finger
375	6	Lateral fold of little finger
376	6	Hyponychium of little finger
377	5	Little fingernail
378	6	Lunula of little finger
379	6	Nail bed of little finger
380	6	Nail plate of little finger
381	5	Pad of little finger
382	1	Lower extremity
383	2	Buttock
384	3	Gluteal fold
385	2	Thigh
386	3	Anterior surface of thigh
387	3	Lateral surface of thigh
388	4	Trochanteric region
389	3	Posterior surface of thigh
390	3	Medial surface of thigh
391	4	Upper medial surface of thigh
392	2	Knee
393	3	Patellar region
394	3	Lateral surface of knee
395	3	Popliteal fossa
396	3	Medial surface of knee
397	2	Lower leg
398	3	Anterior surface of lower leg
399	3	Lateral surface of lower leg
400	3	Posterior surface of lower leg
401	3	Medial surface of lower leg
402	2	Ankle
403	3	Anterior surface of ankle
404	3	Lateral surface of ankle
405	4	Lateral malleolus
406	3	Posterior surface of ankle
407	3	Medial surface of ankle
408	4	Medial malleolus

Continued

Table I. Cont'd

Index	Level	Surface Topography Hierarchical Classification
409	2	Foot
410	3	Hind Foot
411	4	Heel
412	5	Lateral surface of heel
413	5	Posterior surface of heel
414	5	Medial surface of heel
415	5	Plantar surface of heel
416	3	Mid Foot
417	4	Dorsal surface of midfoot
418	3	Forefoot
419	4	Dorsal surface of forefoot
420	4	Metatarsophalangeal joints
421	5	First metatarsophalangeal joint
422	5	Second metatarsophalangeal joint
423	5	Third metatarsophalangeal joint
424	5	Fourth metatarsophalangeal joint
425	5	Fifth metatarsophalangeal joint
426	4	Interdigital web spaces of foot
427	5	First interdigital web space of foot
428	5	Second interdigital web space of foot
429	5	Third interdigital web space of foot
430	5	Fourth interdigital web space of foot
431	4	Plantar surface of forefoot
432	5	Ball of foot (First metatarsal head region)
433	5	Second metatarsal head region
434	5	Third metatarsal head region
435	5	Fourth metatarsal head region
436	5	Fifth metatarsal head region
437	3	Sole of foot
438	4	Lateral surface of sole of foot
439	4	Medial surface of sole of foot
440	4	Arch of foot
441	3	Toes
442	4	Great toe
443	5	Proximal phalanx of great toe
444	5	Interphalangeal joint of great toe
445	5	Distal phalanx of great toe
446	5	Perionychium of great toe
447	6	Proximal nail fold of great toe
448	6	Eponychium of great toe
449	6	Lateral nail fold of great toe
450	6	Hyponychium of great toe
451	5	Great toenail
452	6	Lunula of great toe
453	6	Nail bed of great toe
454	6	Nail plate of great toe
455	5	Pad of great toe
456	4	Second toe
457	5	Proximal phalanx of second toe
458	5	Proximal interphalangeal joint of second toe
459	5	Middle phalanx of second toe
460	5	Distal interphalangeal joint of second toe
461	5	Distal phalanx of second toe
462	5	Perionychium of second toe
463	6	Proximal nail fold of second toe
464	6	Eponychium of second toe
465	6	Lateral nail fold of second toe
466	6	Hyponychium of second toe
467	5	Second toenail
468	6	Lunula of second toe
469	6	Nail bed of second toe
470	6	Nail plate of second toe
471	5	Pad of second toe
472	4	Third toe
473	5	Proximal phalanx of third toe
474	5	Proximal interphalangeal joint of third toe
475	5	Middle phalanx of third toe
476	5	Distal interphalangeal joint of third toe

Continued

Table I. Cont'd

Index	Level	Surface Topography Hierarchical Classification
477	5	Distal phalanx of third toe
478	5	Perionychium of third toe
479	6	Proximal nail fold of third toe
480	6	Eponychium of third toe
481	6	Lateral nail fold of third toe
482	6	Hyponychium of third toe
483	5	Third toenail
484	6	Lunula of third toe
485	6	Nail bed of third toe
486	6	Nail plate of third toe
487	5	Pad of third toe
488	4	Fourth toe
489	5	Proximal phalanx of fourth toe
490	5	Proximal interphalangeal joint of fourth toe
491	5	Middle phalanx of fourth toe
492	5	Distal interphalangeal joint of fourth toe
493	5	Distal phalanx of fourth toe
494	5	Perionychium of fourth toe
495	6	Proximal nail fold of fourth toe
496	6	Eponychium of fourth toe
497	6	Lateral nail fold of fourth toe
498	6	Hyponychium of fourth toe
499	5	Fourth toenail
500	6	Lunula of fourth toe
501	6	Nail bed of fourth toe
502	6	Nail plate of fourth toe
503	5	Pad of fourth toe
504	4	Fifth toe
505	5	Proximal phalanx of fifth toe
506	5	Proximal interphalangeal joint of fifth toe
507	5	Middle phalanx of fifth toe
508	5	Distal interphalangeal joint of fifth toe
509	5	Distal phalanx of fifth toe
510	5	Perionychium of fifth toe
511	6	Proximal nail fold of fifth toe
512	6	Eponychium of fifth toe
513	6	Lateral nail fold of fifth toe
514	6	Hyponychium of fifth toe
515	5	Fifth toenail
516	6	Lunula of fifth toe
517	6	Nail bed of fifth toe
518	6	Nail plate of fifth toe
519	5	Pad of fifth toe

Index, "Surface Topography Sorting Index;" Level, "Hierarchical level."

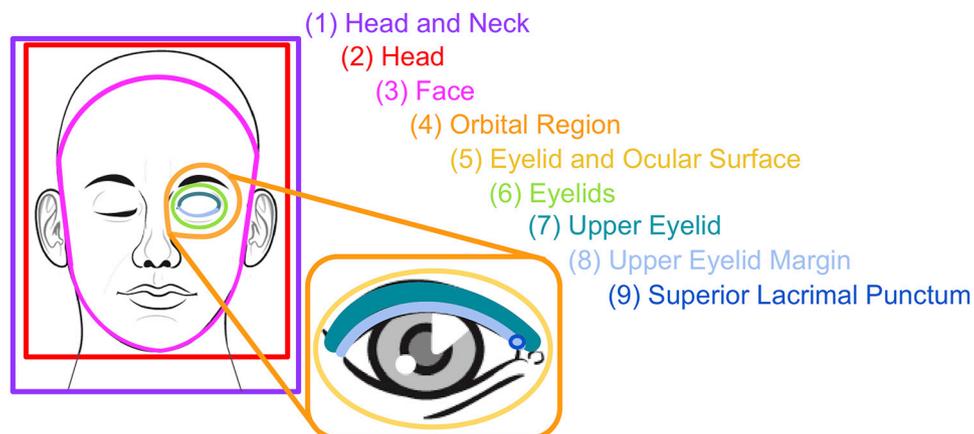


Fig 1. Demonstration of the hierarchical nature of the term set for the face with 9 hierarchical levels beginning with head and neck and terminating in superior lacrimal punctum. *Table II* shows the corresponding term synonyms and crosslinking to Systematized Nomenclature of Medicine terms and New York University numbers.

Table II. Demonstrating the hierarchical terminology structure depicted in the graphical abstract with correlated SNOMED terms and associated SCTIDs and NYU numbers

Surface topography sorting index	Hierarchical level	Surface topography hierarchical classification	Synonym	Closest SNOMED term match	Closest SNOMED match SCTID	Other SNOMED term matches	Other SNOMED match SCTIDs	Left NYU best match	Left NYU overlapping matches	Right NYU best match	Right NYU overlapping matches
1	1	Head and Neck	Head and neck	Entire skin of head and neck (body structure)	244067007	Entire head and neck (body structure) Entire skin of head and neck (body structure) Head and neck structure (body structure) Skin structure of head and neck Skin of part of head and neck (body structure)	361355005 774007 58308009 281707000		TMTL		TMTL
2	2	Head	Head	Entire skin of head (body structure)	181484006	Skin structure of head (body structure) Skin of part of head (body structure) Entire skin and subcutaneous tissue of head (body structure) Skin AND subcutaneous tissue structure of head (body structure)	70762009 281708005 731863002 389074000		TMTL		TMTL
37	3	Face	Face	Entire face (body structure)	302549007	Face structure (body structure) Region of face (body structure) Entire skin of face (body structure) Skin structure of face (body structure)	89545001 123853000 361703006 73897004		TMTL		TMTL
44	4	Orbital region	Orbital area	Entire orbital region (body structure)	181143004	Entire orbital margin (body structure) Eye region structure (body structure)	362641009 371398005		TMTL		TMTL
49	5	Eyelid and ocular surface	Eyelid and ocular surface	Entire conjunctiva (body structure)	181161008	Eyelid structure (body structure) Eyebrow and/or eyelid structures (body structure) Entire skin of eyelid (body structure) Skin structure of eyelid (body structure) Entire anterior aspect of eyelids (body structure) Structure of anterior aspect of eyelids (body structure) Skin structure of eyelid and periocular area (body structure) Structure of bulbar conjunctiva (body	305083001 80243003 245947005 51360009 368786008 22824006 399996007 1832000 264509009 721992008 721993003 29445007 305089002 363653001 28726007 314853007		105 107 113 115 109 111		104 106 112 114 108 110

					structure) Entire bulbar conjunctiva (body structure) Structure of left bulbar conjunctiva (body structure) Structure of right bulbar conjunctiva (body structure) Conjunctival structure (body structure) Conjunctival and/or corneal structures (body structure) Conjunctival and corneal surface structure (body structure) Corneal structure (body structure) Structure of surface of cornea (body structure) All corneal epithelium (body structure) Conjunctiva and cornea (combined site) (body structure) Entire anterior surface of cornea (body structure) Conjunctival and/or corneal structures (body structure) Conjunctival and corneal surface structure (body structure)	368825001 110703002 362509009 305089002 363653001		
50	6	Eyelids	Eyelid	Entire eyelid (body structure)	265782007 Eyelid structure (body structure) Eyebrow and/or eyelid structures (body structure) Entire skin of eyelid (body structure) Skin structure of eyelid (body structure) Entire anterior aspect of eyelids (body structure) Structure of anterior aspect of eyelids (body structure) Skin structure of eyelid and periocular area (body structure)	305083001 80243003 245947005 51360009 368786008 22824006 399996007	105 107 113 115	104 106 112 114
51	7	Upper eyelid	Eyelid - upper	Entire upper eyelid (body structure)	244499008 Upper eyelid structure (body structure) Entire skin of upper eyelid (body structure) Skin structure of upper eyelid (body structure) Skin of part of eyelid (body structure) Entire anterior lamella of upper eyelid (body structure)	38934000 245948000 41310005 360576009 363540007	105	104

Continued

Table II. Cont'd

Surface topography sorting index	Hierarchical level	Surface topography hierarchical classification	Synonym	Closest SNOMED term match	Closest SNOMED SCTID	Other SNOMED term matches	Other SNOMED match	SCTIDs	Left NYU best match	Left NYU overlapping matches	Right NYU best match	Right NYU overlapping matches
52	8	Upper eyelid margin	Eyelid - upper margin	Entire free margin of eyelid (body structure)	362527007	Entire skin of palpebral margins (body structure) Structure of free margin of eyelid (body structure) Skin structure of palpebral margins (body structure)	368770001 77024004 19701007		107		106	
53	9	Superior lacrimal punctum	Eyelid - superior lacrimal punctum	Entire upper lacrimal punctum (body structure)	728533002	Upper lacrimal punctum (body structure)	263345002		No matches		No matches	

TMTL= too many to list where a single number is not available and aggregate numbers for entire region are too numerous. No matches = no available NYU number corresponding to the new term.

epidemiologic tracking and analysis for dermatologic conditions, for which <10 locations are available (eg, skin of trunk and skin of upper limb and shoulder).

Each of these terminologies has its own weaknesses, with most systems being too specific, not specific enough, or too inclusive. While the United States has only recently transitioned to ICD-10, many countries have been using ICD-10 for well over a decade and are now making preparations for the recently released ICD-11. ICD-11 will enable disorders to be linked to precise anatomic locations including laterality and surface topography, a provisional new classification which was drawn up and agreed upon by members of the ICD-11 Dermatology Topic Advisory Group and co-opted experts at an international workshop held in Manchester, United Kingdom, in January 2014. This ad hoc Dermatology Anatomy Terminology Working Group was informed by existing classifications from the British Association of Dermatologists and the U.S. Anatomy Mapper project.⁴ An important issue considered at the workshop was the appropriate granularity to be incorporated, with recognition that creating a system that is too finely granular may inhibit adoption. Thus certain terms relevant only to aesthetic medicine (eg, “marionette line” and “tear trough”) have not been included. The group was able to achieve consensus (Table I). The proposed surface topography classification (ICD-ST) has been accepted by the World Health Organization for incorporation into the ICD-11. It was subsequently agreed upon at the International Skin Imaging Collaboration meeting held in 2017 in New York that ICD-ST should be used as the foundation for a Delphi Consensus study on classification of surface topography. ICD-ST represents a strong starting point for a future internationally standardized surface anatomy terminology.

To further expand our ICD-ST proposal, we are recommending adoption of the system of postcoordination built into ICD-11, which enables a set of “extensions” including location to be appended to stem concepts. Extensions allow for more specific data to be captured without an explosion in the number of codes required to achieve this, promising higher accuracy and precision than is currently available. The hierarchical nature of the proposed system with the facility to qualify enables different levels of anatomic detail to be recorded appropriately, ranging from large areas, for example “head and neck,” all the way down to the smallest areas (eg, “perionychium of the left fifth toe”). The ICD-ST is shown here as a flat table (ie, each term has only one parent) but when integrated into an electronic

Table III. Example of proposed hierarch with correlated SNOMED terms with associated SCTIDs and NYU numbers for the ear

Surface topography sorting index	Hierarchical level	Surface topography hierarchical classification	Synonym	Closest SNOMED term match	Closest SNOMED match SCTID	Other SNOMED term matches	Other SNOMED match SCTIDs	Left NYU best match	Left NYU overlapping matches	Right NYU best match	Right NYU overlapping matches
14	3	External ear	Outer ear	Entire external ear (body structure)	420893000	External ear structure (body structure) Skin structure of ear (body structure)	28347008 1902009		TMTL		TMTL
15	4	Pinna	Auricle	Pinna structure (body structure)	113327001	Entire skin of ear (body structure) Entire pinna (body structure) Skin structure of pinna (body structure)	244073008 421159007 44737009		TMTL		TMTL
16	5	Helix of pinna	External ear - helix	Entire helix of ear (body structure)	279607004	Helix structure (body structure) Entire skin of helix (body structure)	86153000 368606001	119	117 133 135	118	116 132 134
17	6	Crus of helix	External ear - helix - crus	Entire crus of helix (body structure)	362547004	Structure of crus of helix (body structure) Skin structure of crus of helix (body structure) Entire skin of crus of helix (body structure)	78743007 57726007 368605002	117		116	
18	6	Apex of helix	External ear - helix - apex Apex of pinna	No Matches	No Matches	No Matches	No Matches	119	117 133 135	118	116 132 134
19	6	Spine of helix	External ear - helix - spine	Entire spine of helix (body structure)	362535005	Structure of spine of helix (body structure) Skin structure of spine of helix (body structure) Entire skin of spine of helix (body structure)	78389002 25987008 368602004	119	117 133 135	118	116 132 134
20	6	Tail of helix	External ear - helix - tail	Entire tail of helix (body structure)	362536006	Structure of tail of helix (body structure) Skin structure of tail of helix (body structure) Entire skin of tail of helix (body structure)	55418004 89342002 368603009	119	117 133 135	118	116 132 134
21	5	Antihelix of pinna	External ear - antihelix	Entire antihelix (body structure)	279612003	Antihelix structure (body structure) Entire skin of antihelix (body structure) Skin structure of antihelix (body structure)	55881008 368608000 33294007	121	123	120	122
22	6	Crura of antihelix	External ear - antihelix - crura	Entire crura of antihelix (body structure)	362539004	Entire skin of crura of antihelix (body structure) Structure of crura of antihelix (body structure)	368607005 113328006	121		120	

Continued

Table III. Cont'd

Surface topography sorting index	Hierarchical level	Surface topography hierarchical classification	Synonym	Closest SNOMED term match	Closest SNOMED match SCTID	Other SNOMED term matches	Other SNOMED match SCTIDs	Left NYU best match	Left NYU overlapping matches	Right NYU best match	Right NYU overlapping matches
23	6	Scaphoid fossa of pinna	External ear - scaphoid fossa	Entire scaphoid fossa (body structure)	362540002	Scaphoid fossa structure (body structure) Entire skin of scaphoid fossa of external ear (body structure) Skin structure of scaphoid fossa of external ear (body structure)	82024001 368610003 20166000	121		120	
24	5	Concha	External ear - concha	Entire skin of concha (body structure)	368615008	Concha of ear structure (body structure) Skin structure of concha (body structure) Entire concha of ear (body structure) Skin of part of concha (body structure)	52678007 21439001 361669004 360590007	125		124	
25	6	Cymba conchae	External ear - cymba conchae	Entire skin of cymba conchae (body structure)	368613001	Cymba conchae structure (body structure) Skin structure of cymba conchae (body structure) Entire cymba conchae (body structure)	68530009 44767003 362545007	125		124	
26	6	Conchal bowl of pinna	External ear - conchal bowl	Entire skin of cavity of concha (body structure)	368614007	Structure of cavity of concha (body structure) Skin structure of cavity of concha (body structure) Entire cymba conchae (body structure) Entire cavity of concha (body structure)	42407000 51098001 362545007 362546008	125		124	
27	5	Triangular fossa of pinna	External ear - triangular fossa	Entire fossa triangularis of ear (body structure)	362538007	Structure of fossa triangularis of ear (body structure) Entire skin of fossa triangularis of ear (body structure) Skin structure of fossa triangularis of ear (body structure)	31136007 368609008 82858008	121		120	
28	5	Tragus of pinna	External ear - tragus	Entire tragus (body structure)	362541003	Tragus structure (body structure) Entire skin of tragus (body structure) Skin structure of tragus (body structure)	59581006 244076000 79502000	127		126	
29	5	Intertragic notch of pinna	External ear - intertragic notch	Entire intertragal incisure (body structure)	362542005	Intertragal incisure structure (body structure) Skin structure of intertragal incisure (body structure)	3362007 45591000 368611004	129		128	

30	5	Lobule of pinna	External ear - lobule Earlobe	Entire ear lobule (body structure)	362544006	Entire skin of intertragal incisure (body structure) Ear lobule structure (body structure) Entire skin of ear lobule (body structure) Skin structure of ear lobule (body structure)	48800003 244077009 2059009	131	141	130	140
31	5	Antitragus of pinna	External ear - antitragus	Entire antitragus (body structure)	362543000	Antitragus structure (body structure) Skin structure of antitragus (body structure) Entire skin of antitragus (body structure)	24264001 38407007 368612006	123		124	
32	5	Posterior surface of pinna	External ear - posterior surface	No Matches	No matches	Structure of eminentia conchae (body structure) Entire eminentia conchae (body structure)	87789006 368638006	137 139	133 135	136 138	132 134
33	5	Retroauricular sulcus	External ear - retroauricular sulcus postauricular sulcus	Entire postauricular region (body structure)	362623001	Entire skin of postauricular region (body structure) Skin structure of postauricular region (body structure) Postauricular region structure (body structure)	244080005 24483006 81124000	10		9	
34	4	External auditory canal	External ear - auditory canal	Entire external auditory canal (body structure)	181178004	External auditory canal structure (body structure) Skin of external auditory canal (body structure) Entire skin of external auditory canal (body structure)	84301002 86409001 361704000	No matches		No matches	
35	5	External auditory meatus	External ear - auditory canal opening Meatus of external auditory canal	Entire external auditory canal opening (body structure)	279654000	Structure of external auditory canal opening (body structure)	67283004	No matches		No matches	
36	5	Tympanic membrane	Eardrum	Entire tympanic membrane (body structure)	181180005	Tympanic membrane structure (body structure) Region of tympanic membrane (body structure)	42859004 272648000	No matches		No matches	

TMTL = too many to list where a single number is not available and aggregate numbers for entire region are too numerous. No matches = no available NYU Number corresponding to the new term.

Table IV. Example of proposed hierarchy with correlated SNOMED terms with associated SCTIDs and NYU numbers for the nose

Surface topography sorting index	Hierarchical level	Surface topography hierarchical classification	Synonym	Closest SNOMED term match	Closest SNOMED match SCTID	Other SNOMED term matches	Other SNOMED match SCTIDs	Left NYU best match	Left NYU overlapping matches	Right NYU best match	Right NYU overlapping matches
80	4	Nose	Nose	Entire nose (body structure)	181195007	Entire external nose (body structure) Nose (surface region) (body structure) Nasal structure (body structure) Skin structure of nose (body structure) Entire skin of nose (body structure) External nose structure (body structure) Region of nose (body structure) Skin of external nose (body structure) Region of external nose (body structure)	265785009 182324007 45206002 113179006 244085000 44032009 279542008 245501006 314742005		15 17 19 21 23		16 18 20 22 24
81	5	Root of nose	Nose - root	Entire root of nose (body structure)	1825009	Structure of root of nose (body structure) Entire skin of root of nose (body structure) Skin structure of root of nose (body structure)	368121008 399987007 400033007	19	7	20	8
82	5	Dorsum of nose	Nose - dorsum	Entire dorsum of nose (body structure)	368114008	Structure of dorsum of nose (body structure)	84047001	19		20	
83	6	Supratip of nose	Nose - supratip	Entire supratip of nose (body structure)	399896008	Structure of supratip of nose (body structure) Entire skin of supratip of nose (body structure) Skin structure of supratip of nose (body structure)	400205004 400041007 400203006	21		22	
84	5	Lateral side wall of nose	Nose - lateral side wall	Skin of lateral nose structure (body structure)	314395006	Skin of side of nose (body structure) Skin of part of nose (body structure) Skin of lateral nose structure (body structure)	244089006 281714003 314395006	17	15	18	16

85	5	Tip of nose	Nose - tip	Entire apex of nose (body structure)	361926005	Structure of apex of nose (body structure) Skin structure of tip of nose (body structure) Entire skin of tip of nose (body structure)	81001005 79283007 244090002	21		22	
86	6	Infratip lobule of nose	Nose - infratip lobule	No matches	No matches	No matches	No Matches	21	23	22	24
87	5	Ala nasi	Nose - ala	Entire ala nasi (body structure)	361345006	Entire skin of ala nasi (body structure) Alar structure (body structure) Skin structure of ala nasi (body structure)	244087008 61913009 68598004	23		24	
88	6	Side wall of ala nasi	Nose - alar sidewall	No specific matches	No specific matches	Skin of side of nose (body structure) Skin of part of nose (body structure) Alar structure (body structure)	244089006 281714003 61913009	23		24	
89	6	Alar groove	Nose - alar groove	No specific matches	No specific matches	Skin of part of nose (body structure) Alar structure (body structure)	281714003 61913009	No specific match	23 17 15	No specific match	24 18 16
90	6	Alar rim	Nose - alar rim	No specific matches	No specific matches	Skin of part of nose (body structure) Alar structure (body structure)	281714003 61913009	23		24	
91	5	Nostril	Nare	Both anterior nares (body structure)	244506005	Structure of anterior naris (body structure) Entire left anterior naris (body structure) Entire right anterior naris (body structure)	1797002 421652004 421814002	No matches		No matches	
92	6	Sill of nostril	Nose - sill of nostril	No matches	No matches	No matches	No matches	No specific match	23	No specific match	24
93	6	Columella	Nose - columella	Entire columella (body structure)	361930008	Columella structure (body structure) Skin structure of lower margin of nasal septum (body structure)	113249009 40021003	No specific match	23	No specific match	24

No matches, No available NYU Number corresponding to the new term; *TMTL*, too many to list where a single NYU number is not available and aggregate numbers for entire region are too numerous.

environment, as in ICD-11 (<https://icd.who.int/browse11/>), can have a polyhierarchical architecture, enabling any term to be accessed, if appropriate, via more than one route. Extensions to surface topography terms, such as laterality, directional additions, histologic subtype, and Boolean values, can transform “squamous cell carcinoma of nose” to “recurrent, previously irradiated, invasive squamous cell carcinoma of the left posterosuperior lateral sidewall of nose,” for example.

ANATOMY MAPPING

The need for standardized anatomic terms is clear, but accurate use of terms is partly dependent on the user, because knowledge of anatomy is required, particularly in areas with nondiscrete borders. A potential solution to this issue is computerized anatomic mapping. With visual maps, an accurate term can be easily generated with a single click. With the increasing sophistication of computer graphics and their incorporation into electronic health record systems via computers, tablets, smartphones, smart cameras enabled with digital imaging communication in medicine (DICOM) functionality or other means, there is opportunity for increasingly precise, accurate, thorough documentation, which may become a requirement for full reimbursement in the future in many countries. With a potential shift to value-based payments, it is important that dermatologists thoroughly document the treatments they perform in order to illustrate the value and extent of the services they provide in a given encounter, a focus of the American Academy of Dermatology’s DataDerm initiative.⁵ An appropriately designed user interface with standardized clickable body surface graphics incorporated into the electronic health record will enable this to be done in an accurate and reliable manner. In busy practices or when technical difficulties, such as a crashed server, occur, historical, established maps or the maps presented on anatomymapper.com can be printed and sites manually marked by providers for later documentation by medical assistants. In addition to being fast and easy, maps may serve as an educational tool to assist staff and medical trainees in learning the terminology themselves.

An anatomic numbering system (hereby referred to as NYU Numbers) was created under the direction of Dr Alfred W. Kopf for The New York University Melanoma Cooperative Group in 1972 and has been used at a number of well-respected institutions throughout the years, including New York University, Memorial Sloan Kettering Cancer Center, Cleveland Clinic, and Mayo Clinic.⁶ The

NYU Numbers have distinctly bordered surface regions labeled with numbers rather than text-based terms. This map has sometimes arbitrary borders on areas such as the scalp, which has a single defined area that most would regard as including both the parietal and occipital scalp regions. Furthermore, the NYU Numbers do not have a standardized or widely used legend correlating the numbers with anatomic topography terms, and therefore it does not assist in the generation of descriptive anatomic terms for documentation.

Anatomy Mapper is an easy-to-use web-based interactive map, created by one of the authors, that displays a precise anatomic term on hovering over a specific body location, enabling its text descriptor to be exported with a mouse click.⁷ There are many advantages to this type of system that pairs terms with a map, including increased accuracy, increased efficiency, and improved interoperator agreement. While this system efficiently generates text-based documentation, it does not yet have a publicly available image markup facility.

Finally, there are commercial dermatology-specific electronic health record systems with and without maps that enable fast, accurate documentation. Some systems function in 2 dimensions while others provide 3-dimensional (3D) maps for the notation of lesions. While 3D maps facilitate the precise documentation of lesions on curved body areas, increased time in mouse clicks and model rotations causes decreased overall efficiency. While 2-dimensional maps can be printed and notated in times of technology failure or to increase the speed of documentation, the same cannot be said for 3D maps. Therefore, while there are obvious advantages to 3D models, they are not without their drawbacks. There are clear advantages to the even more advanced systems that incorporate photograph documentation superimposed on a map or assist in coding of location or diagnosis. All of these dermatology-specific systems are, however, generally expensive and unlikely to be accessible to primary care physicians, nondermatologists, or physician extenders, all of whom are performing more dermatologic evaluations and obtaining more biopsy specimens. In addition, the need for a publicly available standardized terminology set that can be adopted by the international community is not being met by these proprietary systems.

DICOM began as a radiology initiative in 1993 to establish standards for the formatting, storage, printing, and secure transmission of medical images and has since crossed over into a number of specialties, including dermatology.^{8,9} Photographs encoded as DICOM images that can be uploaded to

picture archiving and communication systems are becoming increasingly common, especially since the advent of DICOM cameras and smartphone applications. While these photographs are immensely useful for tracking lesions over time and sharing among providers, the “body part examined” DICOM terminology set used to identify the photographed lesion location is weak, consisting of only 25 location terms, with a laterality notation.⁹ With such a minimal number of surface topography terms available, when photographs are taken close-up it may be difficult to discern the true location of the lesion(s) imaged, particularly if only close-up views are available. Therefore, even the criterion standard in medical photography has significant room for improvement.

Although we do not claim that we have presented an exhaustive list of available maps or topographic term lexicons, we have attempted to illustrate the advantages and pitfalls of each and to propose a system that avoids the dangers we have highlighted by combining standardized terms with detailed anatomic surface maps.

While standardized anatomic maps are promising tools, they should be considered an adjunct to—rather than a replacement for—photographic documentation. Photographs are the best way to record the precise location of a lesion in a given individual and are especially important for those occurring at the borders of anatomic regions (eg, posterior shoulder vs back) where no clear boundaries exist.

PROPOSAL FOR A HIERARCHICAL TERMINOLOGY SYSTEM CROSS-LINKING ICD TOPOGRAPHY TO SNOMED CT AND NYU NUMBERS

We have described a new detailed surface anatomy terminology classification that will be a component part of the recently released ICD-11. Terms have been arranged in a hierarchical format for ease of use with 9 levels of granularity. There exist 5 level 1 terms, 20 level 2 terms, 68 level 3 terms, 77 level 4 terms, 180 level 5 terms, 136 level 6 terms, 26 level 7 terms, 5 level 8 terms, and 2 level 9 terms (Table I). Approximately 2000 SNOMED terms with SCTID codes and 310 NYU Numbers were then cross-linked back to the 519 standardized terms. A representation of the hierarchical format of the terms is shown in Figure 1 and the corresponding linkage to SNOMED and NYU Numbers (Table II). In correlating anatomic locations across systems, a larger standardized data pool is created for retrospective analysis and prospective tracking of topographic

data from NYU Numbers and SNOMED. Though not a part of the original 519 terms, we propose the addition of 32 optional qualifiers, such as “posterolateral,” “superomedial,” etc, for optional further subdivision of larger areas. These qualifiers were in some cases included in SNOMED terms but never in NYU Numbers. Our cross-linking of SNOMED/SCTID and NYU Numbers can be accessed online at <http://anatomymapper.com/terms>.¹⁰ Two important sites for dermatologic oncology are the ear and nose, which are poorly represented in existing classifications. Examples of the granularity of the proposed terminology set crosslinked to SNOMED/SCTID and NYU Numbers for the ear and nose can be seen in Tables III and IV.

To complement our cross-mapping and for historical reference, we have generated an interactive NYU Numbers map with the most precise anatomic terms possible linked to each of the numbered and bordered regions, which can be accessed at <http://anatomymapper.com/nyu>.¹⁰ Also included on this site are the best match anatomic descriptors for all NYU Numbers; as previously noted, not all NYU Numbers have clearly defined or anatomically correct borders. Terms were generated to best describe the NYU Number regions and thus they are not identical to the proposed 519 proposed terms.

In conclusion, the need for a standardized, widely used surface anatomy terminology is evident. None of the currently available terminologies is ideally suited for universal adoption. In creating a more complete and precise yet concise set of surface anatomy terms, we sought to create a language to facilitate improved interprovider communication, generation of a rich dataset that may be used for clinical and epidemiologic research, quality monitoring, recurrence monitoring, and to ensure the correct treatment site. The proposed terminology set of 519 nonlateralized terms incorporates the strengths of existing systems while avoiding excessive granularity, a factor that could inhibit adoption. We recognize that this proposed set of terms will require further validation and consensus building to achieve universal adoption. We further anticipate that more granularity, including lateralization, will be added as electronic documentation becomes ubiquitous, making such granularity broadly practical.

The fact that ICD-ST has been accepted by the World Health Organization and is incorporated into the recently released ICD-11 should prove a spur to its wider adoption by clinicians. Furthermore, by crosslinking the NYU Numbers map and SNOMED-CT terms to our terminology, we hope to facilitate the transition to ICD-ST for institutions using NYU

Numbers and SNOMED-CT–based systems. Finally, the proposed terminology set is freely available for open access online in the public domain in the hopes of promoting adoption and providing a foundation for the generation of increasingly practical systems of accurate, consistent, and precise anatomic labeling.

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