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The appropriate use criteria process synthesizes evidence-based medicine, clinical practice experience, and expert judgment. The American Academy of Dermatology in collaboration with the American College of Mohs Surgery, the American Society for Dermatologic Surgery Association, and the American Society for Mohs Surgery has developed appropriate use criteria for 270 scenarios for which Mohs micrographic surgery (MMS) is frequently considered based on tumor and patient characteristics. This document reflects the rating of appropriateness of MMS for each of these clinical scenarios by a ratings panel in a process based on the appropriateness method developed by the RAND Corp (Santa Monica, CA)/University of California Los Angeles (RAND/UCLA).

At the conclusion of the rating process, consensus was reached for all 270 (100%) scenarios by the Ratings Panel, with 200 (74.07%) deemed as appropriate, 24 (8.89%) as uncertain, and 46 (17.04%) as inappropriate. For the 69 basal cell carcinoma scenarios, 53 were deemed appropriate, 6 uncertain, and 10 inappropriate. For the 143 squamous cell carcinoma scenarios, 102 were deemed appropriate, 7 uncertain, and 34 inappropriate. For the 12 lentigo maligna and melanoma in situ scenarios, 10 were
deemed appropriate, 2 uncertain, and 0 inappropriate. For the 46 rare cutaneous malignancies scenarios, 35 were deemed appropriate, 9 uncertain, and 2 inappropriate.

These appropriate use criteria have the potential to impact health care delivery, reimbursement policy, and physician decision making on patient selection for MMS, and aim to optimize the use of MMS for scenarios in which the expected clinical benefit is anticipated to be the greatest. In addition, recognition of those scenarios rated as uncertain facilitates an understanding of areas that would benefit from further research. Each clinical scenario identified in this document is crafted for the average patient and not the exception. Thus, the ultimate decision regarding the appropriateness of MMS should be determined by the expertise and clinical experience of the physician. (J Am Acad Dermatol 10.1016/j.jaad.2012.06.009.)

**Key words:** appropriate use criteria; dermatology; lentigo maligna; melanoma in situ; Mohs micrographic surgery; nonmelanoma skin cancer.

### DISCLAIMER

These appropriate use criteria are intended to guide clinical decision making regarding dermatologic treatment. Generally, the complexity and severity of a patient’s clinical condition should dictate the selection of appropriate dermatologic procedures or treatments. The availability of equipment or personnel may influence the selection of appropriate diagnostic or therapeutic procedures or treatments. Adherence to these criteria will not ensure successful treatment in every situation. Furthermore, these criteria should not be interpreted as setting a standard of care, or be deemed inclusive of all proper methods of care nor exclusive of other methods of care reasonably directed to obtaining the same results, even for those indications scored as inappropriate. The ultimate judgment regarding the propriety of any specific diagnostic or therapeutic treatment must be made by the physician and the patient in light of all the circumstances presented by the individual patient, and the known variability and biological behavior of the presenting disease. These criteria reflect the best available data and expert judgment at the time of development. The results of future studies may require revisions to these criteria to reflect new data and patient scenarios.

### INTRODUCTION

This report addresses the appropriate use of Mohs micrographic surgery (MMS) in the treatment of cutaneous neoplasms. In the United States in 2006, there were an estimated 3.5 million nonmelanoma skin cancers diagnosed, and it is projected that there will be nearly 4 million new cases of nonmelanoma skin cancer diagnosed in the United States each year. Similarly, the incidence of melanoma in situ continues to increase with an estimated 55,560 to be newly diagnosed in 2012, with many of these likely to be of the lentigo maligna (LM) subtype.

Because of this epidemic of skin cancer and an increase in the number of dermatologists trained in MMS, the use of this treatment modality has expanded significantly in recent years. In fact, the use of MMS increased by 400% from 1995 to 2009, and currently 1 in 4 skin cancers is being treated with MMS. As the incidence of skin cancer continues to climb and the...
field of MMS continues to advance, dermatologists, primary care providers, Mohs surgeons, and the health care community in general will need to understand how to best use MMS in the treatment of skin cancer.

This appropriate use criteria (AUC) document from the American Academy of Dermatology (AAD), American College of Mohs Surgery, American Society for Dermatologic Surgery Association, and American Society for Mohs Surgery reflects an ongoing effort to systematically review and categorize the appropriate use of MMS. This publication is not a comparative document of different modalities used to treat cutaneous malignancy, but a document that pertains solely to the use of MMS and the appropriateness of MMS in certain clinical scenarios. It is thus important to understand the background and scope of this publication before interpreting the rating tables.

METHODS

Evidence review

The development of this document was supported by an evidence review and analysis of surgical and disease outcomes related to the practice of MMS within the United States. The following additional search limitations were placed on the evidence review:

- Search years: 1940 to 2011 (with corrections for overlapping study populations)
- Case series of n ≥ 3 included.
- Case reports included if no other evidence available.
- Data from Chemosurgery: Microscopically Controlled Surgery for Skin Cancer, by Frederick E. Mohs, MD, have been included with correction for duplicative information from journal publications.

In total, 161 primary articles were identified and analyzed for the development of the supporting evidence tables for the MMS AUC: 53 for basal cell carcinoma (BCC), 63 for squamous cell carcinoma (SCC), 6,8,10,13,15,16,18-21,23,24,25,26,39-42,45,46,48,49,54,58-96 23 for LM and melanoma in situ, 10,41,97-117 20 for disease outcomes related to the practice of MMS within the United States. The following additional search limitations were placed on the evidence review:

- Case series of n ≥ 3 included.
- Case reports included if no other evidence available.
- Data from Chemosurgery: Microscopically Controlled Surgery for Skin Cancer, by Frederick E. Mohs, MD, have been included with correction for duplicative information from journal publications.

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Development of clinical indications

The indications included in this document cover a wide array of dermatologic tumor and patient characteristics encompassing the scenarios most often encountered in the contemporary clinical setting. The developed indications are not intended to be a comprehensive roster of the scenarios for which MMS could be considered, but are intended to represent approximately 85% of anticipated clinical scenarios. Although the majority of the indications in this document involve malignant neoplasms, certain benign neoplasms were also included because of their potential for locally aggressive and destructive growth, in spite of their inability to metastasize. In addition, although the Ad Hoc Task Force (AHTF) initially considered including invasive melanoma in the rating, because of the complexity of the issue, the AHTF unanimously concluded that it not be included in these AUC.

In developing the clinical indications and supporting information for this document, the 2011 National Comprehensive Cancer Network (NCCN) clinical guidelines on nonmelanoma skin cancer, 187 the 2011 updates to the American Joint Committee on Cancer staging system for SCC, 188 the 15 current Medicare carrier local coverage determination poli-

cies, 189 the 1995 AAD clinical practice guidelines for MMS, 190 and the available literature defined by the evidence review were taken into consideration.

The indications were initially developed by members of the AHTF; modified after independent review by indication reviewers, a group composed of 44 prominent dermatologists from across the country and representatives from 2 Medicare carrier organizations; and finalized after in-person clarification and refinements by the Ratings Panel (RP) with AHTF final approval. Thus 70 experts reviewed and approved these scenarios. Fig 1 illustrates the mul-

tiple layers of the MMS AUC development process.

Rating process

The AUC process combines evidence-based medicine, clinical practice experience, and expert judgment by engaging a RP in a modified Delphi exercise based on the validated appropriateness method of RAND/UCLA, with the incorporation of modifications developed by the American College of Cardiology (consideration of cost) and the American College of Radiology (consensus-based ratings determination). 191-193 The 17-member panel was composed of 8 Mohs surgeons and 9 non-Mohs dermatologists representing various regions of the country, practice settings, and specialty interests. This was done to increase the breadth of panel experience and to minimize bias.

Successive rounds (3 rounds total) of individual scoring before and after a face-to-face meeting (post-round 1) and conference-call discussions (post-round
2) by the panelists allowed opportunity for all interpretations of evidence and clinical viewpoints to be exchanged, with the goal to achieve ratings consensus where possible. RP members were provided the evidence review tables and all current US guidelines on skin cancers covered by this document. Panel members were not provided detailed, explicit cost information in determining their appropriate use ratings, although they were provided access to 8 published US studies with related information. In review of this information, they were asked to implicitly consider cost as an additional factor in their evaluation of appropriate use.

For each meeting of the RP, panel members were provided a blinded summary of the group’s scores with their own ratings highlighted for reference and comparison. The rating of each indication was facilitated using a 9-point scale, broken out as follows:

- **Score 7 to 9.** The use of MMS is **appropriate** for the specific indication and is generally considered acceptable.
- **Score 4 to 6.** The use of MMS is **uncertain** for the specific indication, although its use may be appropriate and acceptable. Uncertainty implies that more research is needed to classify the indication definitively.
- **Score 1 to 3.** The use of MMS is **inappropriate** for the specific indication and is generally not considered acceptable.

In rating each indication, the following definition of appropriate use was provided to the panel: “An appropriate treatment modality is one in which the anticipated clinical benefit* combined with clinical judgment, exceeds the possible negative consequences** for a specific indication.”

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*Anticipated clinical benefits of MMS may include high cure rate related to total margin assessment, low rate of recurrence, small defect size, range of reconstructive possibilities, retention of functional capacity, and low morbidity and mortality.

**Negative clinical consequences of MMS may include the possible risks of an extended surgical procedure under local anesthesia, risk of incorrectly interpreted margins, and risks associated with office-based surgery.
Consensus is defined as at least 12 of the 17 panel members rating the procedure within the same 3-score category (appropriate, uncertain, inappropriate). The delineation of the scoring categories into 3 levels per the RAND/UCLA appropriate use methodology is arbitrary; therefore the numeric designations should be viewed as a continuum.

The final appropriate use category was determined by the median score for each indication where consensus was achieved via the 3-round rating process. After 3 rounds of scoring, the final rating for each indication that did not reach consensus was determined via panel e-mail ballot; the round-3 median score was proposed as the final value for each of those indications. Consistent with the definition of consensus for the individual rounds of rating, if at least 12 of the 17 panel members approved the proposed score, the indication was determined to have reached consensus. The final scores generated by the RP were accepted and not altered by the AHTF or other approval bodies in keeping with the RAND/UCLA appropriateness method.

RATING CONSIDERATIONS

To prevent any inconsistencies in interpretation, specific considerations and assumptions for the appropriate use of MMS were understood by the AHTF and RP in developing and rating all indications.

1. The MMS AUC address the merits of the MMS modality alone and not in comparison with other modalities for the presented clinical scenarios. For each indication, the rating should reflect whether MMS is reasonable for the patient according to the appropriate use definition, not whether MMS is preferred over another modality. That is, the AUC are not to be translated as a comparative effectiveness document. To do the latter, it would be necessary to first determine an appropriateness rating for each possible treatment modality before true comparisons could be made, a task outside the scope of the current document.

2. Panelists may consider cost, age, and cosmesis in each clinical scenario to facilitate a rating determination as follows:

a. Cost may be considered in the appropriate use determination, albeit not explicitly, as a secondary consideration in relationship to clinical benefits once these have been determined for the patient represented in the clinical indication. By considering cost in this manner, the AUC facilitate the clinical care assessment process in the environment of constrained financial resources.

b. In developing the clinical indications, the AHTF recognized that patient age and cosmesis may also impact the clinical decision to use MMS. Yet, patient age represents a continuum with indistinct categories, and the importance of cosmesis, that is, the aim to return the patient to a near normal appearance, is similarly difficult to strictly categorize based on tumor and/or patient characteristics.

3. A clinical history and physical examination has been completed such that the clinical status of the patient can be assumed to be valid as stated in the indication (eg, healthy, immunocompromised), and the patient is determined to be a good candidate for MMS.

4. Ideally, tumor characteristics are best defined with a biopsy specimen into the deep reticular dermis, if more than a superficial lesion is suspected, as recommended by the NCCN.187

5. Available data demonstrate that the initial partial biopsy specimen may misrepresent pathological findings of final tumor characteristics206-212; the later findings may supersede those of the initial biopsy specimen as the indication for consideration of MMS. In addition, if for any reason, based on tumor type/subtype, size, or location, the lesion can be assigned to more than 1 indication (eg, coexistence of 2 subtypes of BCC within the same lesion), it should be classified according to the most aggressive feature.

6. Documentation of the clinical tumor border definition may be accomplished by preoperative photography with the skin stretched to delineate the visible clinical borders: (a) with or without debulking curettage (using a centimeter ruler or relation of size by another anatomic structure); or (b) with possible use of photodynamic therapy, 5-fluorouracil, or other method. Postoperative photography to document the defect may also be considered, especially for small lesions that have a significant subepithelial component (ie, tip of the iceberg phenomenon). It is understood that photographic documentation may not be possible in a small percentage of cases because of technical difficulties.
7. The tumor is not arising in prior radiated skin, a traumatic scar, an area of osteomyelitis, or an area of chronic inflammation/ulceration unless otherwise specified.

8. The category of uncertain may be used when insufficient clinical data are available for definitive categorization or there is varying agreement regarding the appropriateness of MMS for that indication. This rating should be interpreted as indicating the need for further research and not as an indicator that MMS is inappropriate. A final rating of uncertain should not equate with grounds for denial of payment.

DEFINITIONS

Mohs micrographic surgery

As defined by the American Medical Association Current Procedural Terminology (American Medical Association, Chicago, IL), MMS is a technique for the removal of complex or ill-defined skin cancer with histologic examination of 100% of the surgical margins. It is a combination of surgical excision and surgical pathology that requires a single physician to act in 2 integrated but separate and distinct capacities: surgeon and pathologist. If either of these responsibilities is delegated to another physician who reports the services separately, these codes should not be reported. The Mohs surgeon removes the tumor tissue and maps and divides the tumor specimen into pieces, and each piece is embedded into an individual tissue block for histopathologic (hematoxylin-eosin or toluidine blue) examination. Thus, a tissue block in MMS is defined as an individual tissue piece embedded in a mounting medium for sectioning.213

Areas of body

- Area H: “Mask areas” of face (central face, eyelids [including inner/outer canthi], eyebrows, nose, lips [cutaneous/mucosal/vermillion], chin, ear and periauricular skin/sulci, temple), genitalia (including perineal and perianal), hands, feet, nail units, ankles, and nipples/areola.
- Area M: Cheeks, forehead, scalp, neck, jawline, pretibial surface.
- Area L: Trunk and extremities (excluding pretibial surface, hands, feet, nail units, and ankles).

Patient characteristics

- Immunocompromised: patient with HIV, organ transplant, hematologic malignancy, or pharmacologic immunosuppression.
- Genetic syndromes: basal cell nevus syndrome, xeroderma pigmentosum, or other syndromes at high risk for skin cancer.
- Healthy: no immunosuppression, prior radiation therapy, chronic infections, or genetic syndromes.
- Prior radiated skin: patient has previously received therapeutic radiation in this area of the body.
- Patient known to have high-risk tumors: patient without other known health risk factors but with a history of unexpectedly more aggressive tumors than suggested by clinical appearance.

Tumor characteristics

Positive margin on recent excision. Unexpected tumor involvement at lateral and/or deep edges after prior excision presumed to have been definitive.

Aggressive features (eg, high-risk for recurrence)

- For BCC:
  - Morpheaform/fibrosing/sclerosing
  - Infiltrating
  - Perineural
  - Metatypical/keratotic
  - Micronodular
- For SCC:
  - Sclerosing
  - Basosquamous (excluding keratotic BCC)
  - Small cell
  - Poorly or undifferentiated (characterized by a high degree of nuclear polymorphism, high mitotic rate, or low degree of keratinization)
  - Perineural/perivascular
  - Spindle cell
  - Pagetoid
  - Infiltrating
  - Keratoacanthoma (KA) type: central facial
  - Single cell
  - Clear cell
  - Lymphoepithelial
  - Sarcomatoid
  - Breslow depth 2 mm or greater
  - Clark level IV or greater

RESULTS

The final ratings for the appropriate use of MMS are listed by indication in Tables I to V, and summarized by final rating category in Table VI. The final score reflects the median score of the 17 RP members, and is labeled according to the 3 appropriate use categories as appropriate (median 7-9), uncertain (median 4-6), and inappropriate (median 1-3).

A total of 270 clinical scenarios were evaluated by the RP. After 3 rounds of scoring, the RP reached consensus on 205 (75.93%) scenarios with 168 (81.95%) of those scenarios deemed as appropriate,
Table I. Basal cell carcinoma

A. Recurrent BCC of any size, or unexpected positive margin on recent excision (healthy or immunocompromised patients, or patients with genetic syndromes)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Pathology</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
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</thead>
<tbody>
<tr>
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<td>Aggressive</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (7)</td>
</tr>
<tr>
<td>2</td>
<td>Nodular</td>
<td>A (9)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>3</td>
<td>Superficial</td>
<td>A (7)</td>
<td>A (7)</td>
<td></td>
</tr>
</tbody>
</table>

B. Primary aggressive BCC (healthy or immunocompromised patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
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<th>Area M</th>
<th>Area L</th>
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<tbody>
<tr>
<td>4</td>
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<td>A (8)</td>
<td>A (8)</td>
<td>U (6)</td>
</tr>
<tr>
<td>5</td>
<td>0.6-1</td>
<td>A (9)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>6</td>
<td>1.1-2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (8)</td>
</tr>
<tr>
<td>7</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (8)</td>
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C. Primary nodular BCC (healthy patients)

<table>
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<td>A (7)</td>
<td>A (7)</td>
<td>I (3)</td>
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<tr>
<td>9</td>
<td>0.6-1</td>
<td>A (8)</td>
<td>A (8)</td>
<td>I (3)</td>
</tr>
<tr>
<td>10</td>
<td>1.1-2</td>
<td>A (9)</td>
<td>A (8)</td>
<td>U (6)</td>
</tr>
<tr>
<td>11</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (7)</td>
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D. Primary nodular BCC (immunocompromised patients)

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<td>12</td>
<td>≤0.5</td>
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<td>A (7)</td>
<td>I (3)</td>
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<tr>
<td>13</td>
<td>0.6-1</td>
<td>A (9)</td>
<td>A (8)</td>
<td>U (5)</td>
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<tr>
<td>14</td>
<td>1.1-2</td>
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<td>A (9)</td>
<td>A (7)</td>
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<tr>
<td>15</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (7)</td>
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E. Primary superficial BCC (healthy patients)

<table>
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<tr>
<th>Indication</th>
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<th>Area M</th>
<th>Area L</th>
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<td>≤0.5</td>
<td>A (7)</td>
<td></td>
<td>U (4)</td>
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<tr>
<td>17</td>
<td>0.6-1</td>
<td>A (7)</td>
<td></td>
<td>A (7)</td>
</tr>
<tr>
<td>18</td>
<td>1.1-2</td>
<td>A (7)</td>
<td></td>
<td>A (7)</td>
</tr>
<tr>
<td>19</td>
<td>&gt;2</td>
<td>A (8)</td>
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<td>A (8)</td>
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F. Primary superficial BCC (immunocompromised patients)

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<td></td>
<td>A (7)</td>
</tr>
<tr>
<td>21</td>
<td>0.6-1</td>
<td>A (8)</td>
<td></td>
<td>A (7)</td>
</tr>
<tr>
<td>22</td>
<td>1.1-2</td>
<td>A (8)</td>
<td></td>
<td>A (7)</td>
</tr>
<tr>
<td>23</td>
<td>&gt;2</td>
<td>A (8)</td>
<td></td>
<td>A (8)</td>
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</tbody>
</table>

Appropriate use scores and final ratings for 69 BCC indications. Appropriate indications (A; scores 7-9) are colored green; Uncertain indications (U; scores 4-6) are colored yellow; Inappropriate indications (I; scores 1-3) are colored red.

Area H: ‘Mask areas’ of face (central face, eyelids [including inner/outer canthi], eyebrows, nose, lips [cutaneous/mucosal/vermillion], chin, ear and periauricular skin /sulci, temple), genitalia (including perineal and perianal), hands, feet, nail units, ankles, and nipples/areola.

Area M: Cheeks, forehead, scalp, neck, jawline, pretibial surface.

Area L: Trunk and extremities (excluding pretibial surface, hands, feet, nail units and ankles).

BCC, Basal cell carcinoma.
Table II. Squamous cell carcinoma

A. Recurrent SCC of any size or unexpected positive margin on recent excision
   (healthy or immunocompromised patients, or patients with genetic syndromes)

<table>
<thead>
<tr>
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<th>Area L</th>
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<td>Aggressive</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (8)</td>
</tr>
<tr>
<td>25</td>
<td>Verrucous</td>
<td>A (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>KA-type SCC (not central facial)</td>
<td>A (8)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>27</td>
<td>In situ/Bowen</td>
<td>A (7)</td>
<td>A (7)</td>
<td>U (6)</td>
</tr>
<tr>
<td>28</td>
<td>AK with focal SCC in situ; Bowenoid AK; SCC in situ, AK type</td>
<td>I (2)</td>
<td>I (2)</td>
<td>I (2)</td>
</tr>
<tr>
<td>29</td>
<td>Without aggressive histologic features, &lt;2-mm depth without other defining features, Clark level =III</td>
<td>A (8)</td>
<td>A (8)</td>
<td>A (7)</td>
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B. Primary aggressive SCC (healthy patients)

<table>
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<tr>
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<tr>
<td>31</td>
<td>0.6-1</td>
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<td>1.1-2</td>
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<td>A (7)</td>
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<tr>
<td>33</td>
<td>&gt;2</td>
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C. Primary aggressive SCC (immunocompromised patients)

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<th>Indication</th>
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<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>35</td>
<td>0.6-1</td>
<td>A (9)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>36</td>
<td>1.1-2</td>
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<td>A (9)</td>
<td>A (8)</td>
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<tr>
<td>37</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (9)</td>
</tr>
</tbody>
</table>

D. Primary SCC; without aggressive histologic features, <2-mm depth without other defining features, Clark level =III (healthy patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>≤0.5</td>
<td>A (8)</td>
<td>A (7)</td>
<td>I (3)</td>
</tr>
<tr>
<td>39</td>
<td>0.6-1</td>
<td>A (8)</td>
<td>A (7)</td>
<td>I (3)</td>
</tr>
<tr>
<td>40</td>
<td>1.1-2</td>
<td>A (8)</td>
<td>A (8)</td>
<td>U (6)</td>
</tr>
<tr>
<td>41</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (7)</td>
</tr>
</tbody>
</table>

E. Primary SCC; without aggressive histologic features, <2-mm depth without other defining features, Clark level =III (immunocompromised patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>42</td>
<td>≤0.5</td>
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<td>A (8)</td>
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</tr>
<tr>
<td>43</td>
<td>0.6-1</td>
<td>A (9)</td>
<td>A (8)</td>
<td>U (6)</td>
</tr>
<tr>
<td>44</td>
<td>1.1-2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (7)</td>
</tr>
<tr>
<td>45</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (8)</td>
</tr>
</tbody>
</table>

F. Primary verrucous SCC (healthy or immunocompromised patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>≤0.5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>0.6-1</td>
<td>A (8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>1.1-2</td>
<td>A (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>&gt;2</td>
<td>A (9)</td>
<td></td>
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</tbody>
</table>

Continued
Table II. Cont’d

G. Primary SCC KA-type; not central facial (healthy patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
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<td>A (7)</td>
<td>I (2)</td>
</tr>
<tr>
<td>51</td>
<td>0.6-1</td>
<td>A (8)</td>
<td>A (7)</td>
<td>I (3)</td>
</tr>
<tr>
<td>52</td>
<td>1.1-2</td>
<td>A (8)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>53</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (7)</td>
<td>A (7)</td>
</tr>
</tbody>
</table>

H. Primary SCC KA-type; not central facial (immunocompromised patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>54</td>
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<td>U (6)</td>
</tr>
<tr>
<td>55</td>
<td>0.6-1</td>
<td>A (8)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>56</td>
<td>1.1-2</td>
<td>A (8)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>57</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (8)</td>
</tr>
</tbody>
</table>

I. Primary in situ SCC/Bowen disease (healthy patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
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<td>≤0.5</td>
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<td>A (7)</td>
<td>I (2)</td>
</tr>
<tr>
<td>59</td>
<td>0.6-1</td>
<td>A (7)</td>
<td>A (7)</td>
<td>I (3)</td>
</tr>
<tr>
<td>60</td>
<td>1.1-2</td>
<td>A (8)</td>
<td>A (8)</td>
<td>U (6)</td>
</tr>
<tr>
<td>61</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
</tbody>
</table>

J. Primary in situ SCC/Bowen disease (immunocompromised patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>≤0.5</td>
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<td>A (7)</td>
<td>I (3)</td>
</tr>
<tr>
<td>63</td>
<td>0.6-1</td>
<td>A (8)</td>
<td>A (7)</td>
<td>U (4)</td>
</tr>
<tr>
<td>64</td>
<td>1.1-2</td>
<td>A (8)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
<tr>
<td>65</td>
<td>&gt;2</td>
<td>A (9)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
</tbody>
</table>

K. Primary AK with focal SCC in situ; Bowenoid AK; SCC in situ, AK type (healthy patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td>≤0.5</td>
<td>I (3)</td>
<td>I (2)</td>
<td>I (1)</td>
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<tr>
<td>67</td>
<td>0.6-1</td>
<td>I (3)</td>
<td>I (2)</td>
<td>I (1)</td>
</tr>
<tr>
<td>68</td>
<td>1.1-2</td>
<td>I (3)</td>
<td>I (3)</td>
<td>I (1)</td>
</tr>
<tr>
<td>69</td>
<td>&gt;2</td>
<td>I (3)</td>
<td>I (3)</td>
<td>I (2)</td>
</tr>
</tbody>
</table>

L. Primary AK with focal SCC in situ; Bowenoid AK; SCC in situ, AK type (immunocompromised patients)

<table>
<thead>
<tr>
<th>Indication</th>
<th>Size, cm</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>≤0.5</td>
<td>I (2)</td>
<td>I (2)</td>
<td>I (1)</td>
</tr>
<tr>
<td>71</td>
<td>0.6-1</td>
<td>I (2)</td>
<td>I (2)</td>
<td>I (2)</td>
</tr>
<tr>
<td>72</td>
<td>1.1-2</td>
<td>I (2)</td>
<td>I (2)</td>
<td>I (2)</td>
</tr>
<tr>
<td>73</td>
<td>&gt;2</td>
<td>I (2)</td>
<td>I (2)</td>
<td>I (2)</td>
</tr>
</tbody>
</table>

Appropriate use scores and final ratings for 140 SCC indications. Appropriate indications (A; scores 7-9) are colored green; Uncertain indications (U; scores 4-6) are colored yellow; Inappropriate indications (I; scores 1-3) are colored red. Black boxes indicate areas not assessed or scored by the ratings panel.

Area H: 'Mask areas' of face (central face, eyelids [including inner/outer canthi], eyebrows, nose, lips [cutaneous/mucosal/vermillion], chin, ear and periauricular skin /sulci, temple), genitalia (including perineal and perianal), hands, feet, nail units, ankles, and nipples/areola.

Area M: Cheeks, forehead, scalp, neck, jawline, pretibial surface.

Area L: Trunk and extremities (excluding pre-tibial surface, hands, feet, nail units and ankles).

AK, Actinic keratosis; KA, keratoacanthoma; SCC, squamous cell carcinoma.
Table III. Basal or squamous cell carcinoma

<table>
<thead>
<tr>
<th>Indication</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>74</td>
<td>A (9)</td>
<td>A (9)</td>
<td>A (7)</td>
</tr>
</tbody>
</table>

Appropriate use scores and final ratings for 3 combined BCC or SCC indications. Appropriate indications (A; scores 7-9) are colored green. Area H: 'Mask areas' of face (central face, eyelids [including inner/outer canthi], eyebrows, nose, lips [cutaneous/mucosal/vermillion], chin, ear and periauricular skin /sulci, temple), genitalia (including perineal and perianal), hands, feet, nail units, ankles, and nipples/areola.

Area M: Cheeks, forehead, scalp, neck, jawline, pretibial surface.

Area L: Trunk and extremities (excluding pretibial surface, hands, feet, nail units and ankles).

BCC, Basal cell carcinoma; SCC, squamous cell carcinoma.

Table IV. Lentigo maligna and melanoma in situ

<table>
<thead>
<tr>
<th>Indication</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
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<tbody>
<tr>
<td>75</td>
<td>A (8)</td>
<td>A (7)</td>
<td>U (4)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Indication</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>76</td>
<td>A (8)</td>
<td>A (8)</td>
<td>A (7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indication</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>77</td>
<td>A (7)</td>
<td>A (7)</td>
<td>U (5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indication</th>
<th>Area H</th>
<th>Area M</th>
<th>Area L</th>
</tr>
</thead>
<tbody>
<tr>
<td>78</td>
<td>A (8)</td>
<td>A (7)</td>
<td>A (7)</td>
</tr>
</tbody>
</table>

Appropriate use scores and final ratings for 12 lentigo maligna and melanoma in situ indications. Appropriate indications (A; scores 7-9) are colored green; Uncertain indications (U; scores 4-6) are colored yellow. Area H: 'Mask areas' of face (central face, eyelids [including inner/outer canthi], eyebrows, nose, lips [cutaneous/mucosal/vermillion], chin, ear and periauricular skin /sulci, temple), genitalia (including perineal and perianal), hands, feet, nail units, ankles, and nipples/areola.

Area M: Cheeks, forehead, scalp, neck, jawline, pretibial surface.

Area L: Trunk and extremities (excluding pretibial surface, hands, feet, nail units and ankles).
Within the 69 scenarios of BCC (Tables I and III), 53 (76.81%) were deemed appropriate, 6 (8.70%) uncertain, and 10 (14.49%) inappropriate, with consensus reached for all indications. All forms of BCC (indications 1-23) including recurrent, primary aggressive, primary nodular, and primary superficial were rated appropriate on areas H and M regardless of size or patient type, with the exception of primary superficial BCC 0.5 cm or smaller in area M for healthy patients, which received a rating of uncertain (indication 16). When located on the trunk and extremities (area L), recurrent superficial BCC, primary nodular BCC 1 cm or smaller in healthy individuals, primary nodular BCC 0.5 cm or smaller in immunocompromised patients, and primary superficial BCC of any size in healthy patients, or 1 cm or smaller in immunocompromised patients (indications 3, 8, 9, 12, and 16-21) were all deemed inappropriate for the use of MMS. Also, when located on the trunk and extremities (area L) primary aggressive BCC 0.5 cm or smaller, primary nodular BCC 1.1 to 2 cm in healthy patients and 0.6 to 1 cm in immunocompromised patients, along with primary superficial BCC larger than 1 cm in immunocompromised patients (indications 4, 10, 13, 22, and 23) were all deemed as uncertain.

Within the 143 scenarios for SCC (Tables II and III), 102 (71.33%) were appropriate, 7 (4.90%) uncertain, and 34 (23.78%) inappropriate, with consensus reached for all indications. The use of MMS for recurrent SCC with or without aggressive histologic features and KA-type SCC was determined to be appropriate in all areas, and appropriate in area H for recurrent verrucous SCC (indications 24-26 and 29). Primary aggressive SCC of any size (indications 30-37) was also deemed appropriate in all locations for both healthy and immunocompromised patients. Primary SCC without aggressive histologic features was appropriate in areas H and M for any size tumor (indications 38-40), and appropriate in all locations when larger than 2 cm in healthy patients (indication 41). For immunocompromised patients, primary SCC without aggressive histologic features was appropriate in areas H and M when 1 cm or smaller (indications 42 and 43), and appropriate in all locations when larger than 1 cm (indications 44 and 45). Primary verrucous SCC of any size (indications 46-49) was appropriate in area H regardless of patient type. Primary SCC KA type (not central facial) was appropriate in areas H and M when 1 cm or smaller (indications 50 and 51), and appropriate in all locations when larger than...
Table VI. Ratings category summary for basal cell carcinoma, squamous cell carcinoma, lentigo maligna, and melanoma in situ

<table>
<thead>
<tr>
<th>AREA H</th>
<th>Appropriate</th>
<th>Uncertain</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCC</td>
<td>Primary or recurrent: Aggressive Nodular Superficial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCC</td>
<td>Primary or recurrent: Aggressive Nonaggressive* Verrucous KA-type SCC† In situ SCC/Bowen</td>
<td></td>
<td>Primary or recurrent: AK with focal SCC in situ</td>
</tr>
<tr>
<td>LM and MIS</td>
<td>Primary or recurrent:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREA M</th>
<th>Appropriate</th>
<th>Uncertain</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCC</td>
<td>Recurrent or primary: Aggressive Nodular Superficial (IC) Primary: Superficial ≥ 0.6 cm</td>
<td></td>
<td>Primary: Superficial ≤ 0.5 cm</td>
</tr>
<tr>
<td>SCC</td>
<td>Primary or recurrent: Aggressive Nonaggressive* KA-type SCC† In situ SCC/Bowen</td>
<td></td>
<td>AK with focal SCC in situ</td>
</tr>
<tr>
<td>LM and MIS</td>
<td>Primary or recurrent:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AREA L</th>
<th>Appropriate</th>
<th>Uncertain</th>
<th>Inappropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCC</td>
<td>Recurrent: Aggressive Nodular Primary: Aggressive ≥ 0.6 cm Nodular &gt; 2 cm Nodular (IC) ≥ 1.1 cm</td>
<td></td>
<td>Recurrent: Superficial Primary: Superficial ≥ 0.6 cm Nodular 1.1-2 cm Nodular (IC) 0.6-1 cm Superficial (IC) ≥ 1.1 cm</td>
</tr>
<tr>
<td>SCC</td>
<td>Primary or recurrent: Aggressive Recurrent: KA-type SCC† Nonaggressive* In situ SCC/Bowen Primary ≥ 1.1 cm Nonaggressive (IC)* KA-type SCC† In situ SCC/Bowen (IC)</td>
<td></td>
<td>Primary or recurrent: AK with focal SCC in situ Primary: ≤ 1 cm Nonaggressive* KA-type SCC† SCC in situ/Bowen Primary ≤ 0.5 cm KA-type SCC (IC)*</td>
</tr>
<tr>
<td>LM and MIS</td>
<td>Recurrent:</td>
<td></td>
<td>Primary: LM</td>
</tr>
</tbody>
</table>

Listed indications are for both healthy and IC patients, and tumors of any size unless otherwise specified.

Area H: ‘Mask areas’ of face (central face, eyelids [including inner/outer canthi], eyebrows, nose, lips [cutaneous/mucosal/vermillion], chin, ear and periauricular skin/sulci, temple), genitalia (including perineal and perianal), hands, feet, nail units, ankles, and nipples/areola.

Area M: Cheeks, forehead, scalp, neck, jawline, pretibial surface.

Area L: Trunk and extremities (excluding pretibial surface, hands, feet, nail units and ankles).

AK, Actinic keratosis; BCC, basal cell carcinoma; KA, keratoacanthoma; IC, immunocompromised; LM, lentigo maligna; MIS, melanoma in situ; SCC, squamous cell carcinoma.

*SCC without aggressive features, <2-mm depth without other defining features, Clark level ≤ III.

†Not central facial.
1 cm in healthy patients (indications 52 and 53). For immunocompromised patients, primary SCC KA type (not central facial) was appropriate in areas H and M when 0.5 cm or smaller (indication 54), and appropriate in all locations when 0.6 cm or larger (indications 55-57). Primary in situ SCC/Bowen disease in healthy patients was appropriate in areas H and M when 2 cm or smaller (indications 58-60), and appropriate in all locations when larger than 2 cm (indication 61). For immunocompromised patients, primary in situ SCC/Bowen disease was appropriate in areas H and M for tumors of any size (indications 62-65), and appropriate in all locations when larger than 1 cm (indications 64 and 65). Primary BCC or SCC regardless of subtype, size, or depth were all deemed appropriate in all areas when arising in prior radiated skin, a traumatic scar, areas of osteomyelitis, areas of chronic inflammation/ulceration, or in patients with genetic syndromes (indication 74).

When located on the trunk and extremities (area L), primary SCC without aggressive histologic features, primary SCC KA type (not central facial), and primary in situ SCC/Bowen disease 1 cm or smaller in healthy patients were deemed inappropriate (indications 38, 39, 50, 51, 58, and 59). Similarly, primary in situ SCC/Bowen disease 0.5 cm or smaller in immunocompromised patients (indication 62) was also inappropriate in area L. Finally, both recurrent and primary actinic keratosis with focal SCC in situ (Bowenoid actinic keratosis; SCC in situ, actinic keratosis type) of any size was inappropriate in all areas in both healthy and immunocompromised patients (indications 28 and 66-73).

A number of SCC scenarios remain uncertain in area L including primary SCC 1.1 to 2 cm without aggressive histologic features in healthy patients (indication 40) and 1 cm or smaller in immunocompromised patients (indications 42 and 43), primary SCC KA type (not central facial) 0.5 cm or smaller in immunocompromised patients (indication 54), recurrent in situ/Bowen disease (indication 27), and primary in situ SCC/Bowen disease 1.1 to 2 cm in healthy patients (indication 60) and 0.6 to 1 cm in immunocompromised patients (indication 63).

Of the 12 clinical scenarios for LM, melanoma in situ (Table IV), 10 (83.33%) were deemed appropriate, 2 (16.67%) uncertain, and 0 (0%) inappropriate with consensus reached for all scenarios. MMS was deemed appropriate for primary LM and primary melanoma in situ (non-LM) in areas H and M for healthy and immunocompromised patients (indications 75 and 77). Locally recurrent LM and melanoma in situ (non-LM) was rated appropriate for MMS in all locations for both healthy and immunocompromised patients (indications 76 and 78). The use of MMS for primary LM and for primary melanoma in situ in healthy or immunocompromised patients was determined to be uncertain when located on area L (indications 75 and 77).

MMS was also deemed appropriate for adenocystic carcinoma, adnexal carcinoma, apocrine/eccrine carcinoma, atypical fibroxanthoma, dermatofibrosarcoma protuberans, extramammary Paget disease, leiomyosarcoma, malignant fibrous histiocytoma (undifferentiated pleomorphic sarcoma), microcystic adnexal carcinoma (sclerosing sweat duct carcinoma), mucinous carcinoma, and sebaceous carcinoma in all locations regardless of patient type (Table V) (indications 79-81, 83, 85, 87-89, and 91-93). MMS for MCC was determined to be appropriate in areas H and M (indication 90). The AUC for MCC were determined by considering MMS as monotherapy, and the possibility of adjuvant radiation therapy was not factored into the final AUC decision.

Angiosarcoma in all locations, desmoplastic trichoepithelioma in areas H and M, and MCC in area L were deemed uncertain (indications 82, 86, and 90). Bowenoid papulosis in area H and desmoplastic trichoepithelioma in area L received a rating of inappropriate (indications 84 and 86). Lastly, rare biopsy-proven malignancies not otherwise specified were deemed uncertain for the use of MMS in all areas (indication 94).

**DISCUSSION**

AUC are often used to define when it is reasonable to use a particular procedure in the context of available medical information, expert clinical opinion, patient characteristics, and the health care environment. The intent of these AUC is to provide guidance for the rational use of MMS in the practice setting. In doing so, this document can provide physicians with practical information to facilitate both clinical decision making and provider-patient dialogue about treatment options for cutaneous malignancies that may include MMS. The goal of these AUC is not to directly address cost-related concerns, but rather to ensure that MMS is used for clinically appropriate indications. Ideally, these AUC will support optimum and justified health care expenditures and improved health care delivery, while providing patients with high-quality care and clinical outcomes.

This document is the first AUC for MMS and also represents the first AUC for any test or treatment option within dermatology. Important this AUC document is not comparative for different treatment
modalities used to treat cutaneous malignancy, but is a document that pertains solely to the use of MMS and the appropriateness of MMS in certain clinical scenarios. AUC pertaining to other treatment modalities of cutaneous malignancy may be forthcoming. It should also be understood that the initial biopsy specimen of a cutaneous malignancy that prompts categorization of appropriate use of MMS may misrepresent the true histopathological findings of final tumor characteristics, particularly if the initial biopsy specimen is superficial or partial. Thus it is important when using the AUC documented herein that an appropriate and accurate biopsy of the represented cutaneous malignancy has been performed, as these clinical scenarios pertain to well-defined pathologic diagnoses.

The rating of these targeted clinical scenarios as appropriate, uncertain, or inappropriate is a reflection of the body of knowledge of the members of the RP at the time of the rating process. It is possible that as medical knowledge increases and new evidence-based guidelines are published and become available, certain clinical scenarios in this document may be determined to have a different appropriateness rating than what has been outlined herein. Whenever possible, published clinical information was used to determine appropriateness; however, in many scenarios where evidence-based information was lacking, clinical expertise played a significant role in determining the appropriateness of scenarios. Thus, this document is intended as a living revisable document that will need to be reviewed and modified as new data become available pertaining to the appropriate use of MMS. Given the patient-centered approach of the AUC process, it is hoped that this document will be used to direct further research to facilitate more definitive classification in future revisions for all clinical scenarios currently classified as uncertain. In addition, further refinement or separation of some clinical scenarios to more clearly delineate specific patient or tumor characteristics may impact these ratings and facilitate more precise patient selection for MMS. It may be beneficial in the future to further segregate patient groups such as healthy, immunocompromised, or those with genetic syndromes into distinct indications for all tumor types and locations. For example, the AHTF recognizes the rating of appropriate for indication 74 in area L, yet the anomalous rating of inappropriate for indication 3 in area L.

Although the appropriate use ratings reflect critical medical literature and expert consensus, physicians and other stakeholders should understand the role of clinical judgment in determining treatment approaches for an individual patient. The clinical scenarios identified in this document are crafted for the average patient and not the exception. Thus, the ultimate decision regarding the appropriateness of MMS should be determined by the expertise and clinical experience of the physician when considering any individual patient’s specific and unique characteristics. However, although individual exceptions to the ratings are both anticipated and justified, the performance of MMS not supported by medical literature or expert consensus should be minimized.

In addition, uncertain indications often require individual physician judgment and understanding of the patient and other clinical factors to better determine the appropriateness of MMS for a particular scenario. As such, the ranking of uncertain should not be viewed as limiting the use of MMS for patients. Importantly for these AUC, RP members were instructed in determining an appropriateness ranking that a designation of uncertain was designed to be reimbursable when determined appropriate via the clinician’s discretion. A final rating in this “uncertain” category does, however, facilitate a better understanding of scenarios of MMS that would benefit most from further research.

In conclusion, this document represents the current understanding and clinical judgment as to the appropriateness of MMS using the framework of the AUC methodology. It will be necessary to periodically assess and update these indications and ratings as further research, expanding clinical experience, and the evolution of the practice of MMS is brought forth, so as to provide the greatest benefit to clinical decision making, optimization of health care expenditures, and impact on quality patient care.

APPENDIX

The supporting evidence tables for these AUC may be found at the AAD World Wide Web site: http://www.aad.org/education-and-quality-care/appropriate-use-criteria/mohs-surgery-auc.

The AHTF thanks the following individuals for their thoughtful review of draft clinical indications, evidence tables, and AUC terminology: Rex Amonette, MD; Maryam Asgari, MD; Richard Bennett, MD; Jeremy Bordeaux, MD; Darryl Bronson, MD; Hank Clever, MD; Clara Curiel, MD; Scott Dinehart, MD; Leonard Dzubow, MD; Roy Geronemus, MD; Hayes Gladstone, MD; David Goldberg, MD; Leonard Goldberg, MD; Hugh Greenway, MD; Warren Heymann, MD; Hillary Johnson-Jahangir, MD; John Maize, MD; Mary Maloney, MD; William Mangold, MD; Ashfaq Marghoob, MD; Vic Marks, MD; John Martinez, MD; Alexander Miller, MD; Brent Moody, MD; Vince
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