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## Obstacles hindering the mainstream practice of teledermatopathology

Danielle Giambrone, BS, Babar K. Rao, MD, Amin Esfahani, MS, and Shaan Rao  
New Brunswick, New Jersey

**Background:** Teledermatopathology has the potential to link underserved areas to experts across the country and assist in making quick diagnoses, which may improve health care costs and delivery. Despite these potential benefits, teledermatopathology is not used routinely for primary diagnosis in the United States.

**Objective:** To assess the current status of and address the potential for improving health care by the use of teledermatopathology for primary diagnosis.

**Methods:** Current available literature and online resources were reviewed to address 3 major variables that hinder the widespread use of teledermatopathology: diagnostic accuracy, licensure requirements, and reimbursement.

**Results:** Recent studies show similar diagnostic accuracy for this technology compared to conventional microscopy. State-to-state variation and ambiguity in laws serve as the biggest hurdles to the widespread use of teledermatopathology. More states are recognizing the importance of the implementation of specific laws regarding telemedicine. More studies are required to evaluate the systems that offer specific telemedicine licenses, in addition to those that pay for telemedicine services specifically.

**Limitations:** This study reviewed current legislation concerning teledermatopathology; these laws are subject to revision.

**Conclusion:** Improving diagnostic accuracy and limiting variations in policy and reimbursement may encourage more pathologists to use teledermatopathology technology. (J Am Acad Dermatol 2014;71:772-80.)

**Key words:** dermatopathology; digital pathology; teledermatology; teledermatopathology; telehealth; telepathology; virtual microscopy.

Telemedicine is defined as the use of medical information exchanged from 1 site to another via electronic communications to improve patient's health.<sup>1</sup> It is generally divided into 2 categories: store and forward and live real-time. Store and forward uses still digital images of patient data for rendering a medical opinion or diagnosis and includes the asynchronous transmission of data from 1 site to another. Live real-time or synchronous transmission is an interactive video connection that

transmits information in both directions during the same time period.<sup>1</sup>

Telepathology is a subset of telemedicine that focuses on pathologic diagnosis by examination of digital histologic slides from a remote location. Telepathology, more specifically teledermatopathology, has the potential to transform the practice of dermatopathology by linking rural and underserved communities—where caseloads exceed the number of experts—to specialists across the country. In

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From the Department of Dermatology, Rutgers Robert Wood Johnson Medical School, New Brunswick.

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Reprint requests: Babar K. Rao, MD, Department of Dermatology, Rutgers Robert Wood Johnson Medical School, 1 World's Fair

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Dr, Ste 2400, Somerset, NJ 08873-1344. E-mail: [babarao@gmail.com](mailto:babarao@gmail.com).

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addition, this practice can save both time and money by providing a platform for timely consultations. Indeed, recent evidence suggests that teledermatopathology may be as efficacious as conventional face to face consultation in preserving skin-related quality of life.<sup>2</sup> Finally, teledermatopathology can serve as an effective training tool for students and residents.<sup>3</sup>

Despite the potential benefits, teledermatopathology is not used routinely in the United States. This lack of use is multifactorial. One major barrier to adoption is the ease of use and convenience of the current slide and microscope model that is the standard for this field. Unlike the transition from radiology to teleradiology, the move to teledermatopathology can lead to significant disruption of workflow. Addressing issues such as diagnostic accuracy, standardization of equipment, licensure requirements, and reimbursement policies may help promote the widespread adoption of teledermatopathology.

The aforementioned potential benefits along with the advancements in technology, which allow for enhanced transmission of high-quality images, precipitate the need for critical evaluation of teledermatopathology as both a primary source of diagnosis and as an efficacious complement to conventional microscopy. We undertook a search of the current available literature and online resources to assess issues of validity, legality, and reimbursement as they relate to teledermatopathology.

## DIAGNOSTIC ACCURACY

Teledermatopathology is rapidly evolving as a result of technology that has led to improved image transmission and quality. Studies have compared the diagnostic accuracy of this method with that of traditional light microscopy.<sup>3-17</sup> Our literature search yielded 15 studies conducted between 1997 and 2012 that evaluated diagnostic accuracy and concordance between the 2 modes (Table D).<sup>3-17</sup> Only 1 study evaluated the efficacy of real-time teledermatopathology,<sup>8</sup> with the remainder of the studies focusing on store and forward methodologies. The analyzed samples from these studies examined a wide variety of conditions, including inflammatory, melanocytic, nonmelanocytic neoplasm, and other commonly encountered lesions. In all studies,

teledermatopathology was either similar or inferior to conventional microscopy, with no study showing a statistically significant improvement in diagnostic accuracy with store and forward technology. A closer inspection of the literature suggested a chronologic pattern, with earlier studies showing worse accuracy. The shortcomings in these earlier studies may be

attributed to the quality of equipment and images. Early store and forward models depended on analysis of preselected slide areas. Now, with the advent of virtual slide systems (whole slide imaging systems), teledermatopathologists can observe the entire slide and are no longer required to rely on preselected areas. In addition, improved technology with better quality images has enhanced diagnostic capabilities. This may account for the recent improved concordance between

teledermatopathology and traditional microscopy.<sup>3,13-17</sup> Yet one of the first studies that used a virtual slide system demonstrated only a 74% diagnostic accuracy in comparison to traditional microscopy when evaluating 46 biopsy samples of inflammatory cutaneous disease.<sup>11</sup> The authors attributed lack of experience with teledermatopathology as a potential cause of discrepancy in concordance, alongside inherent difficulties in the diagnosis of inflammatory cutaneous conditions.<sup>11</sup> Indeed, most studies with better concordance rates focused on melanocytic lesions. Diagnostic accuracy is a challenge that spans the entire field of telepathology and not just teledermatopathology. In the present work, we did not broaden our search to include studies from the entire field, because each area (eg, telecytopathology) faces unique challenges that require in-depth and critical analyses that extend beyond the scope of this paper. For instance, studies have shown that the diagnostic accuracy of telecytopathology can vary based on anatomic location (eg, the cervix<sup>18</sup> and thyroid<sup>19</sup>). By focusing on teledermatopathology, we have been able to critically evaluate an entire subset of telepathology and avoided the pitfall of randomly selecting a few studies without justifiable inclusion and exclusion criteria.

Teledermatopathology is a rapidly evolving field, and its improvements may partially account for the better concordance and diagnostic accuracy seen in

## CAPSULE SUMMARY

- Teledermatopathology is more commonly used for obtaining second opinions or consulting rather than primary diagnosis.
- This study outlines each states' guidelines concerning legality, reimbursement, and licensing for teledermatopathology.
- The use of teledermatopathology for primary diagnoses can minimize traveling costs for the patient, as well as costs for insurance companies and state and federal agencies.

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