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Dual-Energy X-ray Absorptiometry Image Resolution and TBS Precision

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An ideal measurement should possess several critical characteristics. It should reflect an important condition. It should predict meaningful outcomes. It should scale in a predictable and consistent way. It should be reproducible, yielding consistent results on repeat measurement of the same subject.

Bone mineral density (BMD) as measured by dual-energy X-ray absorptiometry (DXA) fulfills these desiderata, and the International Society for Clinical Densitometry has championed rigor in BMD measurement. Among the International Society for Clinical Densitometry's most important and widely used tools is its precision calculator, which facilitates calculation of precision, and which is readily adapted to “any” measurement, not just BMD. The bone densitometry community has led other medical providers in recognizing the importance of precision and incorporating uncertainty about the significance of changes in repeated measurements. This nuanced view of precision is reflected in the concept of least significant change, which is a necessary component of DXA reporting (1).

As new tests become available, defining their performance is an important task, and the various aspects of performance are addressed in a hierarchical fashion. Trabecular bone score (TBS) follows this expected pattern. The first wave of TBS research sought to establish its utility and achieved this goal by demonstrating its ability to predict fracture independently of established fracture risk factors (2). This work has established TBS's potential utility and shifted the knowledge gap to understanding TBS's performance in the context of the usual practice setting.

An article in this issue of the *Journal of Clinical Densitometry* is in the vanguard of what I will term the second wave of TBS-related publications. The authors exploit their existing data (3,4) obtained for the purpose of comparing and cross-calibrating GE Lunar standard-resolution Prodigy scanners to high-resolution iDXA scanners. As TBS is calculated through

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analysis of existing scan data, it can be performed without additional scanning. They report that although TBS precision is comparable to BMD precision, comparable in women and men, and comparable between the Prodigy and iDXA platforms, TBS values obtained on the 2 platforms are not comparable to each other, with poorer correlation of TBS than BMD across platforms. The authors hypothesize that their findings may be a direct consequence of the different resolutions of the instruments. This explanation is highly plausible, as TBS is calculated on the basis of BMD differences between adjacent pixels (5,6). As pixel size changes, such differences would be expected to change.

The larger significance of this work is that the authors have provided the necessary context for gauging serial TBS measurements. Other investigators and clinicians know how reproducible TBS measurements are in experienced, expert hands. They have been provided with a recipe for reproducing a TBS precision assessment using their own data, allowing that knowledge to guide individual patient care. Longitudinal TBS research is also advanced by this work, as the threshold for meaningful change has been established. Finally, an important limitation of cross-calibration across DXA platforms has been identified by the demonstration that TBS is less reproducible than BMD in this setting. These results advance integration of TBS into the armamentarium of bone densitometry.

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