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## Appraisal

## Clinimetrics: The vertical single leg hop test

## Summary

**Description:** The vertical single leg hop test (VSLHT) is a functional performance outcome measuring maximum single leg jump height (cm).<sup>1</sup> The VSLHT is intended to assess sport-related movements and musculoskeletal loading demands.<sup>1,2</sup> To perform this test, an individual stands on one leg, executes a rapid countermovement to a self-selected depth, jumps as high as possible, and then lands on the same leg.<sup>2–4</sup> Height can be measured using instrumentation (eg, contact timing mat)<sup>2–4</sup> or the chalk on wall method. The VSLHT can be completed on both legs in 10 to 15 minutes, including a dynamic warm-up and practice trials (three to five). Typically, multiple maximum effort attempts (minimum of three) are performed with 20 to 30 seconds of rest between attempts.

The VSLHT is a functional performance measure for any lower extremity pathology. However, research has focused on its use following anterior cruciate ligament (ACL) reconstruction (ACLR)<sup>5</sup> because it is associated with high biomechanical knee work and power demands during propulsion.<sup>1</sup> In contrast, the horizontal single leg hop test, which is more commonly used,<sup>6</sup> is associated with less knee work and power during propulsion but more during landing.<sup>1</sup>

The VSLHT is easy to conduct in clinic at no cost and requires no special training or equipment. Clinicians can opt to perform the VSLHT with additional instrumentation (eg, portable force plate, contact timing mat, vertical jump measurement device) to mimic published research methods and collect additional details (eg, knee-related biomechanics).<sup>3</sup>

**Psychometric properties:** There is moderate certainty evidence for construct validity between the VSLHT and quadriceps strength (pooled  $r = 0.56$ , 95% CI 0.34 to 0.73) and the IKDC Subjective Knee Form (pooled  $r = 0.50$ , 95% CI 0.36 to 0.62) after ACL tear.<sup>5</sup> The relative test-retest reliability of the VSLHT post-ACLR is ICC<sub>3,1</sub> 0.94,<sup>7</sup> with similar reliability for uninjured individuals (ICC 0.89 to 0.98).<sup>8,9</sup> In uninjured individuals, standard error of the measurement ranges from 0.6 to 1.2 cm, corresponding to a smallest detectable change of approximately 1.7 cm.<sup>9</sup> In individuals after ACLR, no estimates of absolute reliability, detectable change, minimum important differences or credible normative values are available.<sup>5</sup> Individual studies have average VSLHT values for uninjured athletes, but credible normative distribution of values are lacking.<sup>10</sup>

## Commentary

The ultimate value of the VSLHT is more likely to be as a performance metric than to inform safe return to sport after ACLR. Biomechanical differences<sup>1,3</sup> between horizontal hops and the VSLHT may encourage clinicians to add the VSLHT to return to sport test batteries to capture an additional construct. However, the VSLHT has yet to show a relevant and credible association with ACL re-tear risk.<sup>4,11</sup> It appears that all hop tests, including the VSLHT, have limited to no prognostic value for ACL re-injury.<sup>4,6,11,12</sup> With no current clinical benchmarks or credible minimum important differences, clinicians must rely on other information to interpret VSLHT results. Clinicians should be wary of comparing with the contralateral leg,<sup>4</sup> especially if normal sporting asymmetries are expected to exist or when using a cut-off score.<sup>13</sup> Published uninjured control values could aid decision-making.

The VSLHT can still inform treatment plans by providing relevant data to many sport contexts (eg, basketball, volleyball). Other VSLHT variations can also be implemented (eg, drop VSLHT) to capture different performance constructs (eg, reactive strength).<sup>3</sup> Through instrumentation, other impairments (eg, reduced knee work during propulsion) can be identified and addressed.

In summary, the VSLHT may be a clinically valuable metric to guide treatment planning for performance enhancement but may not be viable for informing injury risk reduction.

**Disclaimer:** This work was not an official duty of the author's Department of Veterans Affairs employment. The opinions are the authors and do not represent an official position of the United States Government.

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