

## **ACLS-5 and LACLS-5 Test: Psychometric Properties and Use of Scores for Evidence-Based Practice** (copyright 2016, the Allen Cognitive Group/ACLS&LACLS Committee)

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### **Introduction**

The intent of this report is to identify all relevant evidence related to the psychometric properties of the Allen Cognitive Level Screen-5 and the Large Allen Cognitive Level Screen-5 test including use of test scores for evidence-based practice in the context of the cognitive disabilities model. The focus is on published research using the ACLS-5 and LACLS-5 and the ACLS-90 versions of the test. We hope that this report will serve as a useful resource for therapists, educators, and researchers who value use of evidence-based assessments in practice. While the Allen Cognitive Group has tried to identify all relevant research, we recognize that we may have inadvertently overlooked some. We hope that readers of this report will notify us of any additional published, unpublished, or “in process” evidence that has not been included. We also realize that additional psychometric and intervention outcome research would strengthen the credibility of the ACLS-5 and LACLS-5 for use in evidence-based practice. The Allen Cognitive Group is available to support these efforts. Please contact us at [www.allencognitive.org](http://www.allencognitive.org). Thank you.

### **Background**

**The cognitive disabilities model (CDM)** was introduced in the 1960’s as a guide for occupational therapy practice with adults in mental health settings who had temporary or permanent impairments in global cognitive processing capacities that affected their ability to participate safely in meaningful daily activities and occupations (Allen, 1985; Allen, Earhart, & Blue, 1992, p. 238; McCraith, Austin, & Earhart, 2011, pp. 383-406). It has been extended to an older adult population with dementia (Allen, Kehrberg, & Burns, 1992; Gitlin, Winter, Vause-Earland, Herge, Chernet, & Piersol, 2009; Levy, 1986; Levy & Burns, 2011; Warchol, 2004), adults who have cognitive and physical disabilities (Allen, Earhart, & Blue, 1992); adolescents with cognitive and emotional disabilities (Lee, Gargiullo, Brayman, Kinsey, Jones, & Shotwell, 2003; Shapiro, 1992); individuals who have sustained a head injury (Voydetich, Jensen, Sigford, & Mehr, 2002); and adults with mental illness at risk for homelessness (Chapleau, A., Seroczynski, A. D., Meyers, S., Lamb, K., & Buchino, S., 2012; Helfrich, Chan, & Sabol, 2011).

When using this model in practice, therapists plan interventions that *compensate* for the impact of cognitive disabilities on occupational performance and *optimize* the use of remaining cognitive abilities. This is accomplished by creating a “fit” between an individual’s functional cognitive abilities and the activity demands of an individual’s valued activities, occupations, contexts, and environments. The expected outcome of this intervention approach is safe,

successful engagement and participation in valued activities and occupations in supportive contexts and environments.

**The Allen Cognitive Level Screen (ACLS) and Large Allen Level Screen (LACLS) Test** are two forms of a theory- and evidence-based, standardized *screening test* of functional cognition designed to provide a quick estimate of cognitive abilities within cognitive levels 3, 4, and 5 on the Allen scale of levels and modes of performance. This scale is a 26-point scale ranging from 1.0 (low) – 6.0 (high) (Allen, Earhart, & Blue, 1992; McCraith, Austin, & Earhart, 2011, pp. 388-391). The larger form of the assessment tool, the LACLS, is intended for use with individuals who have impaired vision or hand function (Allen, Austin, David, Earhart, McCraith, & Riska-Williams, 2007; Kehrberg, Kuskowski, Mortimer, & Shoberg, 1992). Both forms provide opportunities to observe current global cognitive processing capacities related to 1) new learning and problem solving abilities and 2) use of occupational performance skills. These abilities and skills are observed as they are applied in the performance of three stitching tasks with a set of carefully designed, standardized activity demands which increase in cognitive complexity from cognitive level/modes 3.0 to 5.8. As *screens*, these tools may be used to detect unknown or suspected problems in functional cognition or to identify potential cognitive abilities. They are understood to provide an estimate of the severity of a problem or of retained abilities at a given point in time (Allen, Earhart, & Blue, 1992; McCraith, Austin, & Earhart, 2011, pp. 383-406). Further assessment, preferably including observations of performance in meaningful activities, is recommended to verify the screen score and to provide a more specific and complete understanding of an individual's overall level of functional cognitive ability. The Allen Diagnostic Module, 2<sup>nd</sup> edition (Earhart, 2006) and the Routine Task Inventory-E (Katz, 2006) are two of the CDM-based assessments that have been developed for this purpose.

**The fifth version of the ACLS and the LACLS test** is described in the *Manual for the Allen Cognitive Level Screen-5 (ACLS-5) and the Large Allen Cognitive Level Screen-5 (LACLS-5)* (Allen, Austin, David, Earhart, McCraith, & Riska-Williams, 2007). This fifth version of the manual was undertaken in response to feedback from clinicians, educators, and researchers who felt that a more professionalized manual with enhanced administration and scoring guidelines was needed to meet the clinical and scholarly expectations for “best practice.” The enhancements and additions to the Manual for the 5<sup>th</sup> version are guided by the *Standards for Educational and Psychological Testing* (AERA, 1999). The enhancements include:

- Theoretical grounding of the test in the cognitive disabilities model for structure, administration, scoring, and guidelines for interpreting and reporting scores
- Standardized administration protocol including guidelines for providing cues and prompts
- Enhanced scoring tables

The additions include:

- History and development of the ACLS and LACLS assessment tools and test
- Description of *functional cognition* as the theoretical construct measured
- Guidelines for interpreting and reporting scores

- Review of psychometric research

The only change in the administration protocol between the third version, the ACLS-90 test, and the fifth version, the ACLS-5 and LACLS-5 test, is based on anecdotal evidence and feedback. Various stakeholders and experts expressed concern that the test was being stopped prematurely for some individuals and did not reflect best performance for those individuals. Therefore, in the 5<sup>th</sup> version, administrators are instructed to continue on to the next stitching task whether or not the person being tested completes 3 correct stitches in the preceding task. However, if the person refuses to continue or appears sufficiently stressed by the test that continuing on would be counter-indicated, the administrator is instructed to stop the test without proceeding to the next task (Allen, et al., 2007, p xii; Laver-Fawcett, 2007, p. 419; Salkind, 2010, pp. 132-134).

### **Psychometric Properties of the ACLS-5 and LACLS-5 Test**

Many experts and other stakeholders reviewed and contributed to the content of the *Manual for the ACLS-5 and LACLS-5* (Allen, Austin, David, Earhart, McCraith, & Riska-Williams, 2007). This extensive, collaborative process provides an important foundation of validity evidence for the content in this current version. In addition, most of the enhancements and additions in the *Manual for the ACLS-5 and LACLS-5* are efforts to clarify and explicate the set up, administration, and scoring used with the third version, the ACLS-90 test with minimal difference in the administration and scoring protocol. Therefore, scores and resources for interpretation based on administration of the ACLS-90 test are expected to provide relevant and substantive reliability and validity evidence for the current 5<sup>th</sup> version (AERA, 2014, pp.125-129).

While there is a long tradition of psychometric studies across the various versions and forms of the ACLS and LACLS test, this report primarily focuses on published studies using the ACLS-5 and LACLS-5 test (5<sup>th</sup> version) and ACLS-90 test (3rd version). For more detailed description and reviews of earlier studies and findings using other versions of the ACLS and LACLS test, the reader is referred to the works of Allen and Blue (1998); Allen, Earhart, and Blue (1992); McCraith, Austin, & Earhart (2011, pp. 383-406); and the *Manual for the ACLS-5 and LACLS-5* (Allen, et al., 2007).

#### Reliability Evidence

The inter-rater reliability evidence across all versions and forms of the ACLS and LACLS test developed between 1978 and 2007 has been high to very high with reported correlations ranging from  $r = .91$  to  $r = .99$ . Researchers found inter-rater reliability ratings at the high end of this range in studies using the ACLS-90 test (Henry, Moore, Quinlivan, & Triggs, 1998; Keller & Hayes, 1998; Lee, Gargiullo, Brayman, Kinsey, Jones, & Shotwell, 2003; McCraith & Henry, 2003; Penny, Mueser & North, 1995; Raweh & Katz, 1999; Velligan, Bow-Thomas, Mahurin, Miller, Dassori & Erdely, 1998). A study using the LACLS-90 test also reported a high correlation for inter-rater reliability (Velligan, True, Lefton, Moore & Flores, 1995). In a pilot study

of inter-rater reliability using the ACLS-5 and LACLS-5 test, there was 100% correspondence within a .2 margin of error on the Allen Scale among a convenience sample of five therapists with varied exposure to *any version* of the ACLS or LACLS (Helfrich & McCraith, 2015).

Further research examining the inter-rater reliability of the ACLS-5 and LACLS-5 test is currently underway (personal communication, Allen Cognitive Group, 2015). It is hoped that the findings from these studies will not only contribute additional evidence to support the reliability of the ACLS-5 and LACLS-5 test, but that the methodology of these studies will provide an opportunity for practicing therapists to evaluate and compare the consistency of their scores with the scores of others.

Test-retest consistency may be less reliable for a “point in time” screening test like the ACLS-5 and LACLS-5 test because levels of cognitive function are known to fluctuate depending on time of day, medical or psychological status, and changes in function over time. However, significant low to moderate correlations supporting test-retest reliability have been reported in several studies using the ACLS-90 test (McCraith & Henry, 2003; McAnanama, Rogosin-Rose, Scott, Joffe & Kelner, 1999; Roitman & Katz, 1996). Another form of test-retest reliability is offered in a study by Kehrberg, Kuskowski, Mortimer, & Shoberg (1992). These researchers created the Large Allen Cognitive Level (LACL) screening test, a form for persons with impaired vision or hand function. This study found the LACL screening test to be significantly correlated with the ACL screening test in 49 subjects with Alzheimer’s disease ( $r = .95, p = <.0001$ ).

Currently, a study designed to evaluate form equivalence among the ACLS-5, LACLS-5 and the newly released Disposable LACLS-5 (LACLS[D]; Allen Cognitive Group, 2016) across several populations in several settings is underway. The design of this study will also provide substantive test-retest reliability results (personal communication, Allen Cognitive Group, 2016).

The pattern of consistently high reliability ratings across all versions and forms of the test and the highly standardized nature of the *Manual for the ACLS-5 and LACLS-5* test, lends strong support for the consistency of scores between different raters using the ACLS-5 and LACLS-5 test. It also strongly suggests that the administration and scoring guidelines in the *Manual for the 5<sup>th</sup>* version are clear and correlate well with the cognitive disabilities model (CDM) theory including the Allen Scale of levels and modes of performance.

### Validity Evidence

As with reliability evidence, there is a strong body of research supporting content, construct and concurrent validity across various versions and forms of the ACLS test developed between 1978 and 2007. Two validity studies using the *Manual for the ACLS-5 and LACLS-5* test for administration and scoring have focused on the relationship between functional cognition and basic and instrumental activities of daily living. A published study by Scanlan and Still (2013) with 225 persons in a mental health setting found a significant association ( $r = 0.55, p = < 0.01$ ) between functional cognition measured with the LACLS-5 test and level of independence

measured with a functional independence rating developed by Collister & Alexander (1991). Another preliminary study published by Cairns, Hill, Dark, McPhail, & Gray (2013) with 11 adults who accessed community mental health services found a significant association ( $r = 0.71$ ,  $p < 0.01$ ) between functional cognition measured with the LACLS-5 test and medication adherence measured with the Medication Adherence Rating Scale (MARS; Thompson, et al., 2000). Okamura, Takeshita, Teramoto, Aida, and Kino (2010) used a Japanese translation of the *Manual for the ACLS-5 and LACLS-5* and a Japanese translation of the Mini Mental Status Exam (Folstein, M., Folstein, S., & McHugh, 1975) to study validity of the ACLS-5 and LACLS-5 test. Their research established a significant association ( $r = .90$ ;  $p < .00001$ ) between the ACLS-5 and LACLS-5 test and the Mini Mental Status Exam. Additional validity studies of the ACLS-5 and LACLS-5 in other languages are currently in progress (personal communication, Allen Cognitive Group, 2015).

Of particular interest is the strong national and international evidence supporting the relationship between occupational performance and Allen cognitive levels described in the cognitive disabilities model (CDM) and measured using the ACLS and LACLS test. Researchers have described significant correlations between the ACLS-90 test scores and scores from measures of *basic and instrumental activities of daily living* (Burns, McCarten, Adler, Bauer & Kuskowski, 2004; David & Riley, 1990; Keller & Hayes, 1998; McAnanama, et al., 1999; Velligan, et al., 1998; Velligan, et al., 1995; Wilson, Allen, McCormack & Burton, 1989; Ziv, Roitman & Katz, 1999). Two previously mentioned studies carried out in Australia found significant correlations between LACLS-5 test scores and measures of *functional independence* (Scanlan & Still, 2013) and *medication adherence* (Cairns, et al., 2013). Researchers also found significant associations between the ACLS-90 test and *living situation* (Henry, Moore, Quinlivan, & Triggs, 1998; McAnanama, Rogosin-Rose, Scott, Joffe, & Kelner, 1999); *social competence* (Penny, Mueser, & North, 1995); and *staff's work recommendations* (Katz & Perelman, 1993).

Construct validity has been addressed by a number of researchers. A significant association between *functional cognition* measured by ACLS-5 test scores and the cognitive construct, *global cognition*, as measured by the Mini Mental Status Exam, was reported in the previously mentioned pilot study by Okamura, et al. (2010). Other researchers have reported evidence of significant associations between *functional cognition* measured by the ACLS-90 test and various other cognitive constructs. Two groups of researchers (David & Riley, 1990; Secrest, Wood, & Tapp, 2000) addressed the relationship between *functional cognition* and *concentration*. They found significant associations between scores on the ACLS-90 test and the Symbol Digit Modalities Test (Smith, 1982). McCraith and Henry (2003) and Secrest, Wood and Tapp (2000) found significant associations between *functional cognition* as measured by ACLS-90 test and *working memory* as measured by the Wisconsin Card Sorting Test (Heaton, Chelune, Talley, Kay, & Curtiss, 1983) and the Wechsler Adult Intelligence Scale III – Logical Memory Tests I and II (Kaufman & Lichtenberger, 1999). In a validity study by Velligan, et al. (1998) significant associations were reported for the relationship between *functional cognition* measured by the ACLS-90 test and *various other higher level cognitive processes* measured by the Hooper Visual Organization Test (Hooper, 1983) and other cognitive assessments.

There is also some evidence of a predictive relationship between ACLS-90 test scores and measures of community functioning taken at a later point in time (McCraith, & Henry, 2003; Velligan, et al., 1998).

Researchers have established that mean ACLS and LACLS test scores may be used to differentiate between distinct populations (Lee, et al., 2003; Ziv, Roitman, & Katz, 1999). However, studies of the relationship of ACLS and LACLS test scores to ethnicity and level of acculturation have consistently resulted in non-significant results (McAnanama, et al., 1999; Penny, et al., 1995; Roitman & Katz, 1996; Velligan, et al., 1995) as have studies of the relationship of ACLS and LACLS test scores to gender (Henry, et al., 1991; McAnanama et al., 1999; Penny et al., 1995; Roitman & Katz, 1996; Velligan et al., 1995). Results related to the relationship between level of education and test scores have been more mixed (Roitman & Katz, 1996; Velligan, et al., 1995).

### **Intervention Outcome Studies Based on ACLS and LACLS Test Scores**

There are a growing number of intervention outcome studies that provide validity evidence for the ACLS and LACLS test by demonstrating that use of scores from these assessments contributes in part to therapists' ability to provide effective interventions. Currently at least one of these studies using the LACLS-5 test and two others using the ACLS-90 test with community dwelling older adults and caregivers have been published. In addition, several large national and international NIH funded studies with this population are in progress. Some of the more recent published studies are described below. Following "best practice" recommendations, it is important to note that at least four of these studies verified the ACLS or LACLS test score with other performance-based assessments associated with the cognitive disabilities model to ensure a more complete and specific understanding of the functional cognitive capacities of each client.

Dementia and inpatient care: In one study, researchers used the ACLS-90 test as part of a comprehensive assessment of behavioral, cognitive, and functional status. Based in part on the clients' cognitive level, they demonstrated that individualized intervention plans resulted in a reduction in agitated behavior and an improvement in function for older adults with dementia receiving inpatient care (Holm, Michel, Stern, Hung, Klein, Flahery, Michel & Maletta, 1999). Another study used a holistic evaluation that included the ACLS-90 test as a basis for the development of interdisciplinary interventions for persons receiving care within a specialized inpatient geriatric psychiatry unit (Ngoh, Lewis & Connolly, 2005). The participants in this study demonstrated significant improvements by discharge.

Community dwelling older adults and caregivers: Two groups of researchers used clients' cognitive level based on scores from the ACLS-90 and LACLS-90 test and verified with standardized observations of performance using the Allen Diagnostic Module, 2<sup>nd</sup> edition (ADM-2; Earhart, 2006), another CDM-based assessment, to prescribe activities for persons with dementia. They concluded that this individualized intervention approach was effective both for reducing behavioral symptoms and for increasing the confidence of family caregivers (Gitlin,

Winter, Burke, Chernett, Dennis, & Huack, 2008; Gitlin, Winter, Earland, Herge, Chernett, Piersol, and Burke, 2009). More recently, researchers found that use of scores from the LACLS-5 test, the ADM-2 and other assessment data to tailor a prevention program to reduce falls in persons with dementia living in the community was a feasible intervention for fall prevention (Wesson, Clemson, Brodaty, Lord, Taylor, Gitlin & Close, 2013).

Adults with mental illness: Researchers completed a pilot study that showed significant improvement in adults who had schizophrenia following treatment in an out-patient setting based on the cognitive disabilities model and measured by ACLS-90 test and the Routine Task Inventory-2 (Allen, C. K., Earhart, C. A., & Blue, T., 1992b), another assessment based on the cognitive disabilities model that includes observation of ADL and IADL activities (Raweh & Katz, 1999). In another study, researchers used an occupational therapy consultative approach that included use of the ACLS-90 along with other occupational therapy assessments to improve the housing stability and attainment of individualized goals for people with mental illness at risk for homeless. Although results were mixed, significant improvement in both variables at six months lends support to the use of occupational therapy consultation based in part on the client's cognitive level of function (Chapleau, Seroczynski, Meyers, Lamb, & Buchino, 2012). An Italian group of researchers (Donda, Stratta, & Sconci, 2001) also demonstrated treatment effectiveness based on the cognitive disabilities model and measured by the ACLS-90 test for persons diagnosed with schizophrenia and bipolar disorder.

## **Conclusions**

This report provides solid psychometric evidence to support the reliable and valid use of the ACLS and LACLS Test as it has evolved since first being introduced in 1978. There is also a growing body of significant published psychometric evidence to support use of the ACLS-5 and LACLS-5 test. In addition, the more extensive published psychometric evidence for the ACLS-90 test provides relevant and substantive reliability and validity evidence for the ACLS-5 and LACLS-5, particularly since the differences between these two versions are manual additions and enhancements, not substantive changes in the administration and scoring protocol. The growing body of published research demonstrating significant intervention outcomes based in part on ACLS and LACLS test scores, including the ACLS-5 and LACLS-5, also provides additional validity evidence. These encouraging trends lend strong support for the evidenced-based use of the ACLS-5 and LACLS-5 test as a screen to provide a quick estimate of functional cognitive abilities, including an estimate of the severity of a person's cognitive problem or of a person's retained cognitive abilities at a given point in time. In addition, these trends suggest that use of scores from this screening test contribute in part to therapists' ability to provide effective interventions based on the cognitive disabilities model. Further research is recommended to fill in gaps in the psychometric data, to clarify the value and limitations of screen scores, and to better understand the relationship between ACLS-5 and LACLS-5 scores and intervention outcomes.

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