Test and Measurement Statistics Needed to Interpret the Results of an AMPS Observation

When an occupational therapist has successfully calibrated as a reliable and valid AMPS rater, he/she is able to use his/her personal copy of the OTAP software to generate ADL motor and ADL process ability measures for a person's AMPS observation. The purpose of this document is to provide occupational therapists with the information needed to interpret a person's AMPS results from a ***norm-referenced perspective***. More detailed information about how to interpret AMPS results from both a norm-based and a criterion-based perspective are included in Volume 1 of the AMPS manuals, Chapters 10 and 12 (Fisher & Jones, 2012).

Illustrating the Results of an AMPS Observation

Example ADL motor and ADL process scales are shown in Figure 1. Along the left edge of each scale (ADL motor and ADL process) is a small white arrow. These arrows specify where on the AMPS scales the person's ADL motor and ADL process ability measures are located. The higher the person's AMPS measures along the AMPS scales, the more ADL ability he/she demonstrated when observed performing AMPS tasks.

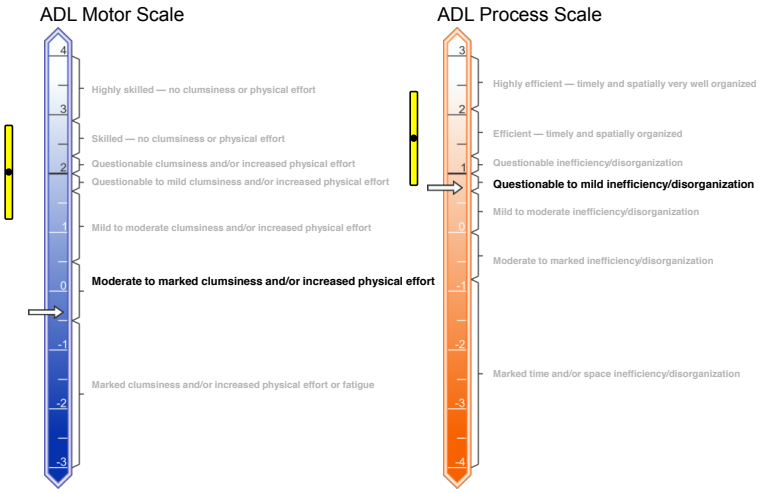

Figure 1. ADL motor and ADL process scales illustrating Renia's AMPS observation results

To the left of each of the AMPS scales is a vertical bar with a small dot located midway between the top and the bottom of the vertical bar. Those small dots depict the ***mean (M)*** ADL ability of a sample of healthy, well persons the same age as the person who was tested (again, mean ADL motor ability and mean ADL process ability). These means represent the *average measure* of the age-matched, well standardization sample of the

AMPS. The vertical bars extend upward and downward 2 ***standard deviations (SD)*** from the mean ADL measure. The normative mean ADL motor and ADL process ability measures for the AMPS are reported in Volume 2 of the AMPS manuals, Chapter 9, Table 9-2 (Fisher & Bray Jones, 2014).

Understanding the Test and Measurement Statistics Needed To Interpret the ADL Motor and ADL Process Ability Measures

More specifically, when a sample of healthy, well, typically-developing persons are tested with the AMPS, their ADL motor and process ability measures are expected to be distributed in the form of a bell-shaped curve (see Figure 2). The majority of the sample's AMPS measures will be located in the middle part of the bell-shaped distribution, and progressively fewer numbers of the sample's ADL measures will be located as one moves toward the right (upper) and left (lower) ends of the curve (commonly called tails).

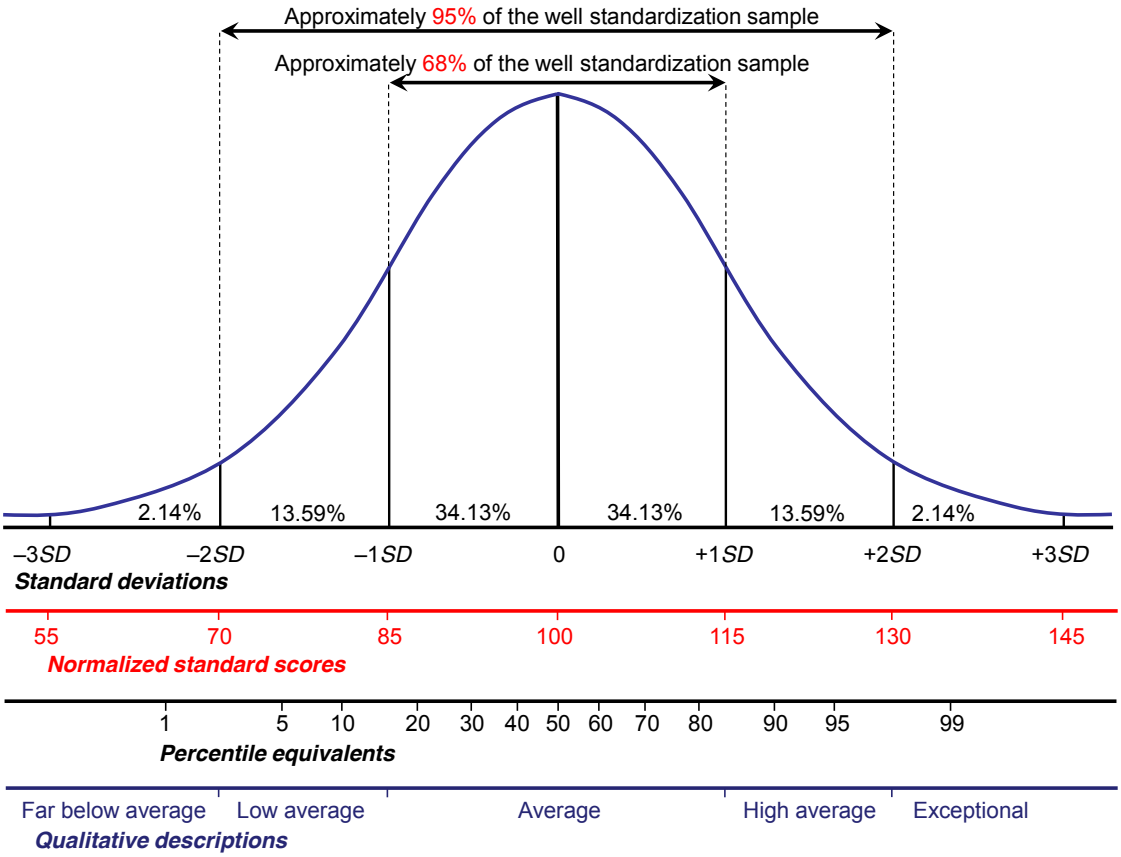

Figure 2. Bell-shaped curve depicting the "normal distribution" of a set of test scores

In the middle of Figure 2 is a long vertical line, located at zero (0) standard deviations (*SD*). This vertical line represents the **mean (*M*)** test score, where *M* = the sum of all the test scores for all of the well people of the same age in the standardization sample,

divided by number of people included in that sample. Thus, the mean can be ***conceptualized as the average AMPS measure for the age-matched standardization sample***.

To the right and left of the long vertical line depicting the mean are additional vertical lines that depict standard deviations from the mean (see Figure 2). Approximately 68% of the age-matched standardization sample of the AMPS would be expected to have AMPS measures within ±1 *SD* and 95% would be expected to have AMPS measures within ±2 *SD* (see Figure 2). While the criteria may vary across settings, it is common practice to consider test scores that are within ±2 *SD* of the normative mean to be "within normal limits"; in some settings, the criterion for indicating need for services may be -1.5 *SD* (Richardson, 2010). It is highly *unexpected* that any person's AMPS measures would fall above +2 *SD*. It is also *unexpected* that the AMPS measures of well persons would fall below –2 *SD*.

In Figure 3, the normal curve has been superimposed onto the AMPS scales. Here, the relationship between the normal curve and the vertical bars displayed to the right of the AMPS scales becomes clearer. Again, the dots in the middle of the vertical bars correspond to the normative mean (average AMPS measure of the well age-matched standardization sample; see Volume 2, Chapter 9, Table 9-2) and the vertical bars extend upward and downward 2 *SD* from that mean. This person's ADL motor and ADL process ability measures are located below the normative range (i.e., below the lower limit of the vertical bars; more than 2 *SD* below the mean).

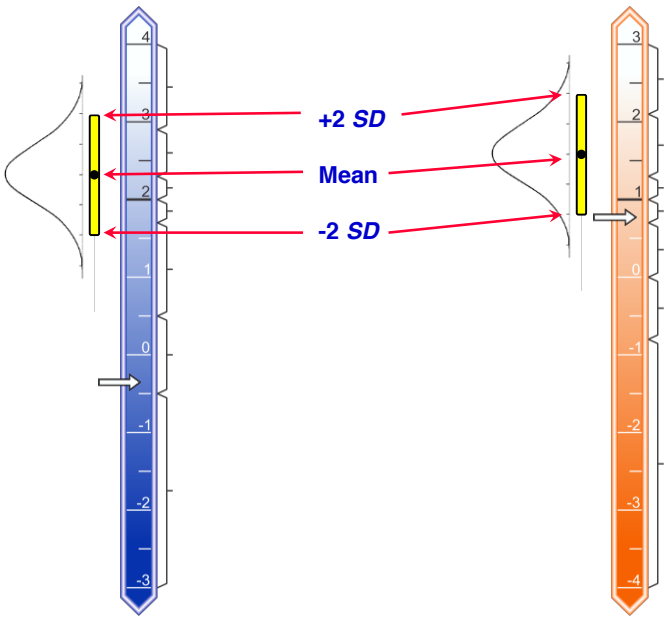

Figure 3. Normal curve superimposed on the ADL motor and ADL process scales illustrating Renia's AMPS observation results

Interpreting the Results of an AMPS Observation Using Statistical Terms

ADL motor and ADL process ability measures (in logits) may also be interpreted from a norm-referenced perspective using a variety of statistical terms, including ***standardized z scores***, ***normalized standard scores***, and ***percentile rank***.

Norm-referenced findings: A summary of the results of the AMPS observation is shown in the table below. The ADL motor and ADL process ability measures, expressed in logits, have been transformed into standardized *z* scores (mean = 0.0, *SD* = 1.0), normalized standard scores (mean = 100, *SD* = 15), and percentile ranks (percentage of people with lower AMPS measures).

	ADL ability measure (in logits)	Standardized *z* score	Normalized standard score	Percentile rank
ADL motor	-.3	<-3.0	<55	<1
ADL process	0.8	-2.1	69	1.8

The numbers in the table above indicate the following in relation to a norm-based interpretation:

- The ADL motor ability measure was more than 3.0 standard deviations below the normative mean, indicating that >99% of healthy, well people the same age likely have a **higher** ADL motor ability measure.
- The ADL process ability measure was 2.1 standard deviations below the normative mean, indicating that 98.2% of healthy, well people the same age likely have a **higher** ADL process ability measure.

Figure 4. Excerpt from Renia's AMPS Results Report

Understanding the Test and Measurement Statistics Used to Interpret the Results of an AMPS Observation

All of the test and measurement terms listed above can be defined and understood in relation to the ***normal curve***. That is, each represents a different way to describe where the person's AMPS measures are located in relation to the mean of the well age-matched standardization sample. ***Standardized z scores*** are among the most commonly used in occupational therapy. The standardized *z* score represents the number of standard deviations a person's AMPS measure is from the normative mean. The mean is set at zero (0 *SD*) and the standard deviation is set = 1. Thus, the "normal range" would be defined as falling within $z = +2$ and $z = -2$ (i.e., within ±2 *SD* from the mean). If the person's AMPS measure is equal to the average AMPS measure for the normative sample, the person's *z* score will be equal to zero (see the first row of numbers, *Standard deviations*, located under the normal curve shown in Figure 2). As shown in Figure 3 and Figure 4, Renia's ADL motor measure fell more than 3 *SD* below the normative mean (*z* is <–3.0) and her ADL process measure fell 2.1 *SD* below the normative mean.

Normalized standard scores are equivalent to *z* scores. In the AMPS, the mean *z* score of zero is merely transformed to a normalized standard score of 100. The standard deviation is transformed to an increment = 15. For example, the normalized standard score of an

AMPS measure that is more than –3.0 *SD* below the mean would be <55 (i.e., 3 *SD* = 3 x 15 = 45; 100 – 45 = 55).

The ***percentile rank*** describes what percentage of the age-matched normative sample would be expected to have AMPS measures that are the same or lower than the person tested. If a person has an AMPS measure that is average for his/her age, 50% of the normative sample would be expected to have AMPS measures equal to or lower than that person (see Figure 2). Renia's ADL motor measure is more than 3 *SD* below the mean, which means that <1% of the normative sample would be expected to have ADL motor measures at or below hers. Similarly, only 1.8% of the normative sample would be expected to have lower ADL process measures (see Figure 4).

References

Fisher, A. G. & Bray Jones, K. (2014). *Assessment of Motor and Process Skills*. *Vol*. *2: User manual* (8th ed.). Fort Collins, CO: Three Star Press.

Fisher, A. G. & Bray Jones, K. (2012). *Assessment of Motor and Process Skills*. *Vol*. *1: Development, standardization, and administration manual* (7th Rev. ed.). Fort Collins, CO: Three Star Press.

Richardson, P. (2010). Use of standardized tests in pediatric practice. In J. Case-Smith & J. O'Brien (Eds.), *Occupational Therapy for Children* (6th ed., pp. 216-243). Maryland Heights, MO: Mosby Elsevier.

Recommended Reading

Ary, D., Jacobs, L. C., & Razavieh, A. (2009). *Introduction to research in education* (8th ed.). Belmont, CA: Wadsworth/Thomson Learning.

Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*. Orlando, FL: Holt, Rinehart, & Winston.