



## **Demographic and Score Differences Between the BDI-2 Standardization and BDI-2 Normative Update Samples May 2016**

### **Demographic Differences**

The *Battelle Developmental Inventory, 2nd Edition Normative Update* (BDI-2 NU) reflects important demographic adjustments in the current U.S. population for children from birth through age 7 years, 11 months. These adjustments are reflected primarily by distributional differences in race, region, and socioeconomic status as measured by the mother's education level and are based on recent census estimates (U.S. Census Bureau, 2014).

The BDI-2 NU reflects an increased proportion of Hispanic/Latino participants among the early-child age groups. The Hispanic/Latino group remains the largest minority group (25.6%) and represents a substantive increase over the BDI-2<sup>TM</sup> Standardization Hispanic/Latino sample percentage of 18.9%. This demographic shift may be contrasted with the period prior to the 2000 U.S. Census in which the largest minority group was African American, followed by the Hispanic, Asian, American Indian, and Native Hawaiian and Pacific Islander groups.

The BDI-2 NU also reflects a regional migration away from the Northeast and Midwest toward the South and West. Respectively, the percentages of the BDI-2 NU sample from the Northeast/Midwest and the South/West were 37.3% and 62.7%. In contrast, the BDI-2 Standardization sample percentages were 39.4% for the Northeast/Midwest and 60.6% for the South/West. The BDI-2 NU sample also reflects the well-known trend of higher percentages of ethnic minorities living in the southern (Hispanic and African American) and western (Asian and Hispanic) regions of the United States.

Additionally, the BDI-2 NU reflects a shift toward higher education levels among mothers with children between the ages of birth and 7 years, 11 months. The updated figures from the U.S. Census Bureau (2014) indicate that the percentage of mothers with schooling beyond high school has increased to 63.9% from the percentage of 50.7% reported in the BDI-2 Standardization.

### **Subdomain Raw Score Differences**

Relative to the BDI-2, slightly higher raw scores for many of the subdomains are seen in the BDI-2 NU. The largest score differences were in the Peer Interaction and Self-Concept/Social Role Subdomains, and the smallest score differences were in the Gross Motor Subdomain. Score differences were most prevalent for the age groups from 3.5 years through 5 years, 11 months. In general, for children in this age range to achieve the same scaled score or age equivalent on the BDI-2, they would need to obtain a slightly higher raw score on the BDI-2 NU. For example, a 42-month-old examinee who received a raw score of 56 in the Self-Concept/Social Role

Subdomain on the BDI-2 would receive a scaled score of 10 (percentile rank of 50) and an age equivalent of 42 months. This same examinee would need to obtain a raw score of 57 on the BDI-2 NU in order to receive the same scaled score of 10 and an age equivalent of 42 months.

### Subdomain Scaled Score and Domain Standard Score Differences

Subdomain scaled score and domain standard score differences between the BDI-2 NU and the BDI-2 were computed for each examinee in the normative update. Difference scores were computed by subtracting each examinee’s BDI-2 subdomain scaled scores and domain standard scores from his or her respective BDI-2 NU scores. The medians of the difference scores are presented in Table 1 for each age group from birth through 7 years. The median score differences are displayed for each domain and subdomain, and the *SDs* of the score differences, when greater than or equal to 1, are displayed in parentheses below these numbers.

**Table 1**  
**Median BDI-2 NU – BDI-2 Score Differences and Standard Deviations (when *SD* ≥ 1.00) for All Examinees, by Age, Based on BDI-2 and BDI-2 NU Norms**

BDI-2 NU Domains and Subdomains	Age in Years								
	Median Score Differences ( <i>SDs</i> ≥ 1.00)								
	< 1 Year	1 Year	2 Years	3 Years	4 Years	5 Years	6 Years	7 Years	TOTAL
<b>ADAPTIVE</b>	0	0	0 (1.79)	0 (2.15)	-1 (1.87)	1 (1.62)	0	0	0 (1.23)
Self-Care	0	0	0	0	0	0			0
Personal Responsibility			0	0	0	0	0	0	0
<b>PERSONAL-SOCIAL</b>	0	0	0 (3.62)	0 (4.14)	0 (3.69)	2 (2.84)	0	0	0 (2.32)
Adult Interaction	0	0	0	0	0	0			0
Peer Interaction			0	0	-1	-1			0
Self-Concept & Social Role	0	0	0	0	0	0	0	0	0
<b>COMMUNICATION</b>	0	0	0 (2.19)	1 (2.32)	1 (2.23)	0 (2.60)	1 (2.81)	2 (2.97)	0 (2.02)
Receptive Communication	0	0	0	0	0	0	0	0	0
Expressive Communication	0	0	0	0	0	0	0	0	0
<b>MOTOR</b>	0	0	0	0	0	0	0	0	0
Gross Motor	0	0	0	0	0	0			0
Fine Motor	0	0	0	0	0	0			0
Perceptual Motor			0	0	0	0	0	0	0
<b>COGNITIVE</b>	0	0	0	0 (1.72)	0 (1.05)	0 (1.25)	1 (1.84)	1 (1.73)	0 (1.25)
Attention and Memory	0	0	0	0	0	0			0
Reasoning & Academic Skills			0	0	0	0	0	0	0
Perception and Concepts	0	0	0	0	0	0	0	0	0
<b>BDI-2 Total</b>	0	0	0	-1 (1.59)	-1 (1.06)	-2 (1.27)	0	0	0 (1.02)

*Note.* BDI-2 NU domain standard scores are based on a mean of 100 and a standard deviation of 15. BDI-2 NU subdomain scaled scores are based on a mean of 10 and a standard deviation of 3. A negative difference indicates that the median BDI-2 NU standard or scaled score is lower. A positive value indicates that the median BDI-2 NU standard or scaled score is higher.

As presented in Table 1, the median subdomain and domain score differences are quite small and are all within one third of a standard deviation of their respective score metrics. As expected, the magnitude of the score differences is greater at the domain level than the subdomain level. This is primarily a reflection of differences in the underlying score metrics as well as the composite nature of the domain standard scores.

In a similar manner, the standard deviations of the score differences are less than 1 in all of the subdomain comparisons. At the domain level, where the underlying score metric has a mean of 100 and a standard deviation of 15, larger difference score *SDs* are expected. In this case 27 of the 54 comparisons (50%) have a difference score *SD* that is less than 1. Of those domains with *SDs* greater than or equal to 1, the largest *SDs* are found with the Personal-Social Domain. As with the median score differences, the difference score *SDs* are small and are within one third of a standard deviation of their respective score metrics.

The score differences in Table 1 may be best understood when the median and the *SD* of the score differences are considered together. For example, at age 3 years with the Communication Domain, the median standard score difference is 1 point, with 68% of the difference scores being within a range of roughly 2 standard score points. Hence, the expectation is for the NU range of standard scores to lie between  $-1$  (1 minus 2) to  $+3$  (1 plus 2) for this domain and age group.

### **Change-Sensitive Scores**

The change-sensitive score (CSS) scale is a “Rasch model” ability growth scale that has been updated to reflect the demographic changes that have occurred with the normative update. As was done with the BDI-2, the NU CSS scale has been centered so that the mean CSS of 36-month-old examinees is 500.

Because the overall ability of examinees has increased slightly since the Standardization, an examinee will, in most cases, need to do at least as well or a little better (achieve a slightly higher raw score) with the NU norms than with the Standardization norms to obtain the same CSS.

A comparison of domain and subdomain CSS means and standard deviations for the NU sample and the Standardization sample are presented in Tables 2.1 and 2.2. Table 2.1 presents this information for examinees ages birth through 3 years, and Table 2.2 presents this information for examinees ages 4 through 7 years. In 73% of the tabled comparisons, the mean CSS scores are slightly higher for the NU sample than for the Standardization sample. There are just two significant differences reported: the Perceptual Motor Subdomain and the Motor Domain at age 7 years.

**Table 2.1**  
**BDI-2 NU and BDI-2 Mean (SD) Change-Sensitive Scores, Ages Birth Through 3 Years**

BDI-2 NU Domains and Subdomains	Age in Years							
	Mean Change-Sensitive Scores (SDs)							
	< 1 Year BDI-2 NU	< 1 Year BDI-2	1 Year BDI-2 NU	1 Year BDI-2	2 Years BDI-2 NU	2 Years BDI-2	3 Years BDI-2 NU	3 Years BDI-2
<b>ADAPTIVE</b>	376.81 (34.79)	375.93 (36.46)	452.70 (17.05)	454.46 (16.58)	486.45 (13.55)	486.49 (14.12)	511.00 (13.32)	510.91 (13.26)
Self-Care	376.81 (34.79)	375.93 (36.46)	452.70 (17.05)	454.46 (16.58)	483.81 (16.46)	484.82 (17.14)	511.27 (14.80)	512.61 (14.78)
Personal Responsibility					489.09 (14.18)	488.15 (14.51)	510.73 (14.68)	509.20 (14.83)
<b>PERSONAL-SOCIAL</b>	392.86 (34.61)	390.22 (34.43)	456.51 (19.81)	455.39 (19.78)	484.48 (15.70)	484.14 (16.21)	510.73 (17.02)	508.86 (17.11)
Adult Interaction	401.59 (41.72)	399.87 (40.73)	465.91 (22.52)	465.09 (22.35)	490.43 (15.63)	489.80 (16.65)	508.01 (17.37)	506.36 (17.84)
Peer Interaction					484.84 (19.38)	485.55 (19.40)	512.50 (21.94)	510.05 (21.67)
Self-Concept & Social Role	384.13 (30.29)	380.58 (30.93)	447.11 (20.16)	445.69 (20.39)	478.16 (19.26)	477.06 (19.52)	511.69 (17.24)	510.16 (17.31)
<b>COMMUNICATION</b>	369.22 (29.87)	368.10 (29.77)	440.74 (19.91)	440.68 (20.08)	479.51 (21.59)	479.12 (21.96)	511.04 (16.23)	510.36 (16.00)
Receptive Communication	384.41 (25.92)	382.45 (26.19)	448.95 (21.70)	449.11 (21.88)	482.96 (21.20)	483.22 (21.02)	512.06 (15.87)	511.37 (15.52)
Expressive Communication	354.04 (36.85)	353.75 (36.32)	432.62 (21.55)	432.25 (21.66)	476.07 (24.82)	475.01 (25.93)	510.01 (18.90)	509.34 (18.90)
<b>MOTOR</b>	357.16 (35.09)	354.40 (35.74)	445.17 (21.07)	444.68 (21.08)	480.04 (16.44)	479.22 (18.26)	510.03 (15.75)	510.32 (15.07)
Gross Motor	335.01 (40.74)	331.17 (41.37)	444.63 (26.18)	442.98 (26.80)	481.78 (17.74)	480.72 (18.75)	511.78 (15.03)	511.42 (14.89)
Fine Motor	379.30 (31.02)	377.62 (31.62)	445.71 (20.08)	446.37 (19.59)	476.12 (17.48)	476.15 (18.28)	507.19 (17.09)	506.65 (16.06)
Perceptual Motor					482.21 (24.37)	480.64 (27.81)	511.15 (23.42)	512.93 (22.87)
<b>COGNITIVE</b>	393.68 (35.11)	392.82 (36.43)	451.76 (18.76)	452.72 (18.40)	485.39 (13.37)	484.68 (13.43)	511.00 (12.62)	510.19 (12.00)
Attention and Memory	406.61 (31.21)	405.81 (32.30)	455.15 (18.68)	455.94 (18.67)	484.84 (15.69)	484.48 (15.84)	511.48 (13.64)	510.49 (13.22)
Reasoning & Academic Skills					484.61 (15.42)	483.70 (14.84)	509.30 (13.94)	508.72 (13.87)
Perception and Concepts	380.75 (42.63)	379.84 (44.14)	448.36 (22.90)	449.50 (22.27)	486.71 (16.05)	485.86 (16.41)	512.21 (14.54)	511.36 (13.72)
<b>BDI-2 Total</b>	377.95 (32.15)	376.29 (32.83)	449.37 (17.12)	449.58 (16.93)	483.17 (13.81)	482.76 (14.51)	510.74 (12.69)	510.11 (12.33)

**Table 2.2**  
**BDI-2 NU and BDI-2 Mean (SD) Change-Sensitive Scores, Ages 4 Years Through 7 Years**

BDI-2 NU Domains and Subdomains	Age in Years							
	Mean Change-Sensitive Scores (SDs)							
	4 Years BDI-2 NU	4 Years BDI-2	5 Years BDI-2 NU	5 Years BDI-2	6 Years BDI-2 NU	6 Years BDI-2	7 Years BDI-2 NU	7 Years BDI-2
<b>ADAPTIVE</b>	525.14 (12.24)	524.66 (12.98)	543.26 (10.07)	543.37 (9.87)	555.03 (12.05)	553.87 (11.87)	561.05 (11.55)	560.31 (12.19)
Self-Care	524.17 (13.46)	524.99 (14.28)	544.58 (13.05)	546.51 (12.75)				
Personal Responsibility	526.10 (14.18)	524.33 (14.88)	541.95 (11.73)	540.23 (11.40)	555.03 (12.05)	553.87 (11.87)	561.05 (11.55)	560.31 (12.19)
<b>PERSONAL-SOCIAL</b>	524.25 (13.99)	523.34 (14.30)	537.67 (10.58)	536.66 (10.98)	550.58 (15.70)	552.04 (16.02)	560.43 (16.26)	561.11 (16.79)
Adult Interaction	519.74 (14.04)	519.15 (14.14)	532.90 (10.43)	531.51 (10.82)				
Peer Interaction	529.44 (16.96)	527.71 (17.86)	540.38 (13.37)	538.94 (13.90)				
Self-Concept & Social Role	523.58 (16.39)	523.17 (16.38)	539.74 (14.74)	539.54 (14.91)	550.58 (15.70)	552.04 (16.02)	560.43 (16.26)	561.11 (16.79)
<b>COMMUNICATION</b>	531.55 (12.65)	530.36 (12.30)	547.12 (11.85)	545.80 (11.58)	559.61 (12.50)	559.15 (12.36)	567.11 (13.03)	566.41 (12.43)
Receptive Communication	533.52 (11.38)	531.89 (11.00)	547.74 (11.23)	545.86 (11.28)	557.83 (13.00)	557.31 (13.11)	565.17 (12.57)	564.86 (12.36)
Expressive Communication	529.57 (15.86)	528.82 (15.35)	546.50 (14.53)	545.75 (14.13)	561.39 (13.75)	560.99 (13.59)	569.04 (15.50)	567.96 (14.52)
<b>MOTOR</b>	532.98 (12.24)	533.09 (13.10)	557.18 (13.52)	556.90 (13.26)	595.52 (17.23)	598.33 (17.57)	608.92** (15.81)	611.90 (15.80)
Gross Motor	528.42 (14.80)	528.94 (15.20)	547.53 (15.16)	547.56 (15.51)				
Fine Motor	529.07 (12.02)	528.57 (12.14)	549.01 (13.02)	547.52 (12.51)				
Perceptual Motor	541.44 (20.43)	541.75 (22.66)	574.99 (20.59)	575.62 (20.82)	595.52 (17.23)	598.33 (17.57)	608.92** (15.81)	611.90 (15.80)
<b>COGNITIVE</b>	528.41 (10.30)	527.36 (10.84)	545.71 (11.41)	544.33 (10.91)	567.23 (13.97)	566.91 (13.88)	580.45 (12.23)	580.28 (12.05)
Attention and Memory	528.32 (12.43)	527.04 (12.80)	540.25 (13.27)	538.80 (12.51)				
Reasoning & Academic Skills	527.28 (12.16)	526.38 (12.80)	548.48 (17.59)	547.26 (16.70)	575.32 (20.18)	574.54 (19.66)	595.25 (17.02)	594.75 (16.70)
Perception and Concepts	529.63 (12.16)	528.66 (12.58)	548.40 (10.22)	546.92 (10.23)	559.14 (10.40)	559.28 (10.64)	565.65 (10.84)	565.81 (10.67)
<b>BDI-2 Total</b>	528.46 (9.99)	527.76 (10.41)	546.19 (9.16)	545.41 (9.02)	565.59 (10.48)	566.06 (10.52)	575.59 (10.07)	576.00 (9.90)

Note. \*\* indicates significant difference at  $\alpha = .05$  level.

## **Summary**

There are important differences in the demographic composition of the BDI-2 NU sample relative to that of the BDI-2. Notable differences are reflected in both the growth of the Hispanic population within the early-child age groups as well as the continued shift toward higher education levels among mothers with young children.

Though the demographic composition has changed, differences in subdomain raw scores, scaled scores, domain standard scores, and change-sensitive scores can be characterized as small, or as less than small.

## **Reference**

U.S. Census Bureau. (2014). *Current Population Survey, Annual Social and Economic Supplement*. Washington, DC: Author.