

Brain Size and Mental Capacity

Correlation and Regression

Background

Are the size and weight of your brain indicators of your mental capacity? In this study by Willerman et al. (1991) the researchers use Magnetic Resonance Imaging (MRI) to determine the brain size of the subjects. The researchers take into account gender and body size to draw conclusions about the connection between brain size and intelligence.

Willerman et al. (1991) conducted their study at a large southwestern university. They selected a sample of 40 right-handed Anglo introductory psychology students who had indicated no history of alcoholism, unconsciousness, brain damage, epilepsy, or heart disease. These subjects were drawn from a larger pool of introductory psychology students with total Scholastic Aptitude Test Scores higher than 1350 or lower than 940 who had agreed to satisfy a course requirement by allowing the administration of four subtests (Vocabulary, Similarities, Block Design, and Picture Completion) of the Wechsler (1981) Adult Intelligence Scale-Revised. With prior approval of the University's research review board, students selected for MRI were required to obtain prorated full-scale IQs of greater than 130 or less than 103, and were equally divided by sex and IQ classification.

The MRI Scans were performed at the same facility for all 40 subjects. The scans consisted of 18 horizontal MR images. The computer counted all pixels with non-zero gray scale in each of the 18 images and the total count served as an index for brain size.

The Data

Willerman et al. (1991) collected a sample of 40 right-handed Anglo introductory psychology students at a large southwestern university. Subjects took four subtests (Vocabulary, Similarities, Block Design, and Picture Completion) of the Wechsler (1981) Adult Intelligence Scale-Revised. The researchers used Magnetic Resonance Imaging (MRI) to determine the brain size of the subjects. Information about gender and body size (height and

weight) are also included. The researchers withheld the weights of two subjects and the height of one subject for reasons of confidentiality.

Number of cases: 40

Table 1: Variable Descriptions

| Variable | Description |
|----------|--|
| Female | 0 = Male, 1 = Female |
| FSIQ | Full Scale IQ scores based on the four Wechsler (1981) subtests |
| VIQ | Verbal IQ scores based on the four Wechsler (1981) subtests |
| PIQ | Performance IQ scores based on the four Wechsler (1981) subtests |
| Weight | Body weight in pounds |
| Height | Height in inches |
| MRICount | Total pixel count from the 18 MRI scans |

A straightforward method for evaluating the relationship between brain size and IQ scores is the correlation coefficient. Your assignment is to examine the relationship between brain size and intelligence as measured by MRI pixel count and full scale IQ. Analyze the data by sex as well as pooled. Explain your findings. As with any analysis, a thoughtful researcher should first examine their data using descriptive statistics and plot (graphs).

References

Willerman, L., Schultz, R., Rutledge, J. N., & Bigler, E. (1991). In vivo brain size and intelligence. *Intelligence*, 15, 223-228.

| Table 2: Observed Data | | | | | | |
|------------------------|------|-----|-----|--------|--------|----------|
| Female | FSIQ | VIQ | PIQ | Weight | Height | MRICount |
| 1 | 133 | 132 | 124 | 118 | 64.5 | 816932 |
| 0 | 140 | 150 | 124 | . | 72.5 | 1001121 |
| 0 | 139 | 123 | 150 | 143 | 73.3 | 1038437 |
| 0 | 133 | 129 | 128 | 172 | 68.8 | 965353 |
| 1 | 137 | 132 | 134 | 147 | 65.0 | 951545 |
| 1 | 99 | 90 | 110 | 146 | 69.0 | 928799 |
| 1 | 138 | 136 | 131 | 138 | 64.5 | 991305 |
| 1 | 92 | 90 | 98 | 175 | 66.0 | 854258 |
| 0 | 89 | 93 | 84 | 134 | 66.3 | 904858 |
| 0 | 133 | 114 | 147 | 172 | 68.8 | 955466 |
| 1 | 132 | 129 | 124 | 118 | 64.5 | 833868 |
| 0 | 141 | 150 | 128 | 151 | 70.0 | 1079549 |
| 0 | 135 | 129 | 124 | 155 | 69.0 | 924059 |
| 1 | 140 | 120 | 147 | 155 | 70.5 | 856472 |
| 1 | 96 | 100 | 90 | 146 | 66.0 | 878897 |
| 1 | 83 | 71 | 96 | 135 | 68.0 | 865363 |
| 1 | 132 | 132 | 120 | 127 | 68.5 | 852244 |
| 0 | 100 | 96 | 102 | 178 | 73.5 | 945088 |
| 1 | 101 | 112 | 84 | 136 | 66.3 | 808020 |
| 0 | 80 | 77 | 86 | 180 | 70.0 | 889083 |
| 0 | 83 | 83 | 86 | . | . | 892420 |
| 0 | 97 | 107 | 84 | 186 | 76.5 | 905940 |
| 1 | 135 | 129 | 134 | 122 | 62.0 | 790619 |
| 0 | 139 | 145 | 128 | 132 | 68.0 | 955003 |
| 1 | 91 | 86 | 102 | 114 | 63.0 | 831772 |
| 0 | 141 | 145 | 131 | 171 | 72.0 | 935494 |
| 1 | 85 | 90 | 84 | 140 | 68.0 | 798612 |
| 0 | 103 | 96 | 110 | 187 | 77.0 | 1062462 |
| 1 | 77 | 83 | 72 | 106 | 63.0 | 793549 |
| 1 | 130 | 126 | 124 | 159 | 66.5 | 866662 |
| 1 | 133 | 126 | 132 | 127 | 62.5 | 857782 |
| 0 | 144 | 145 | 137 | 191 | 67.0 | 949589 |
| 0 | 103 | 96 | 110 | 192 | 75.5 | 997925 |
| 0 | 90 | 96 | 86 | 181 | 69.0 | 879987 |
| 1 | 83 | 90 | 81 | 143 | 66.5 | 834344 |
| 1 | 133 | 129 | 128 | 153 | 66.5 | 948066 |
| 0 | 140 | 150 | 124 | 144 | 70.5 | 949395 |
| 1 | 88 | 86 | 94 | 139 | 64.5 | 893983 |
| 0 | 81 | 90 | 74 | 148 | 74.0 | 930016 |
| 0 | 89 | 91 | 89 | 179 | 75.5 | 935863 |