

Advanced Neuropsychological Diagnostics Infrastructure

Documentation

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Preface

The purpose of this document is to give users background information regarding the construction of the ANDI database and how to use it. The document will provide users with a step-by-step description of the statistical data processing that has been performed of the upload process. It starts at the point where data were donated, up to the documentation of which data are currently available in the ANDI database.

Contents

1 General methods

1.1 Gathering data

2.1 Gathering data The first step was to collect a large amount of normative data on neuropsychological tests. In cooperation with a large group of researchers the ANDI consortium (see: www.andi.nl) was created. These researchers are working in academic hospitals, healthcare institutes and universities. The consortium members donated data of healthy control subjects which they collected in various research projects. All donated data were gathered in studies that were approved by local ethics committees, and all data were anonymized and could not be traced back to individual participants. An index was made to give an overview of the different neuropsychological tests and versions donated by the consortium. Example: Data on the Trail Making Test (TMT) were donated by 26 research projects.

1.2 Combining data

We first determined which neuropsychological test variables were included in each donated data files, i.e. which tests and which scoring type. We created separate files for all neuropsychological measures. For example, a file for the Wechsler Adult Intelligence Scale (WAIS) was created. In this file, data from WAIS variables were combined, specified per subtask and WAIS version. Demographic variables such as age, sex and level of education were also added. Cases which did not have a score on all three of the demographic variables were excluded. For each participant the original study ID was also included. Data were merged per neuropsychological test, i.e. one file for each neuropsychological test was created. In this data file, all data which contained the same measurement were merged in one variable. Example: One file for the TMT was created. In this file data from all test variables were collected. Thus the variable TMTa contained all data we have on the a part of the TMT, TMTb contained all data from the b part of the TMT.

1.2.1 Checking merged variables

After all data from the same test were merged into a new data file, we checked whether no errors were made. We did so by plotting standardized residuals from a simple linear regression of the variable of interest (e.g. *WAIS-III-Coding*) on the demographic variables that potentially influence the test score (e.g. age, sex and level of education). From these plots abnormally distributed study clusters could be detected. When an odd cluster occurred, it was often the case that the variable of this cluster was either mislabeled or the variable type (raw score versus standard score) was not (correctly) specified. More information about these scores was then obtained via the researchers who donated the data, or via their published articles. After corrections were made (e.g. changing the label of the variable), the regression model was run again and the standardized residuals were plotted to check whether the problem had been solved. Consider the *WAIS-III-Coding* variable as an illustrative example:

Example : *WAIS - Coding data*: Figure 1 shows residuals based on the regression of the *WAIS-III-Coding* variable on the demographic variables (age, sex and level of education). These residuals express test performance as z-scores after correction for age, sex and level of education. From this plot it becomes apparent that the participants of study number 8 show a different pattern compared to participants in the other studies. Also, the residuals are not normally distributed around zero, something one would expect from these standardized residuals. Possibly the scores from this group of participants are not in fact *WAIS-III-Coding* raw scores, but some other measure.

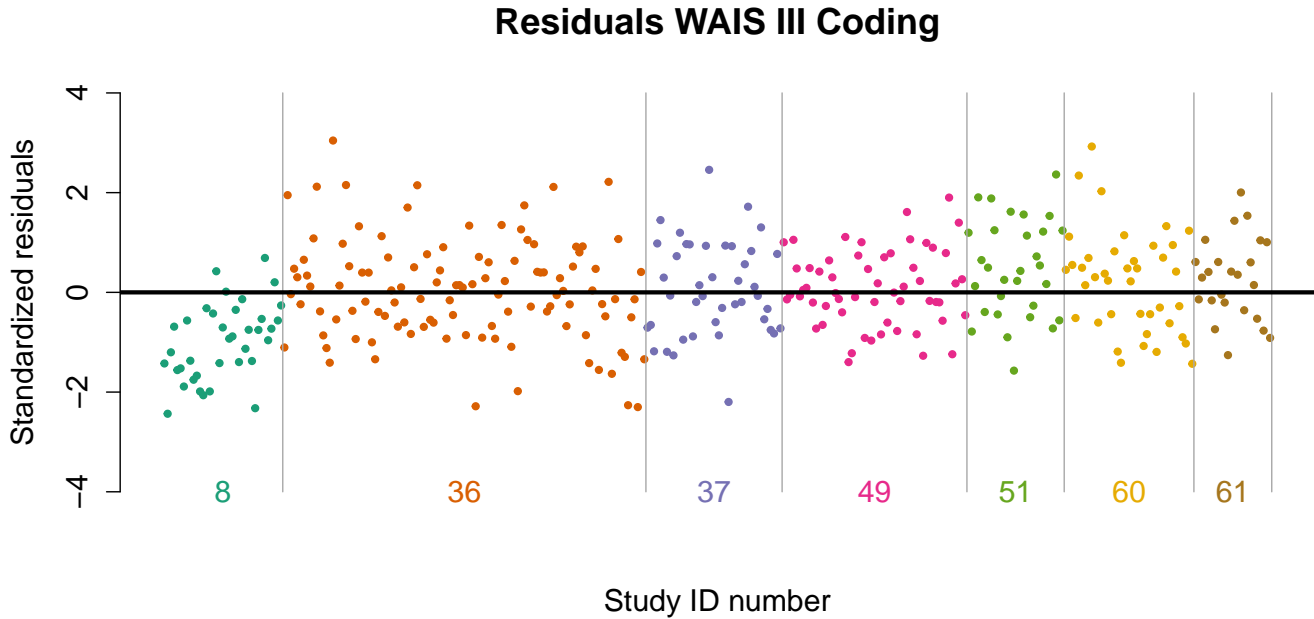


Fig. 1. Standardized residuals for the *WAIS-III-Coding* subtask. Note that the data pattern of study 8 is deviant from the other studies.

To investigate this discrepancy in scores, we contacted the research group of the study to obtain information about this specific variable. It appeared that the measure was mislabeled. Instead of *WAIS-III-Coding* raw score it should have been labeled *WAIS-NL-Coding* raw score (the first Dutch version of the WAIS).

Figure 2 shows the residuals for *WAIS-NL-Coding* including study 8. Participants of study 8 do longer show a different pattern from the rest of the participants, and the residual scores are not normally distributed around zero.

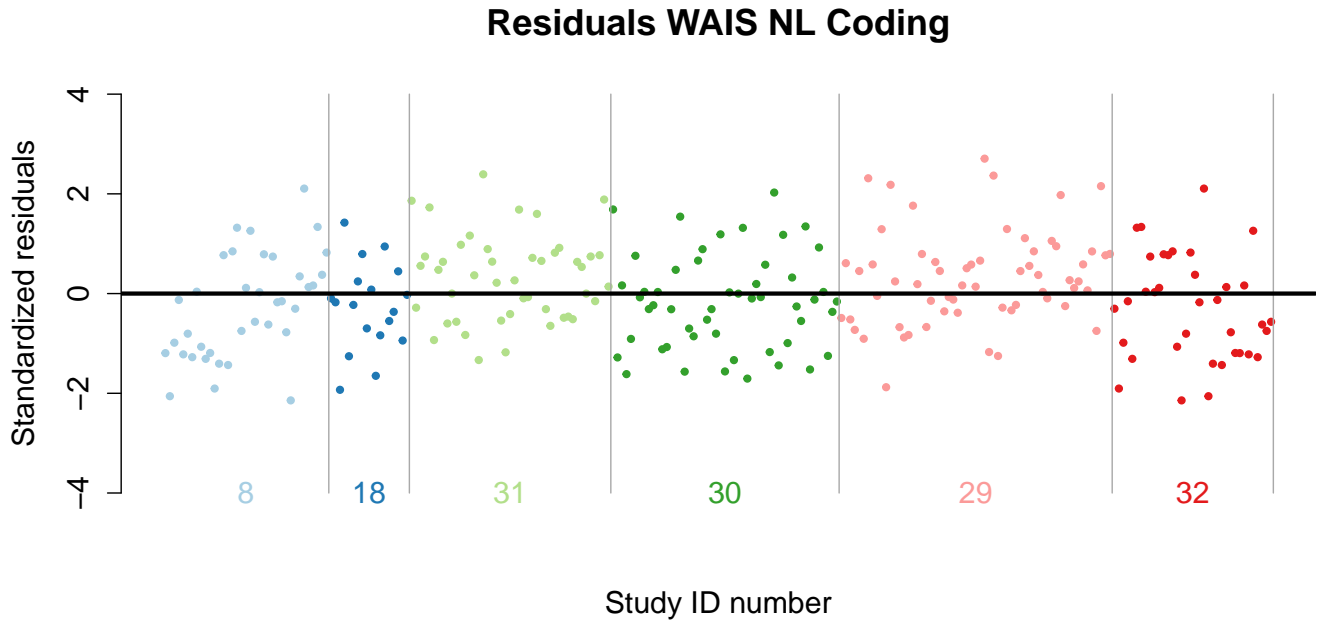


Fig.2. Standardized residuals for the old *WAIS-NL-Coding* plotted on study number with study 8 included. Note that the data pattern of study 8 is similar to the other studies.

When the regression model is fit to the *WAIS-III-Coding* variable again (now without study 8), it can be seen from 20cmure 3 that the data of all studies are normally distributed around zero with no extreme differences between studies.

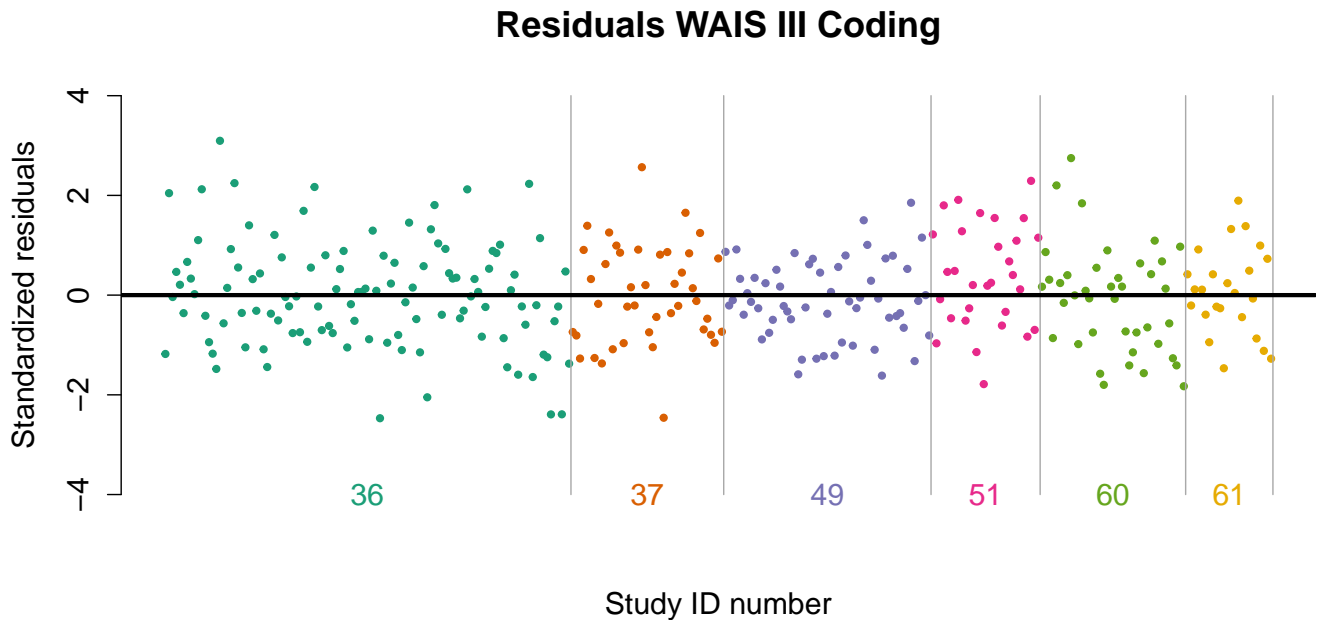


Fig. 3. Standardized residuals for *WAIS-III-Coding* plotted on study number after the removal of study 8.

This was done for all merged variables to check whether the correct variables were merged together.

The steps of this first phase are summarized by the flowchart in 20cmure 4.

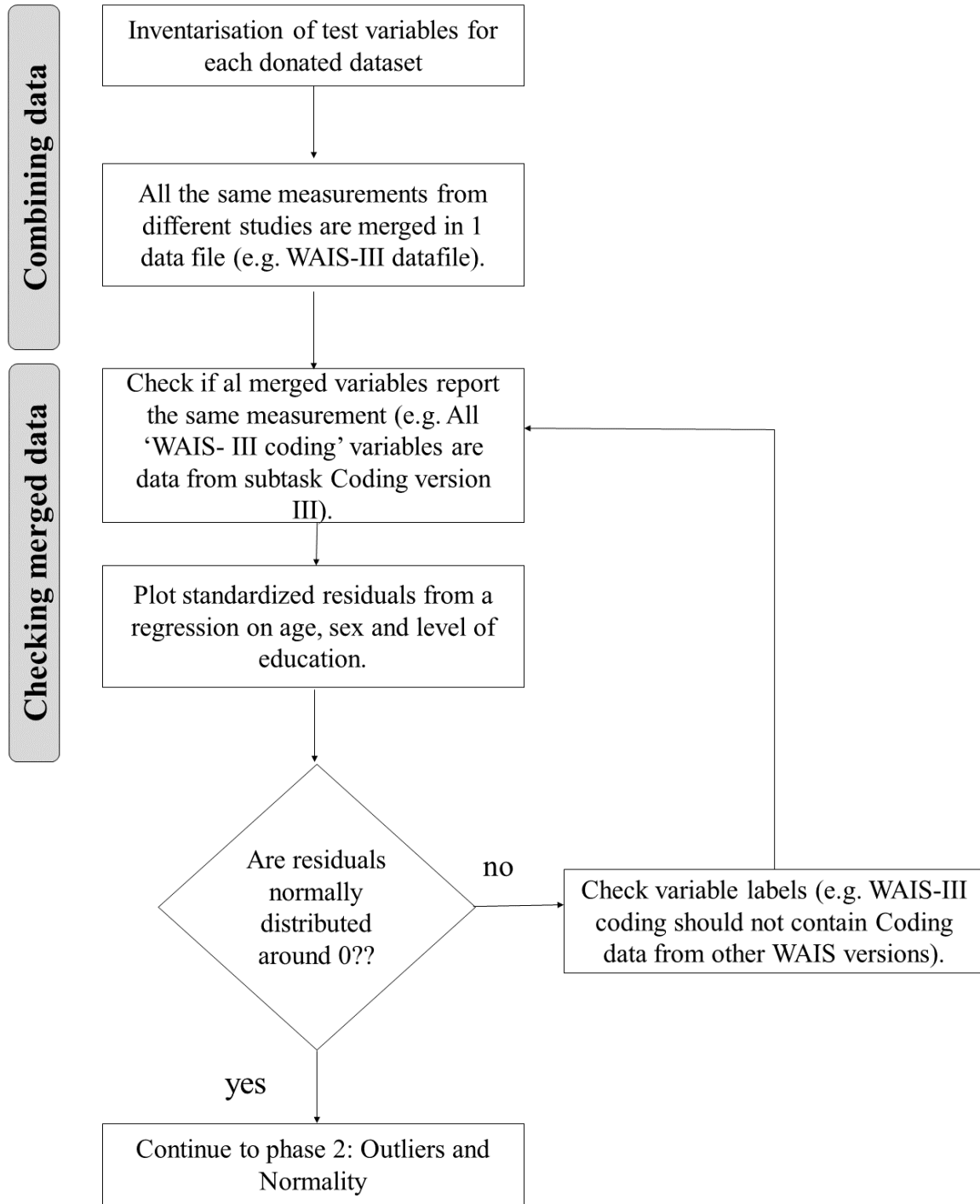


Fig 4. Flow-chart for phase 1: Preparation and merging of the data

2 Outliers

After merging the data from the donated datasets into separate files for each neuropsychological test, we checked whether all recorded values were valid observations from healthy participants. If invalid observations would not be removed from the database, the variance in scores would be overestimated, which would cause a diminished sensitivity to detect subtle impairments. On the other hand, we wanted the database to be an accurate representation of variability in the healthy populations. This implied that the outlier criteria should not be so strict that only the participants who performed very well were included.

Because a persons neuropsychological test scores are dependent on his or her demographic characteristics, not all outlying scores can be found by defining a single criterion, such as deviating 2.5 standard deviations from the mean. For example, scores that are abnormal in young participants may not at all be abnormal in healthy elderly. Thus to define these outliers, we first wanted to partial out the effects of age, sex and level of education, before deciding which values are outliers. In order to do this we needed to fit a regression model to each of the variables in the database. This way we could determine which participants had demographically corrected outlying scores. However, there were some scores in the database that were logically impossible (e.g. due to a typing error). Also, some extremely poor scores were included in the database because a substantial part of the data were donated by large aging studies. If these scores would be maintained in the database when fitting a regression model, the model might not be sufficiently sensitive for detecting (demographically corrected) outliers because the distribution of scores would be too wide. Therefore, we first removed extreme scores from the database before fitting the regression model to detect outliers. This first step is described next. The procedure will be illustrated using data from the Trail Making Test part a (TMT-A).

2.1 Step 1: Extreme border removal

In the first step we removed the extremely outlying values which would distort the regression model. These were scores that were either due to an administrative error or, could not possibly have been gathered from a healthy participant. For every variable of each neuropsychological test, upper and lower borders were defined. We called these borders extreme borders. The upper border was set at the maximum possible score. This removed administrative errors (scores that are logically impossible). The lower border was set at the worst score a participant can obtain while still deemed cognitively healthy. To this end, we selected the raw score corresponding to the lowest percentile of the worst performing normative sample. The exact percentile depended on the resolution of the norm table, but generally a score corresponding to the first percentile was selected. Thus, for a test that has declining scores with increasing age, the raw score that was obtained by the lowest percentile of the oldest participants was defined as the extreme border.

If no information from manuals was available, we relied on our knowledge of the neuropsychological tests and the expertise of the ANDI consortium. The full list of extreme borders that were used for each neuropsychological test can be found in the ANDI background documentation which can be downloaded from the ANDI website (www.andi.nl).

Example In case of the TMT-A the range of acceptable scores is defined as 10-150 seconds. A score of < 10 seconds is impossibly low and must be due to some administrative error. A score > 150 seconds is either due to an error or indicates cognitive or motor pathology. This means that for every test two clinical borders were defined; the lowest possible score for a participant free from pathology, and a (theoretical) highest possible score. We will refer to both kinds of borders as 'clinical borders'. At this point we removed scores that exceed these ranges.

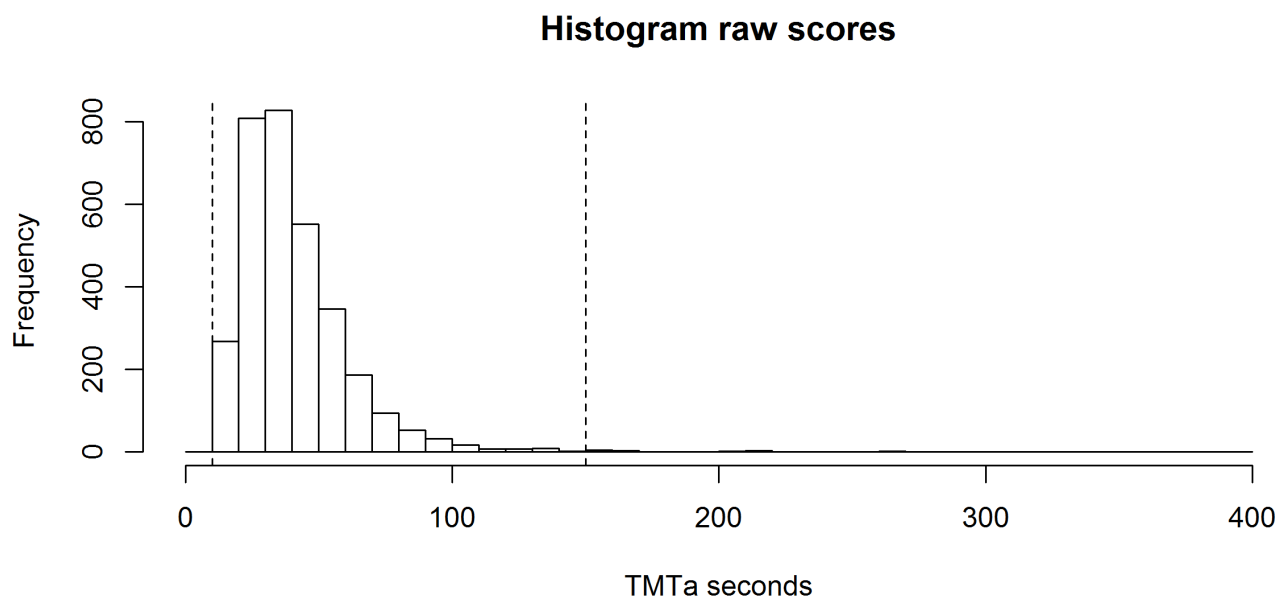


Fig. 5. Histogram of score distribution of TMTa in seconds. The vertical dashed lines show the clinical borders. The right border indicates the lowest possible score someone can have on the TMTa. The left border is the theoretical high point meaning that if a patient completed the test faster than 10 seconds there must have been a administrative error.

2.2 Step 2: Model selection

Now that the observations exceeding extreme borders were removed, we fitted a regression model to model the effects of demographic background variables. To take possible systematic differences between studies into account we used a multilevel regression model. For variables where there were only data from a single study, a single level regression model was fitted.

The demographic variables were age in years, sex and level of education. Level of education was coded on a seven-point scale that is commonly used in the Netherlands (Verhage, 1964). Although this is an ordinal scale, we estimated the linear effect of education to avoid estimating separate parameters for all levels of education. Aside from the main effects of age, sex and level of education, interaction effects between these three demographic variables could also influence test scores, including a three way interaction between age, sex and level of education. To determine which effects to include, we followed variable two-step selection procedure. First a selection on the basis of what demographic information we had available about the participants, and a selection on the basis of what effects are statistically important to include in the model.

The residuals of this model can be considered as demographically corrected scores. We saved the model specification, so these effects can be taken into account in all future analyses, including normative comparisons. An alternative would have been to save the residuals and use these instead of the raw data, as they represent demographically corrected scores. But because exchanging raw scores for residuals removes information which may be useful in further analyses, we kept the raw scores instead. The correction for the effects of demographic variables was done in the models we used.

2.2.1 Part 1: Selection of effects on the basis of availability of demographic data:

To estimate the effects of demographic variables, a reasonable range in values on these variables is necessary. However, the range of values was restricted for some variables in the donated data. For example, for some tests only scores from higher educated individuals were available, which implied that the education effect for these tests could not be estimated. For interaction effects, a sufficiently large sample for every combination of demographic variables is needed. For example, if the data consist of old participants with low and high educations, and young participants with just high education, an age by education effect cannot be estimated.

To find out which effects could plausibly be estimated given the availability of different levels of the demographic variables, we cross-tabulated age, sex and level of education. If the median number of participants in each cell was lower than 10, we considered this too sparse to estimate the corresponding effect for this neuropsychological test variable. Because age is continuous and therefore does not readily lend itself to tabulations, we temporarily created age categories, namely individuals younger than 60, aged between 60 and 70 years, between 70 and 80 years, and 80+. The median is not suited to detect whether just two groups contain enough observations for estimation, as it is non-zero even if one of the groups is completely empty. So for sex, we used a different criterion, where the minimum number of observations instead of the median has to be 10 or larger

Example: In Table 1 and 2, an example of this cross-tabulation is given for the TMTa. The main effects of age and education are deemed estimable, as the median cell count for each of the effects is larger than 10. For sex the criterion is that there should be at least 10 men and 10 women in the sample, this is true for the TMTa and thus the main effect of sex is potentially included. The same holds true for the interaction effects of Age*Sex, Sex*Education and Age*Education. The three-way interaction of Age*Sex*Education can also be included.

Table 1

Overview of median values and the effects that were allowed to be selected.

Demographic effect	Criterion	Potentially included
Age effect	Median = 879.5	Yes
Sex effect	N men > 10, + N women > 10	Yes
Education effect	Median = 316	Yes
Age * Sex effect	Median = 437.5	Yes
Sex * Education effect	Median = 194	Yes
Age * Education effect	Median = 62.5	Yes
Age * Sex * Education effect	Median = 34	Yes

Table 2

Cross tabulation of number of participants by age categories and sex for the TMT-a variable. If the median cell count is lower than 10 for any main or interaction effect, this effect is not included in the model.

	Age [0,60]	Age (60,70]	Age (70,80]	Age (80,120]	N per Educat.
Educat.1	1M + 2F = 3	0M + 2F = 2	3M + 10F = 13	0M + 1F = 1	Educat.1 = 19
Educat.2	18M + 23F = 41	24M + 21F = 45	30M + 56F = 86	13M + 22F = 35	Educat.2 = 207
Educat.3	63M + 67F = 130	30M + 45F = 75	10M + 47F = 57	10M + 15F = 25	Educat.3 = 287
Educat.4	55M + 111F = 166	74M + 105F = 179	85M + 100F = 185	15M + 34F = 49	Educat.4 = 579
Educat.5	132M + 217F = 349	162M + 152F = 314	132M + 138F = 270	23M + 34F = 57	Educat.5 = 990
Educat.6	159M + 209F = 368	131M + 101F = 232	103M + 73F = 176	21M + 16F = 37	Educat.6 = 813
Educat.7	98M + 75F = 173	52M + 14F = 66	48M + 11F = 59	16M + 2F = 18	Educat.7 = 316
N per Age	Age [0,60] = 1230	Age (60,70] = 913	Age (70,80] = 846	Age (80,120] = 222	Total N = 3211

2.2.2 Part 2: Statistical selection of effects to be included in the model:

Even if there are enough observations to estimate the effect of a demographic variable, it does not necessarily imply that the variable has an effect on test scores. To determine which effects to include in the regression models, we used a backward selection procedure, removing effects if removal resulted in a lower Bayesian Information Criterion (BIC) (Raftery, 1995). We use the rule that we can only remove terms that are not constituents of interaction terms that are still in the model. For example, if age*gender is still in the model, neither age nor gender is investigated as a potential term for removal. BIC has a number of advantages over a p-value approach. The p-value approach is highly dependent on the sample size, which would mean that the demographic variables would primarily be added to models for variables that have many observations, in some cases over-fitting the data. The BIC is computed such that the inclusion is less dependent on sample size, and that parsimonious models are preferred over elaborate models. The model that was selected for each variable can be found in the appendix.

Example: Table 3 describes which terms were used in the model for the TMTa

Table 3

Model terms that were selected for the TMTa

Demographic Effects	BIC
Initially included terms	
$s + a + e + s*a + s*e + a*e + s*a*e$	26420.45
Dropped terms	
$s*a*e$	26420.05
$s*a$	26412.05
$s*e$	26404.24
s	26397.93
Terms in the final model	
$a + e + a*e$	26397.93
age = a, sex = s, education = e	

2.3 Removing demographically corrected outliers

After fitting and selecting the appropriate models to correct for demographic characteristics, we used the residuals rather than the raw scores to decide whether scores were abnormal. A common criterion for outlying values is three standard deviations. However, a few outlying scores can increase the standard deviations considerably. Therefore, we used the median absolute deviation from the median (MAD) (Leys et al., 2013). The MAD and the median are more robust to outliers than the standard deviation and the mean. As a cutoff criterion, we used 3.5 MAD rather than the more common three standard deviations, as we intended to include the whole distribution of normal scores, and wanted to be conservative so as to not remove any scores that were not abnormal. Figure 7 illustrates the residuals of the model in a histogram.

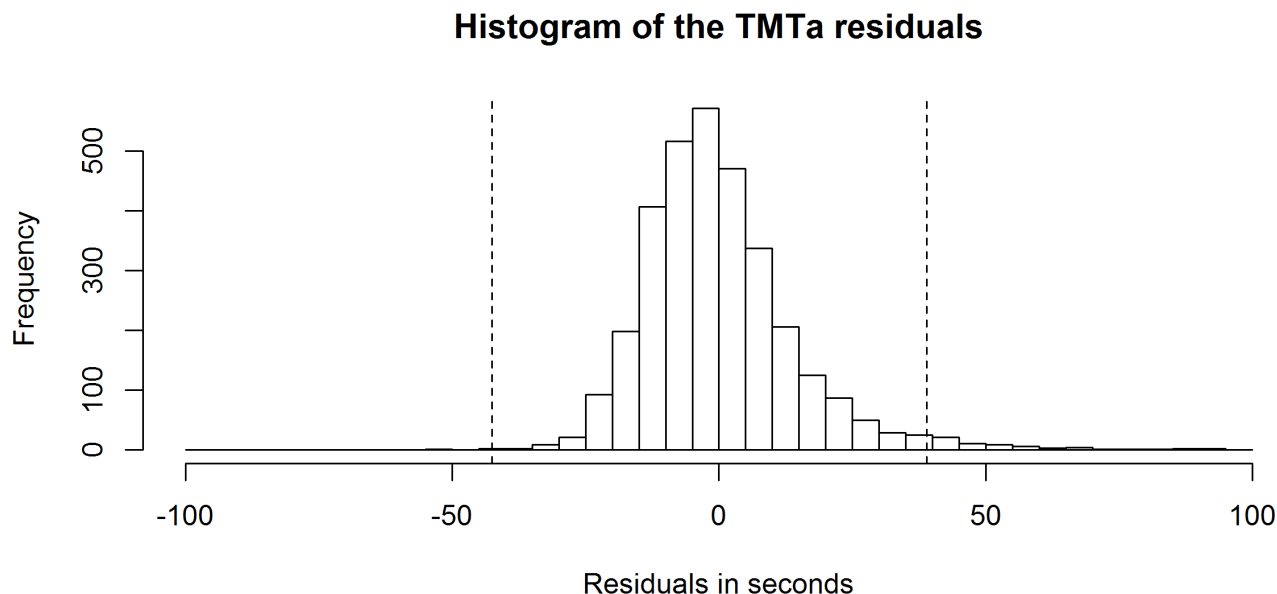


Fig. 6. Histogram of the TMTa (in seconds) standardized residuals. The vertical dashed lines are an indication of the 3.5 MAD cutoff scores.

Note on the removal procedure: If a participants score on a test is outlying, one might either remove only this score, remove all of the participants scores on this test, or remove all of the participants scores on all tests. We opted for the first possibility, because removing scores on more variables than just the outlying one implies that we can identify the participants cognitive functioning as the cause of the outlying value, which we cannot. The source may just as well be a researchers error.

2.4 Normality

The primary aim of the ANDI database is to facilitate normative comparisons. In both univariate and multivariate normative comparison methods, normality of the dependent variables is assumed (Crawford, & Howell, 1998; Huizenga et al., 2007). However, not all neuropsychological test scores are normally distributed. This may be due to effects of demographic variables. For example, if young participants scores are normally distributed with a low mean reaction time, and if old participants scores are normally distributed with a high mean reaction time, then the raw scores for both groups combined may be non-normal (possibly with two peaks, one for the young participants and one for the old). If the effect of age is partial led out in a regression analysis, and if the residual scores of this regression analysis are used instead of raw scores, such non-normality is no longer an issue. However, residual scores may still be non-normal. In those cases, finding a normalizing transformation is recommended to meet the assumption of normality (Crawford et al., 2006).

For many tests the raw scores are transformed to normally distributed standard scores. These transformations for example involve taking the square root of the raw scores, or taking the reciprocal. These can both be written as power transformations, raising to the power of 0.5 and -1, respectively. These transformations are frequently used, but do not necessarily lead to the best approximation of normality. Therefore, we used the Box-Cox procedure (Box, & Cox, 1964; Sakia, 1992) to find the best possible power transformation. In the following, we explain this procedure and describe how it relates to transformations that are common in clinical neuropsychology. The Box-Cox procedure searches for the power transformation that best approximates the normal distribution. For example, the procedure may find that the best transformation is raising to the power 0.5, i.e. the square root transformation. It may however also turn out that the best transformation is raising to the power of 0.563. The Box-Cox procedure requires a large dataset, which is not often available in neuropsychology (Crawford et al., 2006). Fortunately, the ANDI database is very large, and hence such optimal transformations can be estimated.

Note the difference between attempting to normalize the raw scores and attempting to normalize the residuals after

correction for demographic variables. Because in ANDI patients will be compared to demographically corrected norms, i.e. taking into account their age, sex and level of education, we wanted the residuals, i.e. scores that have been corrected for the effects of demographic variables, to be normally distributed. Thus the best Box-Cox power transformation has been applied to the raw data and if the earlier fit regression models are fit to the data again, residuals will be as normal as possible. The Box-Cox procedure is highly flexible, but the application requires a few adjustments. First, all scores have to be larger than 0, so if there were scores that were either negative or 0, a constant was added (e.g. 5.001, if the greatest negative value was -5) to make all scores positive. Second, if the best power transformation turned out to be negative, raising the raw scores to this power flipped the order of values, i.e. the worst scores became the best and vice versa. To reverse this change of ordering, these values were multiplied by -1 to restore the order. Third, power transformations may result in tiny or huge values, which may be difficult to interpret. Therefore, we first transformed all scores, and then standardized all these transformed scores to the familiar standard normal z-scale with mean 0 and standard deviation 1. All standardized transformed z-scores were merged to create the final ANDI database. For the TMTa the residuals of the regression model are not normally distributed, this is illustrated by 20cmure 7. We will therefor apply a Box-Cox power transformation to the data.

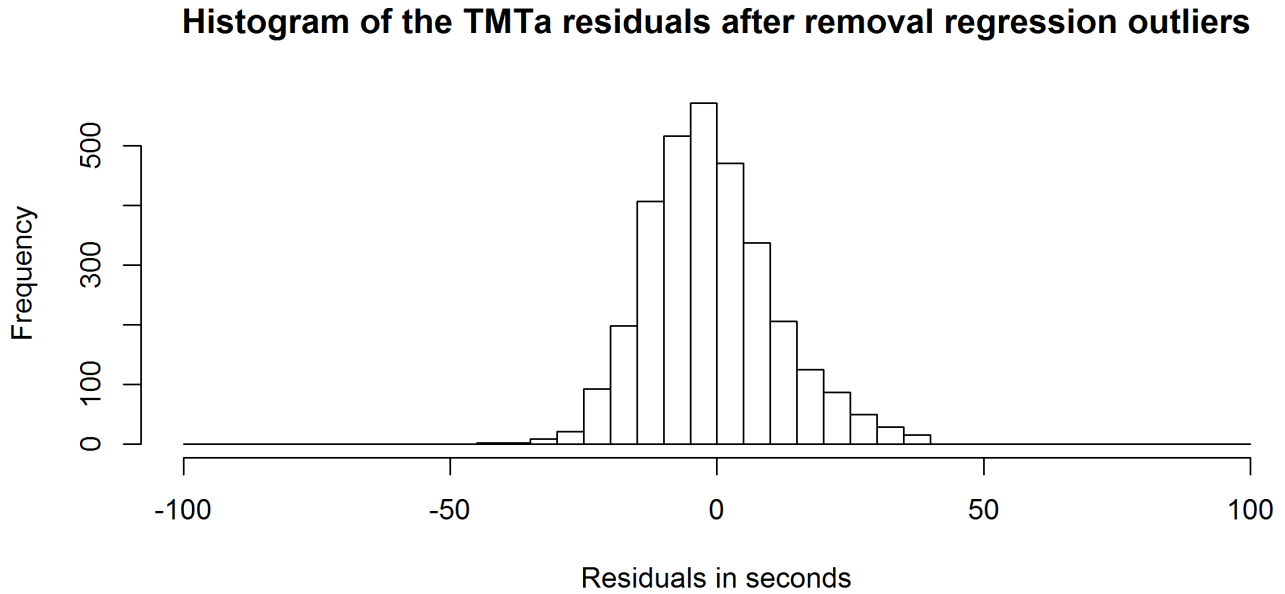


Fig. 7. Histogram of the residuals of the Trail Making Test (version A) data, after regression based outliers have been removed.

Example: The Box-Cox procedure looks for the best possible power transformation to make the residuals as normally distributed as possible. If the best power transformation is negative, this will not only change the scale of the scores, but also the order: Relatively good scores become relatively bad scores, and vice-versa. To preserve the original order of observations, we multiplied scores by -1 when the best transformation was negative. For the TMTa the best power transformation was **0.075**. Thus all TMTa-scores in seconds would be raised to the power -0.03 to obtain scores that result in normally distributed residuals. For example, a raw score of 47 would be transformed to $47^{-0.03} = 0.891$. The transformed scores are not directly interpretable. If a score, predicted or observed, has to be interpreted, it can be transformed back to the original scale, by raising it to the reciprocal power, in our example $1 / -0.03 : 0.891^{1 / -0.03} = 47$. If the best power transformation was negative (such as for the TMTa), the reversal (the multiplication by -1) has to be undone first before the transformation to the original scale can be done. After the Box-Cox power transformation has been applied to the raw data we fit the multi-level model to the data again (20cmure 8). If we now look at the residuals they are more normally distributed.

After the power transformation has been applied to the raw data, we fitted the same (multilevel) model to the data again. Figure 8 shows that the residuals of the model are now more normally distributed than before the transformation (20cmure 7).

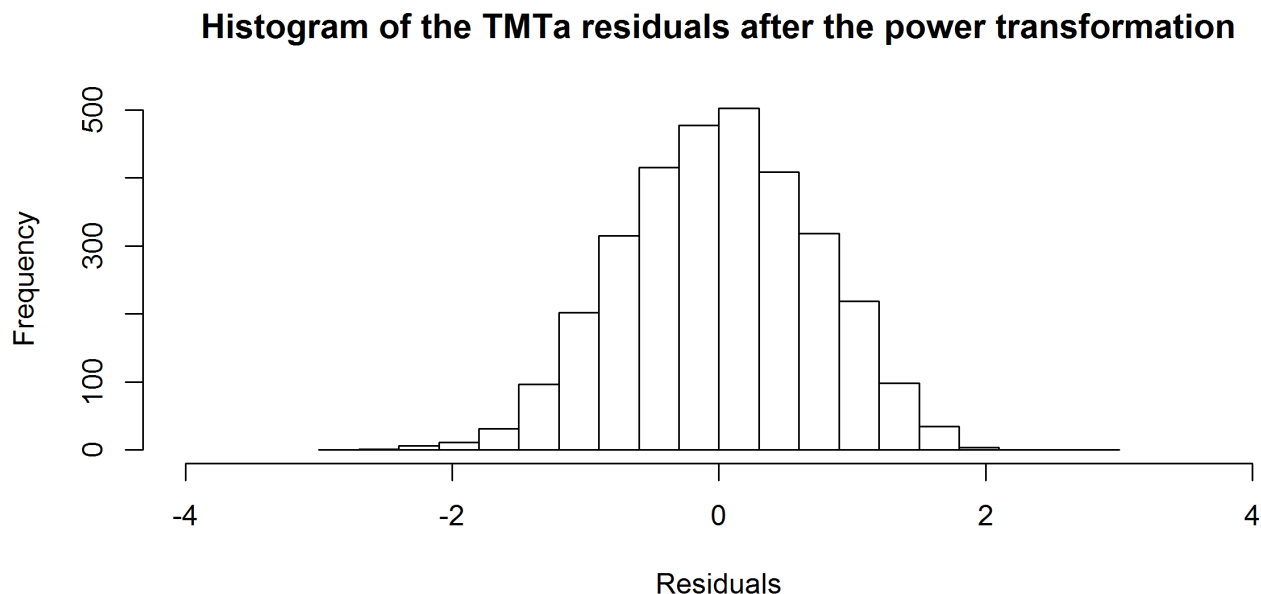


Fig. 8. Histogram of residuals of the TMTa (in seconds), after transformation and standardization.

Power transformations may result in tiny or huge values, which may be difficult to interpret. Therefore, we first transformed all scores, and then standardized all these transformed scores to the familiar standard normal z-scale with mean 0 and standard deviation 1. All standardized transformed z-scores were merged to create the final ANDI database.

Example: In the 20cmure 9, the raw scores on TMTa variable are plotted against age, with men portrayed in blue and women in red. Separate plots were made for different levels of education (ranging from the lowest level of education 1 to the highest 7). The pale colored points depict the raw scores of the participants and it can be seen that all raw scores lie between 3 and 15, as extreme outliers have been removed. There are many data points for education levels 2 through 6, but relatively few for education level 1.

From the red and blue regression lines, which have been transformed back to the original scale for convenience, it can be observed that there is an increase in time it takes to complete the task as participants get older and that men and women perform equally well. The effect age on the scores is the slightly different for the different education levels: Older participants with a higher level of education perform better than elderly with a lower level of education.

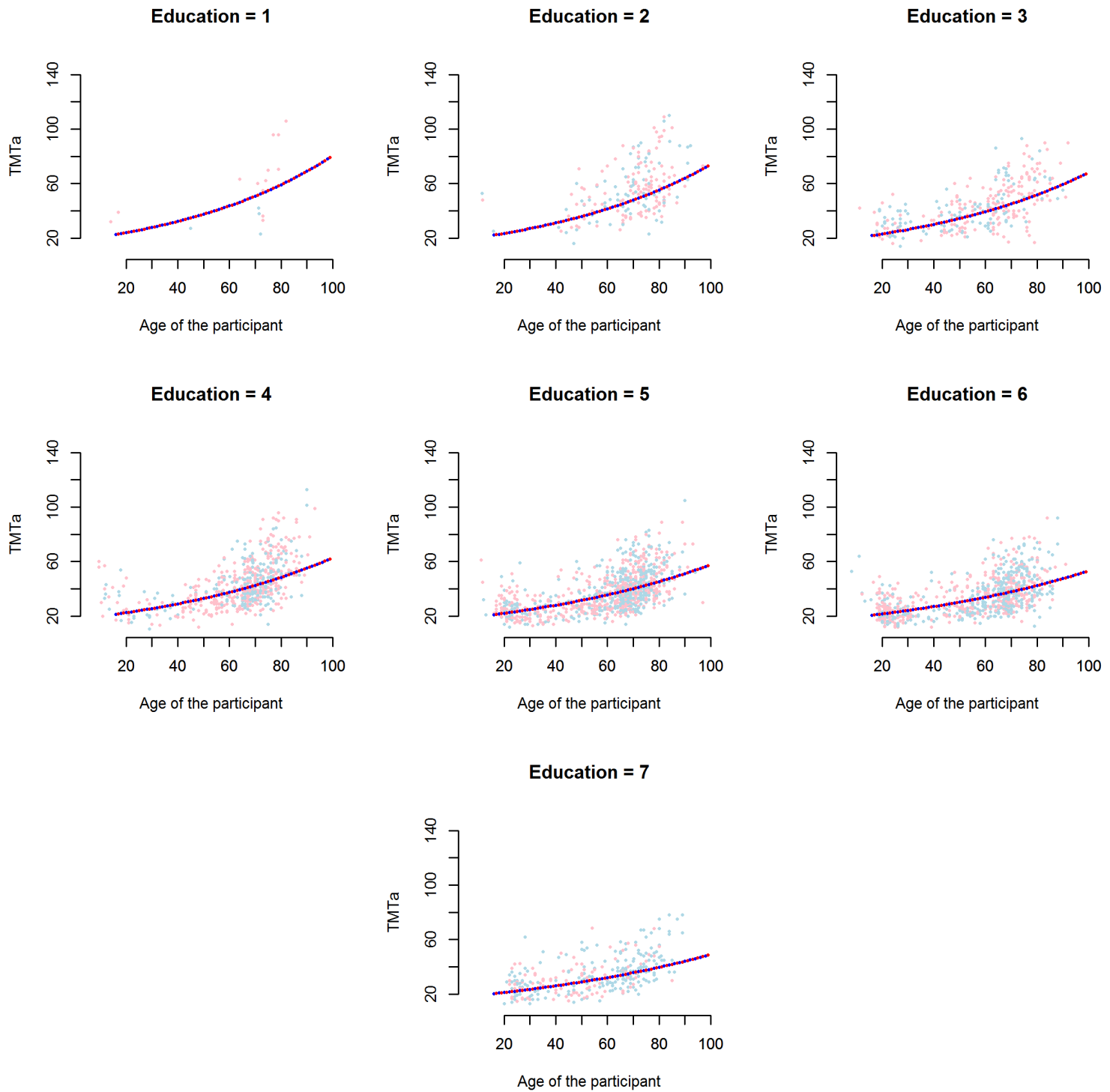


Fig. 9 TMTa in seconds

Figure 10 sums up this phase in a flow-chart.

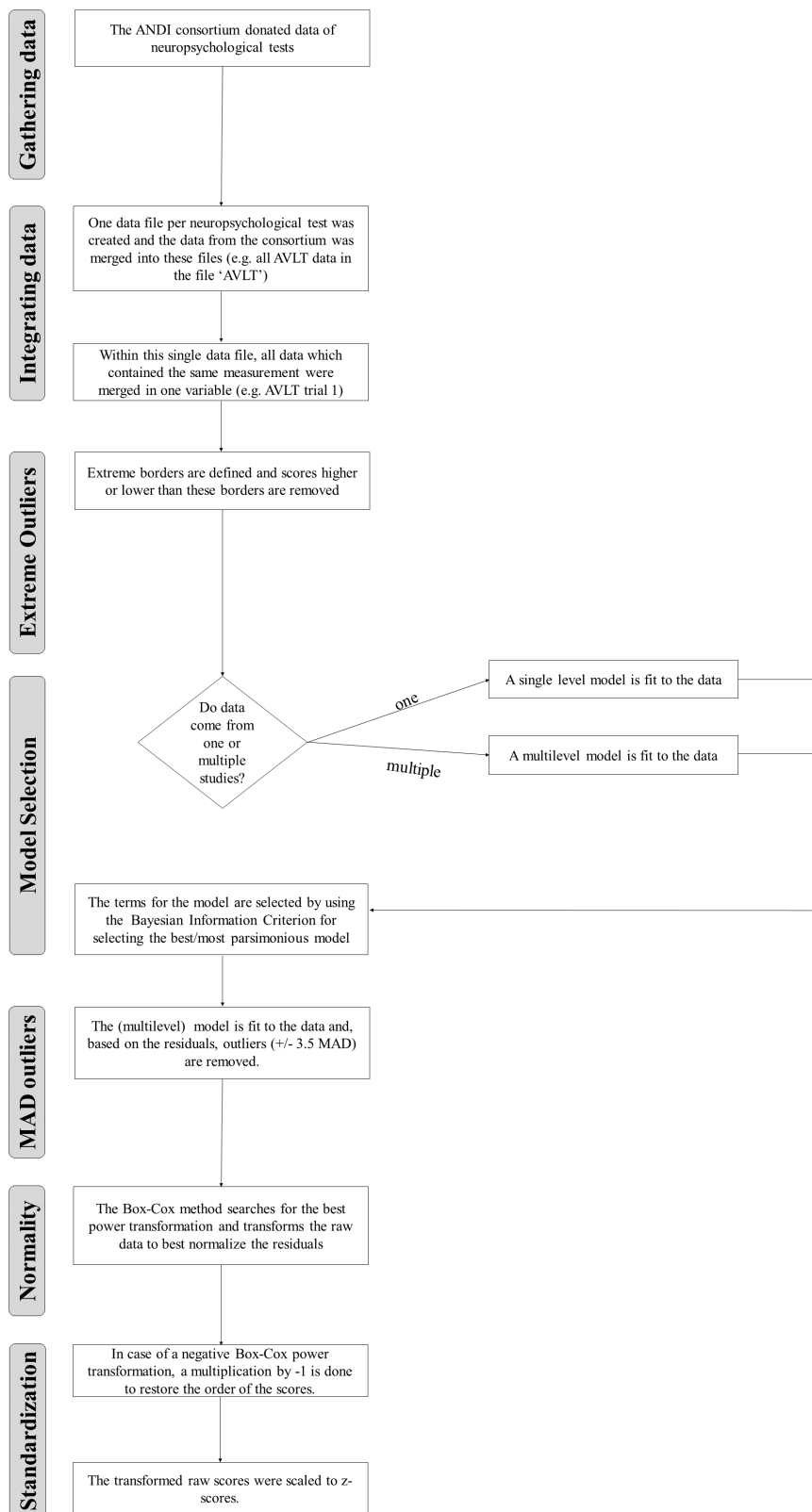


Fig 10.Flow-chart for phase 2: Removing outliers and normalizing data.

3 Contents of ANDI

ANDI currently has data of 26277 healthy participants on 30 neuropsychological tests available. ANDI contains data from neuropsychological tests for different cognitive domains. A list of example variables that are currently included in the database is given in section 3.1 N initial donated is the total amount of data that was donated for that variable. Total in ANDI is the amount of data that is present in the current database (after outliers have been removed). The appendix gives more detailed information per neuropsychological test.

3.1 Contents of ANDI on 12/01/2016

Variable name	N Initial donated total	Total in ANDI
AVLT total 1 to 5	5056	5035
AVLT recognition	3885	3770
AVLTdelayed recall 1 to 5	4774	4557
AVLT total 1 to 3	9584	9437
AVLT delayed recall 1 to 3	4857	4584
BADS Rule shift cards I tijd	234	231
BADS Rule shift cards II score	237	230
BADS Rule shift cards II tijd	234	219
BADS Key Search	55	54
BADS Dysexecutive Questionnaire	91	87
BADS Zoo Map I	199	184
BADS Zoo Map total	239	235
BADS Zoo Map I planning in seconds	113	108
BADS Zoo Map II total in seconds	113	112
BADS Zoo Map II planning in seconds	112	67
BADS Zoo Map II total in seconds	112	111
BDI total score	292	287
BFRT total short form	1362	1338
Boston Naming Test; long version	439	427
Brixton total score	282	275
Brixton number of errors	198	191
BW row time	380	375
BW total time	193	193
BW number missed	379	362
BW number of errors	379	317
CES D total score	620	607
Clock Drawing Task	173	167
D2 test total number of errors - F	48	43
D2 test total processed - TN	48	20
D2 test variance in tempo - VT	18	18
Dart Raw	2219	2136
Dart IQ	5227	5130
GIT 1 Legkaarten	160	160
GIT 1 Cijferen	71	71
GIT 1 IQ score	71	71
GIT 1 Matrijzen	71	71
HADS total score	70	63
HADS anxiety score	70	66
HADS depression score	70	68
HSCL Anxiety	216	201
HSCL Depression	216	207
HSCL total score	277	268
1st letter	2291	2268
2nd letter	2287	2255
3rd letter	2120	2109
Total letter fluency	2156	2140
LLT - Total Displacement Score	149	146
MMSE Total	16627	16130
PASAT 2.8	53	52
PASAT 2.0	138	136
PASAT 1.6	104	102
PASAT 2.4	366	154
PASAT 3.2	19	15

Variable name	N Initial donated total	Total in ANDI
RAND 36 physical functioning	44	41
RAND 36 social functioning	44	44
RAND 36 mental health	44	44
RAND 36 vitality	44	44
RAND 36 pain	44	42
RAND overall health	44	43
RCPM total serie a and b	4085	4020
RSPM total series b c and d	45	43
RAPM 12 item short form	2943	2808
Story 1 immediate recall	492	464
Story 1 delayed recall	419	396
Story 2 immediate recall	366	345
Story 2 delayed recall	365	358
Story 1 + 2 immediate recall	162	134
Rey-Osterrieth Complex Figure Test Copy	400	388
Rey-Osterrieth Complex Figure Test Recall	305	304
Rey-Osterrieth Complex Figure Test Delayed Recall	319	319
Taylor Complex Figure Test Copy	303	294
Taylor Complex Figure Test Recall	151	150
Taylor Complex Figure Test Delayed Recall	302	301
Animals	5958	5784
Occupations	1864	1855
SRT Total Recall	3335	3307
SRT Long Term Retrieval	3335	3322
SRT Long Term Storage	3335	3295
SRT Consistent Long Term Retrieval	3335	3335
SRT Delayed Recall	3334	3256
Stroop Card I	1549	1511
Stroop Card II	1925	1894
Stroop Card III	1924	1878
TMTa	3231	3140
TMTb	3188	3072
TOL total move score	63	62
VAT A trial 1 plus 2	151	141
VAT B trial 1	894	804
VAT B trial 1 plus 2	68	65
VAT A plus B	190	173
WAIS III Arithmetic	1524	1524
WAIS III BlockDesign	1623	1623
WAIS III Coding	1684	1678
WAIS III Comprehension	81	81
WAIS III Information	1495	1493
WAIS III Matrix Reasoning	154	154
WAIS III Object Assembly	34	34
WAIS III Picture Arrangement	125	125
WAIS III Picture Completion	121	115
WAIS III Similarities	277	274
WAIS III Symbol Search	85	85
WAIS III Vocabulary	211	211
WAIS III Letter Number Sequencing	390	384
WAIS IV Picture Completion	39	39
WAIS IV Digitspan	25	23
WAIS NL Arithmetic	18	18
WAIS NL Block Design	18	16
WAIS NL Coding	248	248

Variable name	N Initial donated total	Total in ANDI
WAIS NL Information	18	18
WAIS NL Picture Completion	18	18
WAIS NL Similarities	18	18
WAIS R Coding	70	70
WAIS R Digitspan	248	248
WCST number of categories	179	164
WCST number of errors	179	177
WCST number perseverative answers	58	54
WCST number of perseverative errors	138	135
MWCST number of categories	259	243
MWCST number of errors	259	248
MWCST number of perseverative errors	81	78

4 Conclusion

We have described the steps that were taken to prepare the ANDI database for normative comparisons in neuropsychology. First, data were gathered from research groups that are part of the ANDI consortium. Second, files were created in which data from neuropsychological tests were merged. Third, one of the main goals was that the scores can be considered to be from cognitively healthy participants. This meant that we had to remove outlying scores, without removing too much data. We did this in a two-step fashion, in which we first removed extreme scores by defining extreme borders, returning to the issue after model selection. Fourth, to find out for which demographic effects to correct, we used a selection procedure. There had to be enough data for an effect to be estimated, and the effect had to add sufficient explained variance to the model, as determined by the Bayesian Information Criterion. Fifth, after a model was defined for a variable, we removed scores that were abnormal given demographic characteristics. We did this by using the 3.5 MAD criterion, i.e. by removing raw scores that differed more than 3.5 MAD from the median. Sixth, because normative comparison procedures assume normality of score distributions, we used the Box-Cox procedure to search for a power transformation which when applied to the raw data makes demographically corrected scores (residuals) as normally distributed as possible. These steps were applied for every variable of every neuropsychological test included in the database.

4.1 Benefits of the ANDI database

The ANDI database and infrastructure offers a number of advantages over the normative data published in test manuals. In this section we will elaborate on these advantages.

More appropriate norms: We argue that the ANDI norms are an improvement over the traditional norms. First, scores in ANDI are continuously corrected for the effects of age, sex and level of education. This is an improvement over most published normative data since those are often only corrected for age, and since age is not treated as a continuous variable, but is divided into arbitrary age categories. This implies that when one shifts from one age-group to the next, the interpretation of the test score, i.e. whether it is considered abnormal, may change abruptly. Because in our regression approach, age is considered as a continuous variable, such leaps between groups does not occur (Testa et al., 2009). Second, the ANDI database also contains data for the oldest (80+) participants, making normative comparisons for this group also feasible. Third, ANDI norms have been gathered roughly in the last 10 years making the normative data less outdated than those in some published manuals. Part of the reason that normative data become outdated is that the population characteristics change, with more people achieving higher levels of education. Because we correct the scores for age and level of education, the ANDI norms will probably not become out of data as quickly as traditional test norms. Lastly, while for some neuropsychological tests only norms from other countries were available, with ANDI we now have national norms which makes these norms more applicable to our patients.

Exportable infrastructure: The software of the ANDI infrastructure will be available for researchers. It can be exported easily to other countries. This would only require researchers to collect their own control datasets, after which the methods for merging, standardization and correction described here could be applied in other countries. Extensions to other fields of study (such as clinical psychology, or medicine,) are also possible.

Multivariate normative comparisons: One unique aspect of the ANDI database as a normative database is that many participants have completed multiple tests. This is not the case for traditional normative samples, where usually a single test is administered. Multivariate normative comparisons that use the covariance between tests, and thus require that multiple tests are administered to the same participants, have increased sensitivity for cognitive impairment (Huizenga et al., 2007, Su et al., 2015). Because of a lack multivariate norms, this method could not be broadly adopted in clinical practice. With the ANDI database and the accompanying website, these tools will soon be available for clinicians and researchers.

4.2 Limitations

A number of choices in our procedure were to some extent arbitrary. For example, the choice of 3.5 MAD deviations in the outlier removal, or the choice for a minimum median of 10 observations per cell in selection of which effects to include in the model. Also, some less than ideal choices were made. For example, the Box-Cox procedure was run using a simple linear regression model, while ideally the multilevel structure of the data should be taken into account. If new insights show that a different criterion works better, or that a different procedure works better, we want to be able to upgrade the whole database. This is one of the reasons that we strive for a high level of transparency and automatisisation.

5 Concluding remark

Normative comparisons are a vital part of neuropsychological diagnostics. With the construction of the ANDI database we expect that significant improvements of normative comparisons can be made, without large investments in new data collection. We have provided the readers with a step-by-step description of our data handling procedures, so that it is transparent and can be replicated in other countries or fields.

6 Appendix

6.1 Auditory Verbal Learning Test (AVLT)

6.1.1 Extreme Borders of the AVLT

The table shows extreme minimum and maximum scores on all AVLT variables. The last column shows the number of cases removed based on these criteria¹.

Variable name	Min extreme border	Max extreme border	Percentage removed
AVLT total 1 to 5	15	75	0.004 %
AVLT recognition	8	30	0 %
AVLTdelayed recall 1 to 5	3	15	0.045 %
AVLT total 1 to 3	8	45	0.015 %
AVLT delayed recall 1 to 3	2	15	0.056 %

6.1.2 BIC Selection for AVLT

The table shows the selection of the effects of demographic variables for the AVLT.

Variable	Demographic Effects	BIC
AVLT total 1 to 5	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	36075.66
	Terms in the final model	
AVLT recognition	$s + a + e + s*a + s*e + a*e + s*a*e$	36075.66
	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	17074.51
AVLTdelayed recall 1 to 5	Terms in the final model	
	$s + a + e + s*a + s*e + a*e + s*a*e$	17074.51
	Initially included terms	
AVLT total 1 to 3	$s + a + e + s*a + s*e + a*e + s*a*e$	21683.67
	Terms in the final model	
	$s + a + e + s*a + s*e + a*e + s*a*e$	21683.67
AVLT delayed recall 1 to 3	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	57383.83
	Terms in the final model	
	$s + a + e + s*a + s*e + a*e + s*a*e$	57383.83
	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	21109.68
	Dropped terms	
	$s*a*e$	21105.57
	$s*a$	21097.68
	$a*e$	21089.9
	$s*e$	21084.42
	Terms in the final model	
	$s + a + e$	21084.42

age = a, sex = s, education = e.

6.1.3 Best model fit of the AVLT

The table shows the terms of the best models for the AVLT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

¹Research groups who study aging in the healthy population donated a large amount of these data. Even though these elderly participants are not formally diagnosed with a neuro(psycho)logical disorder, we found that quite a number of them scored well below extreme borders and thus could not be labeled as 'healthy control subject'. This is the reason why a large number of participants was removed on the basis of extreme borders

Variable name	Best model fit	Number of cases removed
AVLT total 1 to 5	s + a + e + a*s + e*s + e*a + e*a*s	0
AVLT recognition	s + a + e + a*s + e*s + e*a + e*a*s	114
AVLTdelayed recall 1 to 5	s + a + e + a*s + e*s + e*a + e*a*s	0
AVLT total 1 to 3	s + a + e + a*s + e*s + e*a + e*a*s	1
AVLT delayed recall 1 to 3	s + a + e	1

age = a, sex = s, education = e.

6.1.4 Box-Cox power transformation of the AVLT

The table shows the best Box-Cox power transformation for the AVLT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
AVLT total 1 to 5	1.08	0.107	2.827
AVLT recognition	9.65	-0.122	2.074
AVLTdelayed recall 1 to 5	0.73	0.07	2.631
AVLT total 1 to 3	0.71	0.008	2.799
AVLT delayed recall 1 to 3	0.53	0.033	2.68

6.1.5 Descriptive statistics for the AVLT

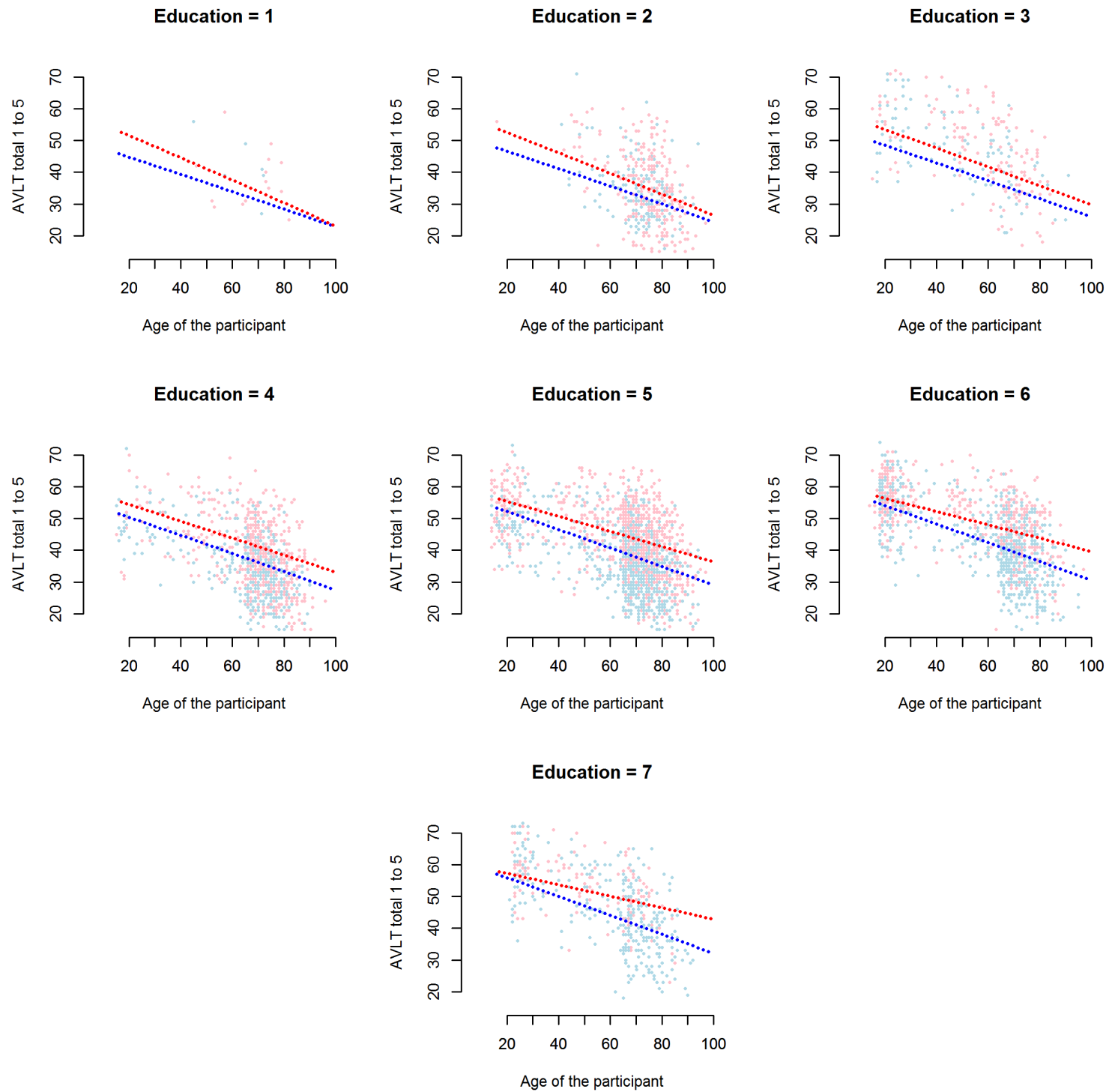
The table gives descriptives after outliers are removed on all AVLT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
AVLT total 1 to 5	15	38	74	2502	14-95	15	43	72	2533	14-97
AVLT recognition	22	28	30	1899	18-95	21	29	30	1871	17-97
AVLTdelayed recall 1 to 5	3	7	15	2226	14-95	3	9	15	2331	14-97
AVLT total 1 to 3	8	19	44	4597	14-95	8	22	42	4840	14-97
AVLT delayed recall 1 to 3	2	6	15	2165	15-86	2	7	15	2419	15-86

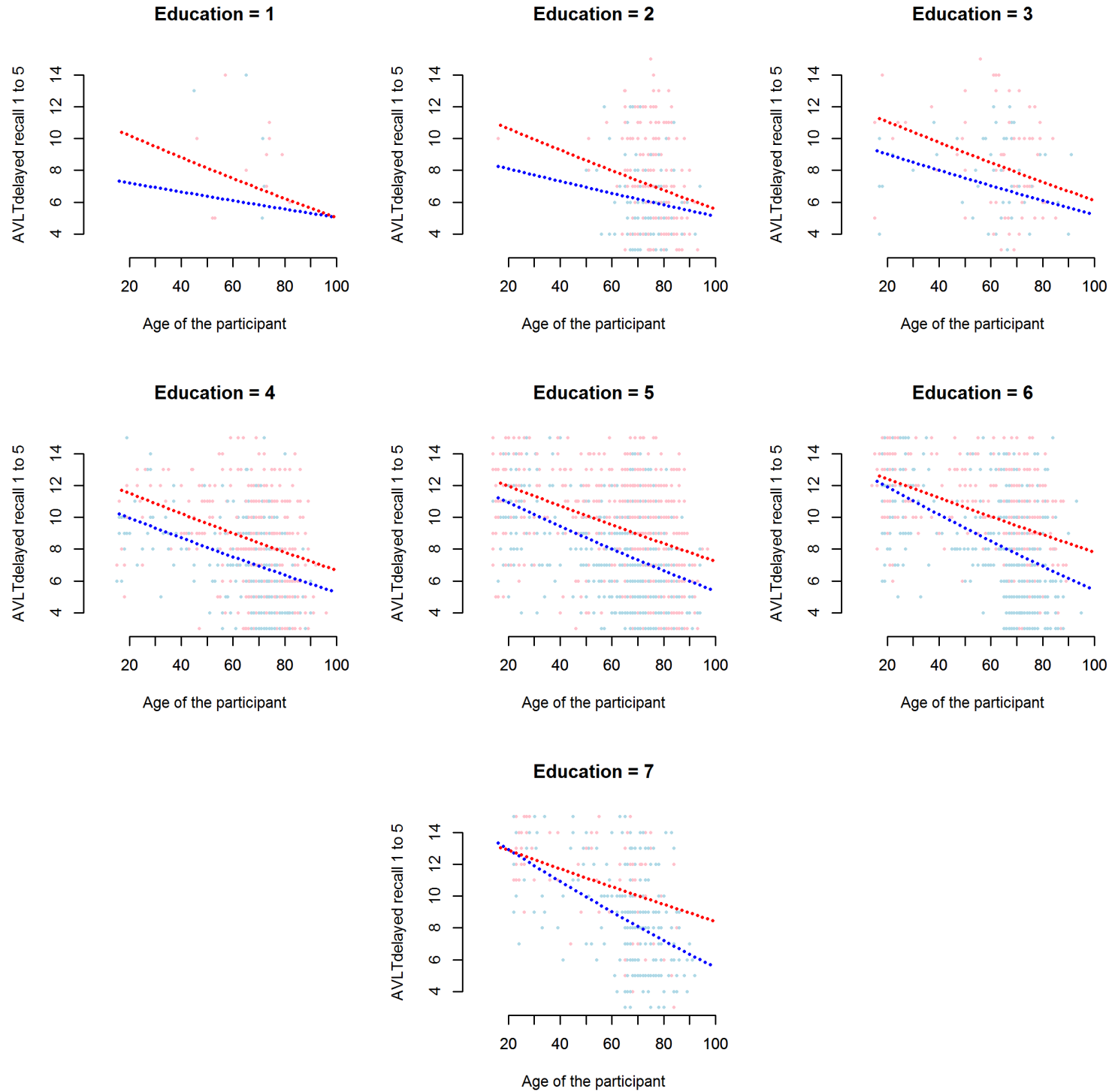
6.1.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

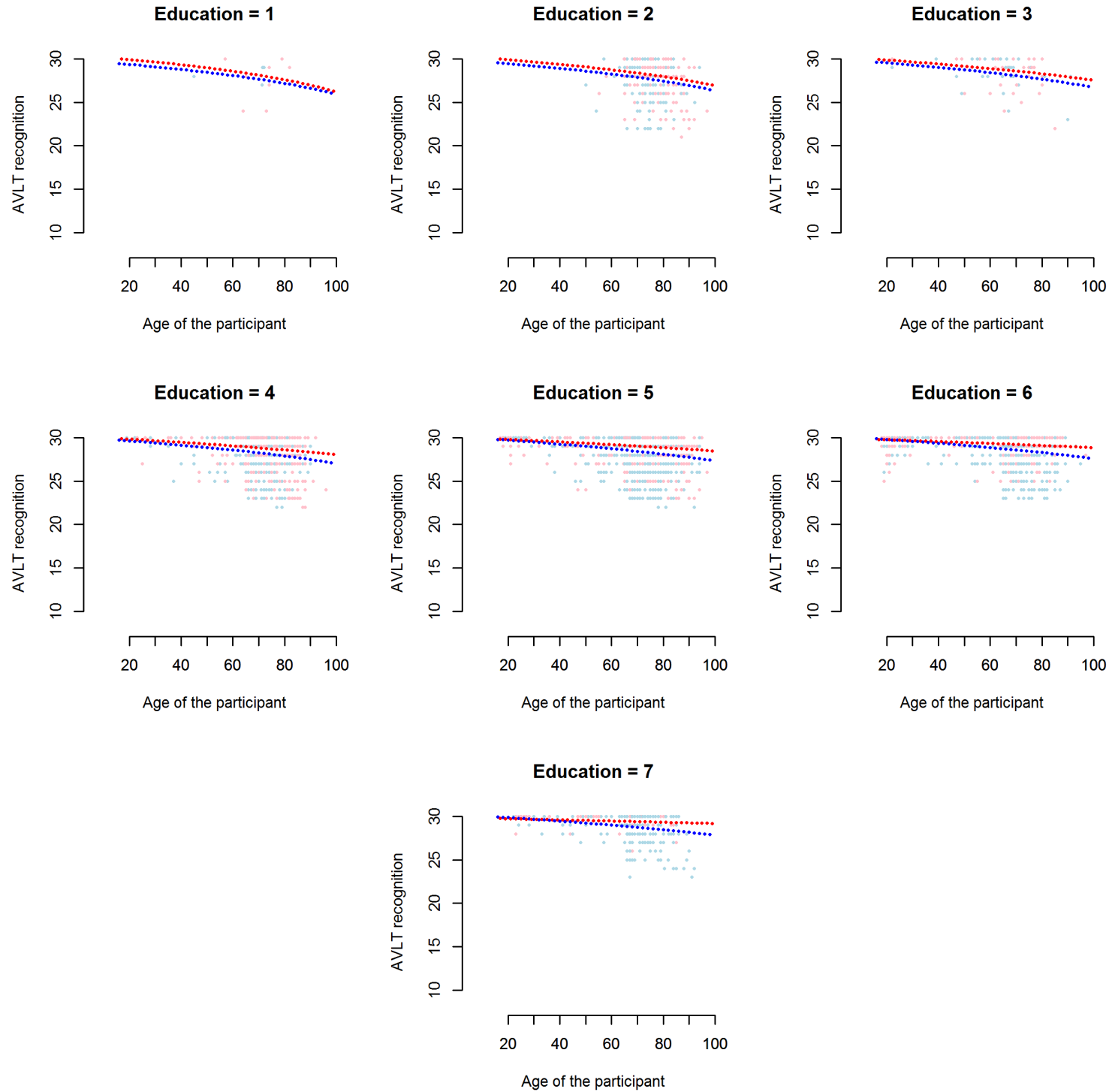
1. AVLT - total (trial 1 to 5)



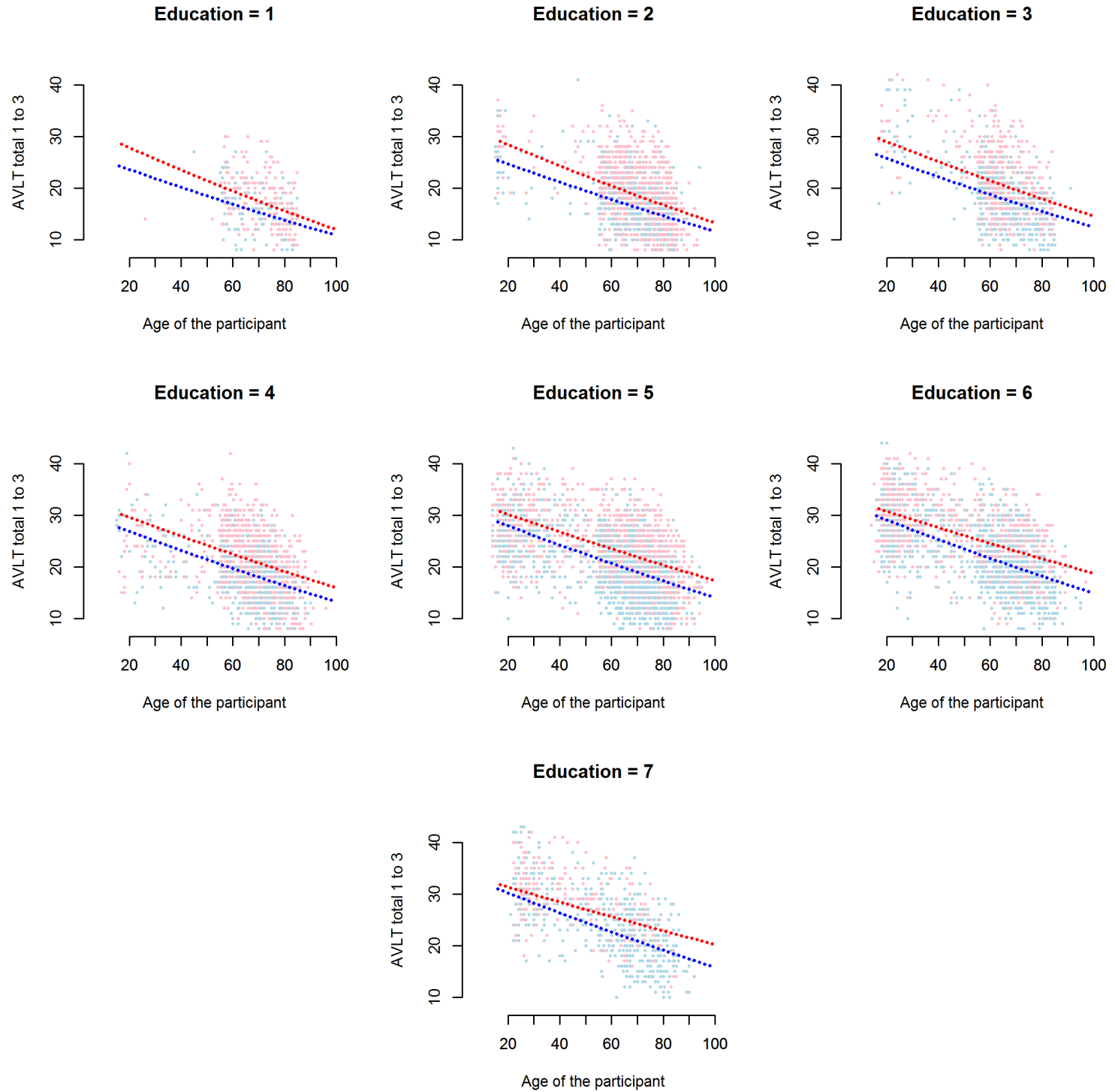
2. AVLT - delayed recall (trial 1 to 5)



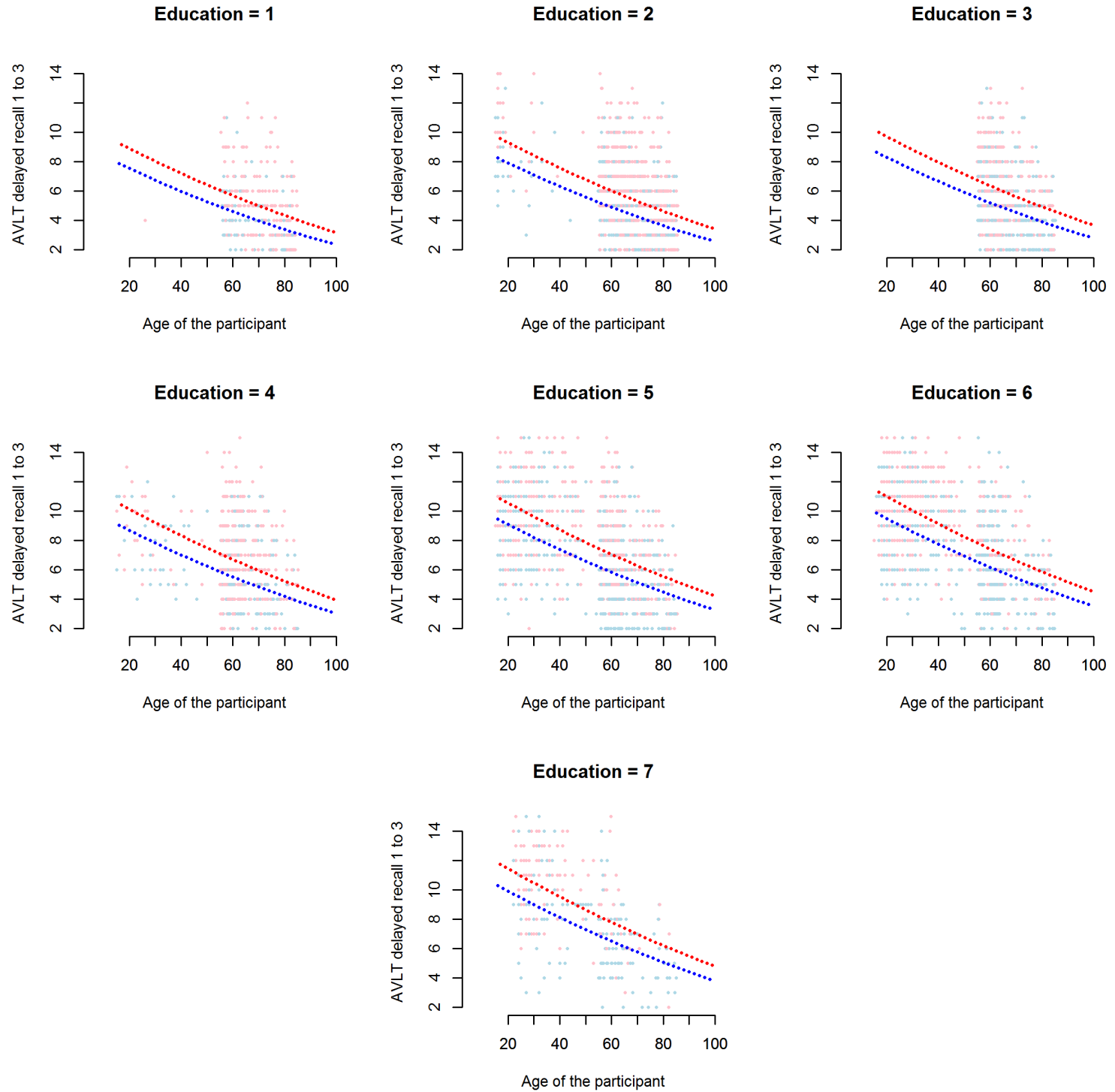
3. AVLT - recognition (trial 1 to 5)



4. AVLT - total (trial 1 to 3)



5. AVLT - delayed recall (trial 1 to 3)



6.2 Behavioral Assessment of Dysexecutive Syndrome (BADs)

6.2.1 Extreme Borders of the BADs

The table shows extreme minimum and maximum scores on all BADs variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
BADs Rule shift cards I tijd	5	67	0 %
BADs Rule shift cards II score	10	20	0.004 %
BADs Rule shift cards II tijd	5	67	0.06 %
BADs Key Search	4	16	0.018 %
BADs Dysexecutive Questionnaire	3	38	0.044 %
BADs Zoo Map I	1	8	0.075 %
BADs Zoo Map total	2	16	0.017 %
BADs Zoo Map I planning in seconds	1	400	0.009 %
BADs Zoo Map II total in seconds	5	400	0.009 %
BADs Zoo Map II planning in seconds	1	400	0.295 %
BADs Zoo Map II total in seconds	5	400	0 %

6.2.2 BIC Selection for BADs

The table shows the selection of the effects of demographic variables for the BADs.

Variable	Demographic Effects	BIC
BADS Rule shift cards I tijd	Initially included terms	
	$s + a + e + s*a + s*e$	863.3
	Dropped terms	
	$s*a$	861.1
	$s*e$	860.2
	e	854.82
	s	849.6
	Terms in the final model	
	a	849.6
BADS Rule shift cards II score	Initially included terms	
	$s + a + e + s*a + s*e$	395.49
	Dropped terms	
	$s*e$	391.2
	$s*a$	387.17
	s	381.71
	a	380.19
	Terms in the final model	
	e	380.19
BADS Rule shift cards II tijd	Initially included terms	
	$s + a + e + s*a + s*e$	1007
	Dropped terms	
	$s*e$	1002.3
	e	998.16
	$s*a$	995.12
	Terms in the final model	
	$s + a$	995.12
BADS Key Search	Initially included terms	
	$s + a$	304.47
	Dropped terms	
	a	303.18
	Terms in the final model	
BADS Dysexecutive Questionnaire	s	303.18
	Initially included terms	
	s	629.03
	Dropped terms	
	s	625
	Terms in the final model	
	None	625

age = a, sex = s, education = e.

Variable	Demographic Effects	BIC
BADS Zoo Map I	Initially included terms	
	$s + a + e + s*a$	893.97
	Dropped terms	
	$s*a$	889.8
	s	884.75
	a	880.61
	Terms in the final model	
BADS Zoo Map total	e	880.61
	Initially included terms	
	$s + a + e + s*a$	1216.27
	Dropped terms	
	$s*a$	1212.32
	s	1206.93
	e	1205.64
BADS Zoo Map I planning in seconds	Terms in the final model	
	a	1205.64
	Initially included terms	
	$s + a$	1264.58
	Dropped terms	
	s	1260.26
	a	1256.33
BADS Zoo Map II total in seconds	Terms in the final model	
	None	1256.33
	Initially included terms	
	$s + a$	1317.18
	Dropped terms	
	s	1312.54
	Terms in the final model	
BADS Zoo Map II planning in seconds	a	1312.54
	Initially included terms	
	$s + a$	692.77
	Dropped terms	
	s	688.43
	a	685.49
	Terms in the final model	
BADS Zoo Map II total in seconds	None	685.49
	Initially included terms	
	$s + a$	1037.24
	Dropped terms	
	s	1035.51
	Terms in the final model	
	a	1035.51

age = a, sex = s, education = e.

6.2.3 Best model fit of the BADS

The table shows the terms of the best models for the BADS variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
BADS Rule shift cards I tijd	a	3
BADS Rule shift cards II score	e	6
BADS Rule shift cards II tijd	s + a	1
BADS Key Search	s	0
BADS Dysexecutive Questionnaire		0
BADS Zoo Map I	e	0
BADS Zoo Map total	a	0
BADS Zoo Map I planning in seconds		4
BADS Zoo Map II total in seconds	a	0
BADS Zoo Map II planning in seconds		12
BADS Zoo Map II total in seconds	a	1

age = a, sex = s, education = e.

6.2.4 Box-Cox power transformation of the BADS

The table shows the best Box-Cox power transformation for the BADS variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
BADS Rule shift cards I tijd	-0.49	-0.029	2.489
BADS Rule shift cards II score	5.824	-0.18	2.147
BADS Rule shift cards II tijd	-0.349	-0.086	2.806
BADS Key Search	0.72	-0.298	1.975
BADS Dysexecutive Questionnaire	0.5	-0.017	2.168
BADS Zoo Map I	0.7	-0.191	1.733
BADS Zoo Map total	1.73	-0.089	1.848
BADS Zoo Map I planning in seconds	0.42	-0.053	2.49
BADS Zoo Map II total in seconds	0.17	-0.08	2.522
BADS Zoo Map II planning in seconds	-0.04	0.013	2.046
BADS Zoo Map II total in seconds	0.09	-0.126	2.256

6.2.5 Descriptive statistics for the BADS

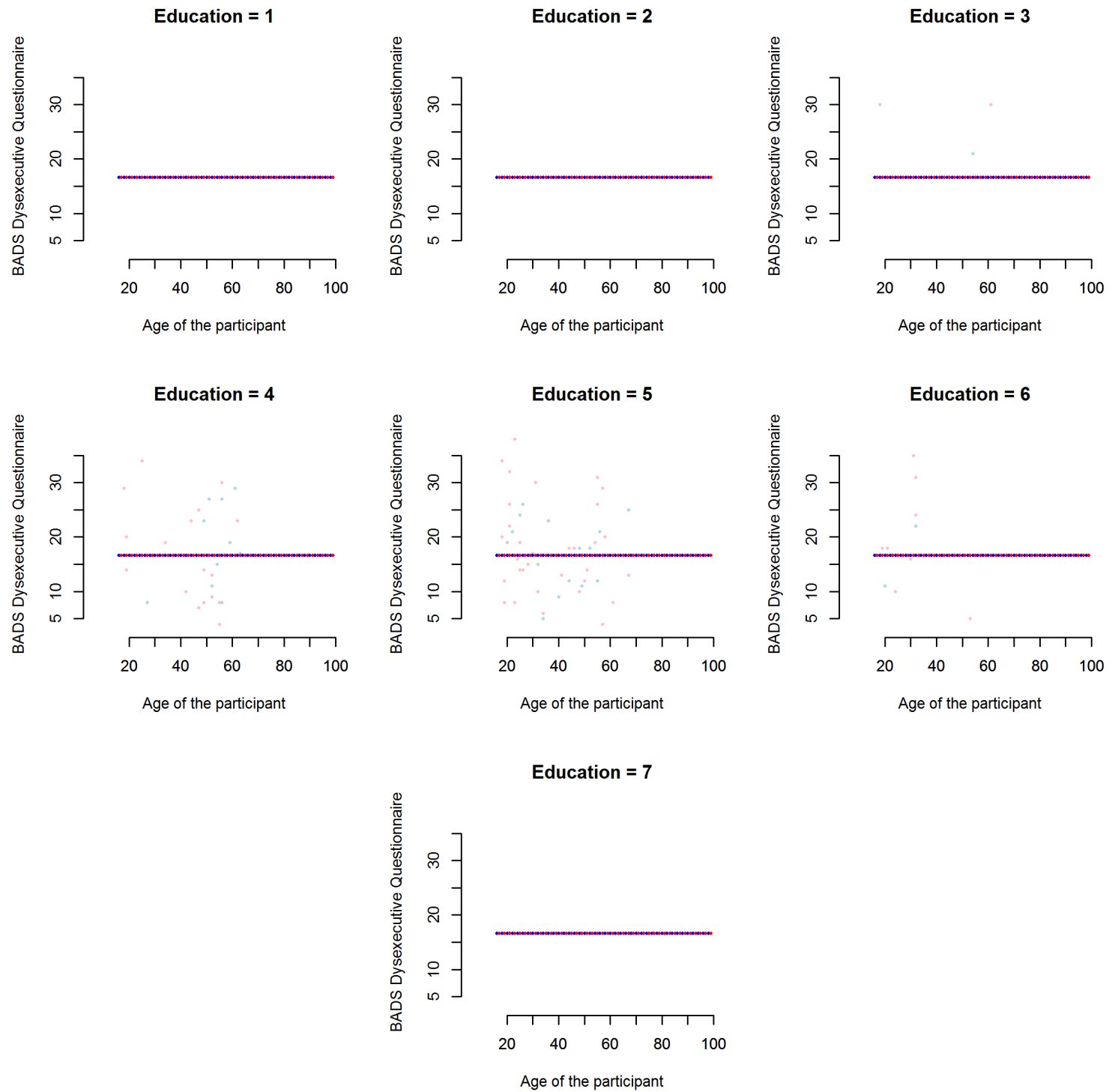
The table gives descriptives after outliers are removed on all BADS variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
BADS Rule shift cards I tijd	15	23	39	78	55-93	16	24	42	153	56-96
BADS Rule shift cards II score	12	19	20	77	55-87	11	19	20	153	55-96
BADS Rule shift cards II tijd	21	32	62	77	55-93	21	39	66	142	56-96
BADS Key Search	5	12	16	28	54-88	4	8	16	26	55-86
BADS Dysexecutive Questionnaire	5	18	29	28	20-67	4	18	38	59	18-67
BADS Zoo Map I	1	5	8	80	20-82	1	5	8	104	17-86
BADS Zoo Map total	6	12	16	109	19-82	2	13	16	126	17-86
BADS Zoo Map I planning in sec	10	60	183	22	20-82	1	56	219	86	17-86
BADS Zoo Map II total in sec	35	145	312	22	20-82	38	138	390	90	17-86
BADS Zoo Map II planning in sec	3	6	30	13	24-80	1	4	30	54	17-86
BADS Zoo Map II total in sec	26	46	99	21	20-82	13	45	108	90	17-86

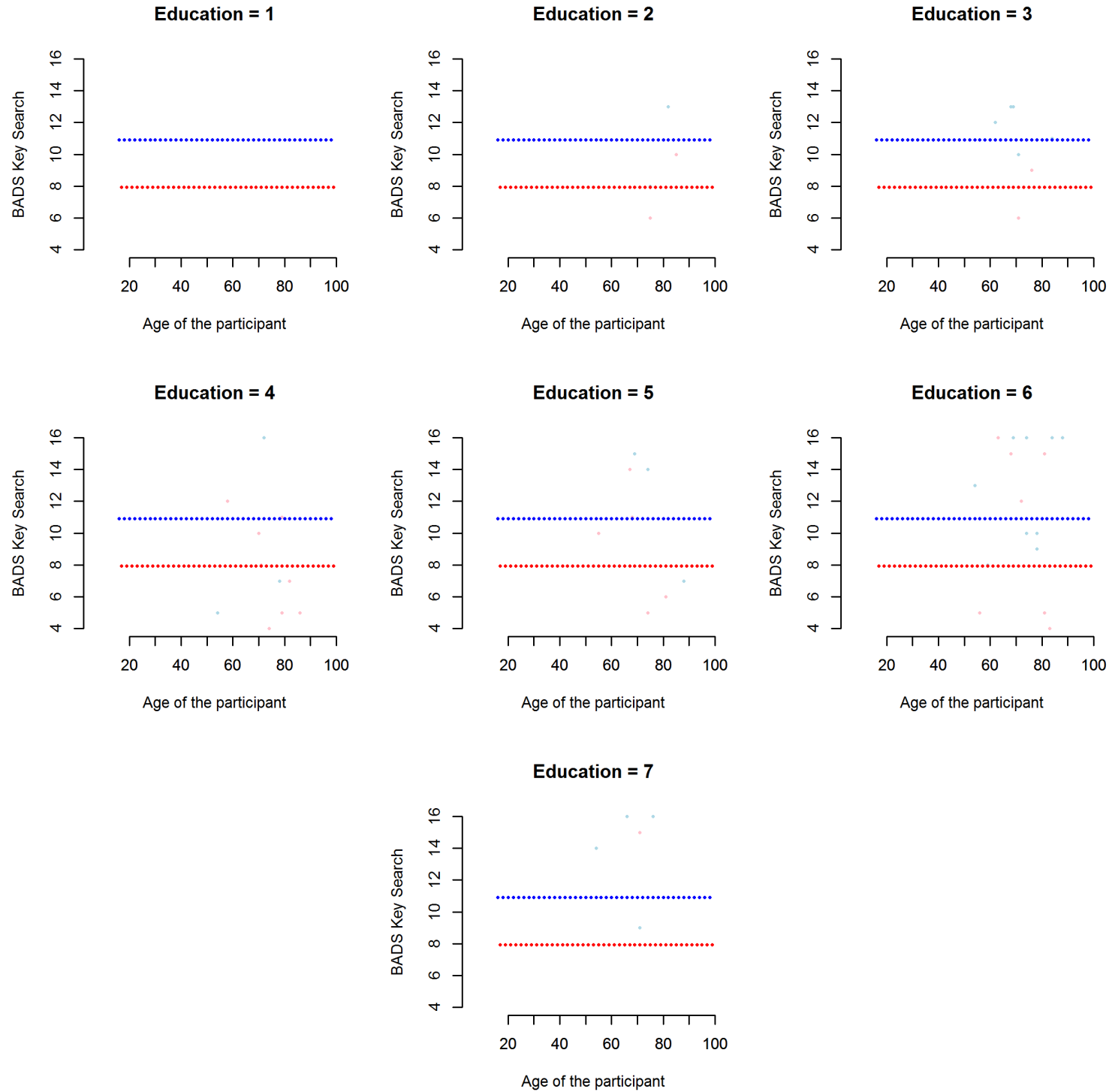
6.2.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

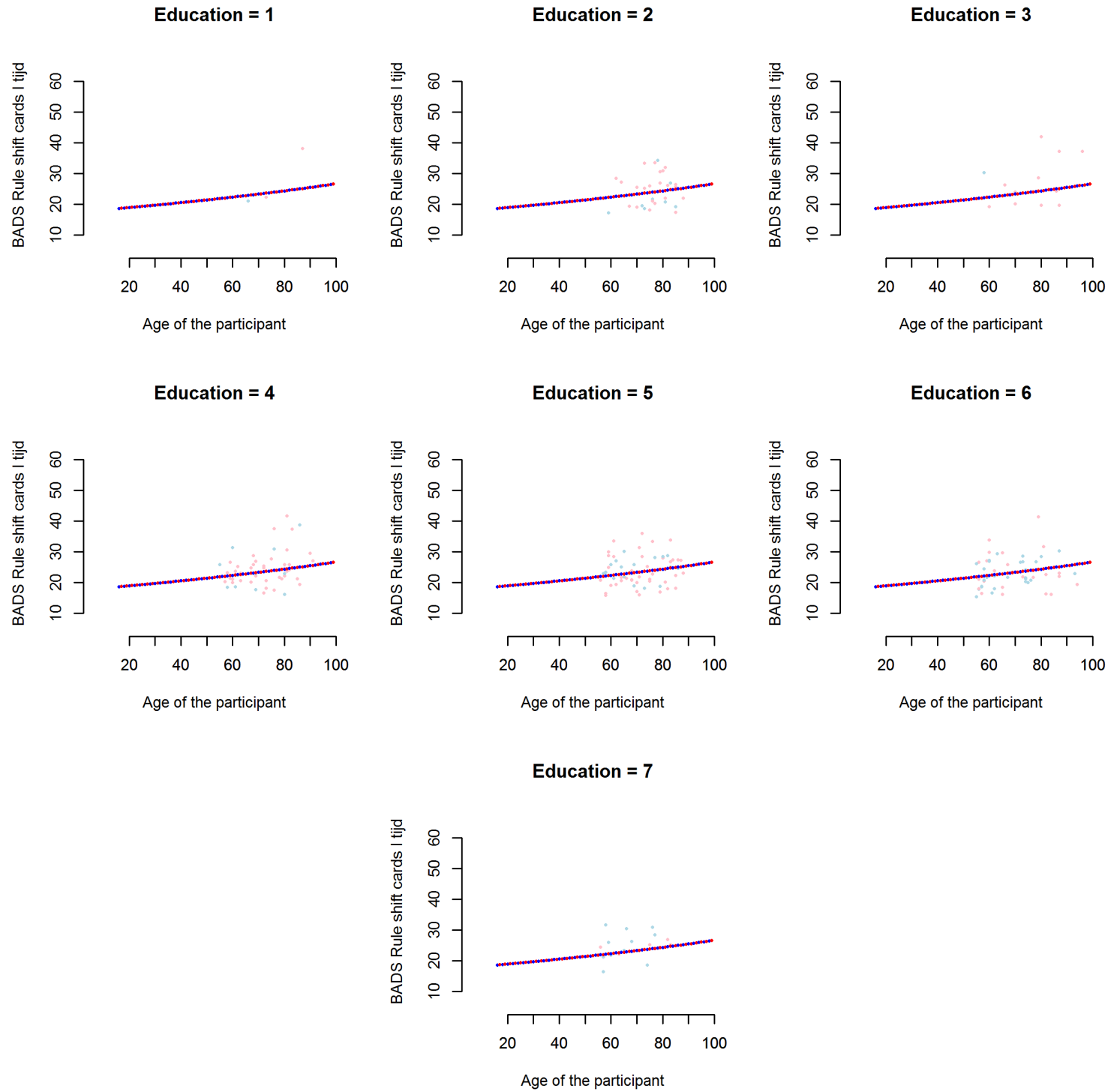
1. BADS - DEX



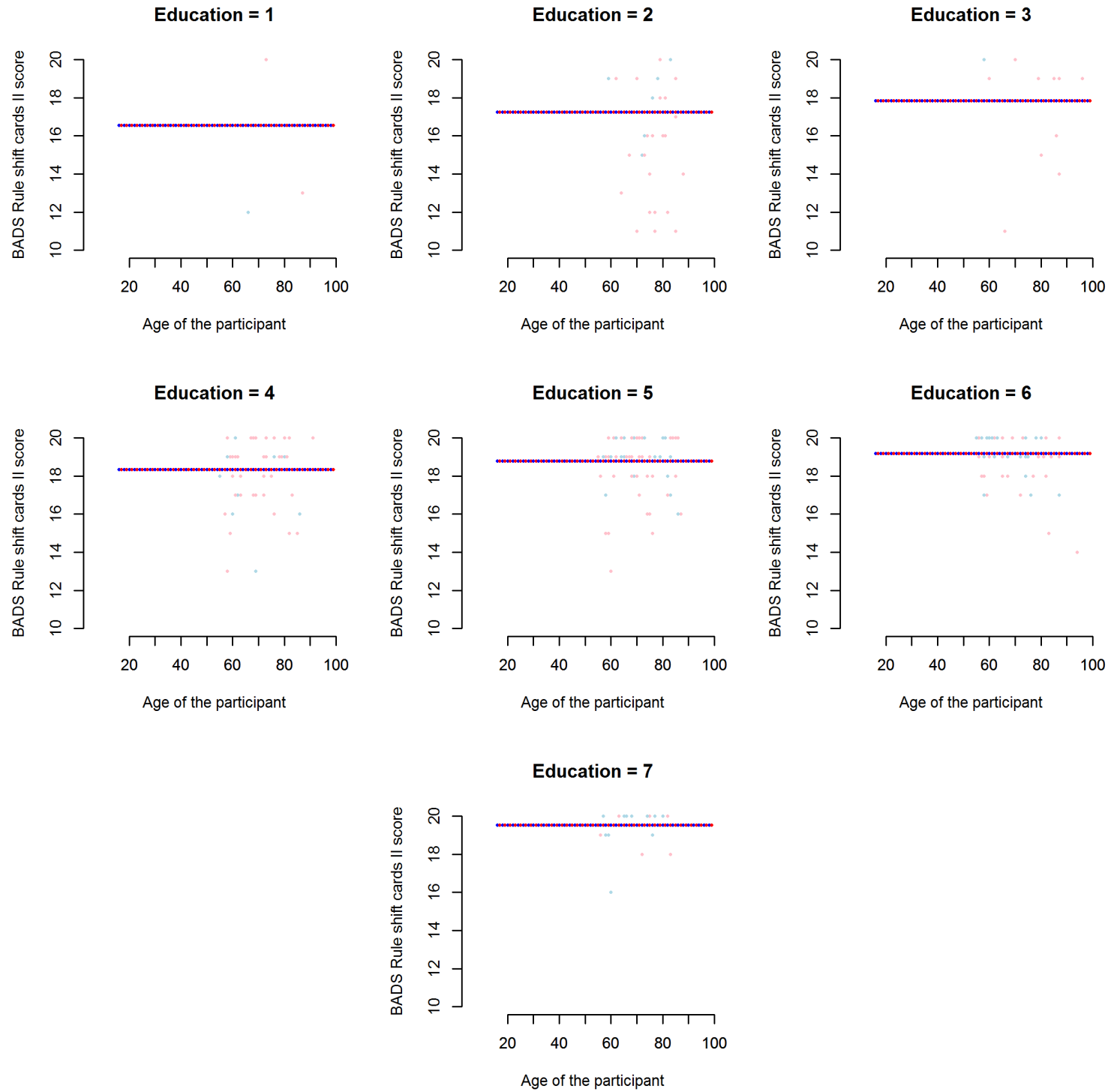
2. BADS - Key search



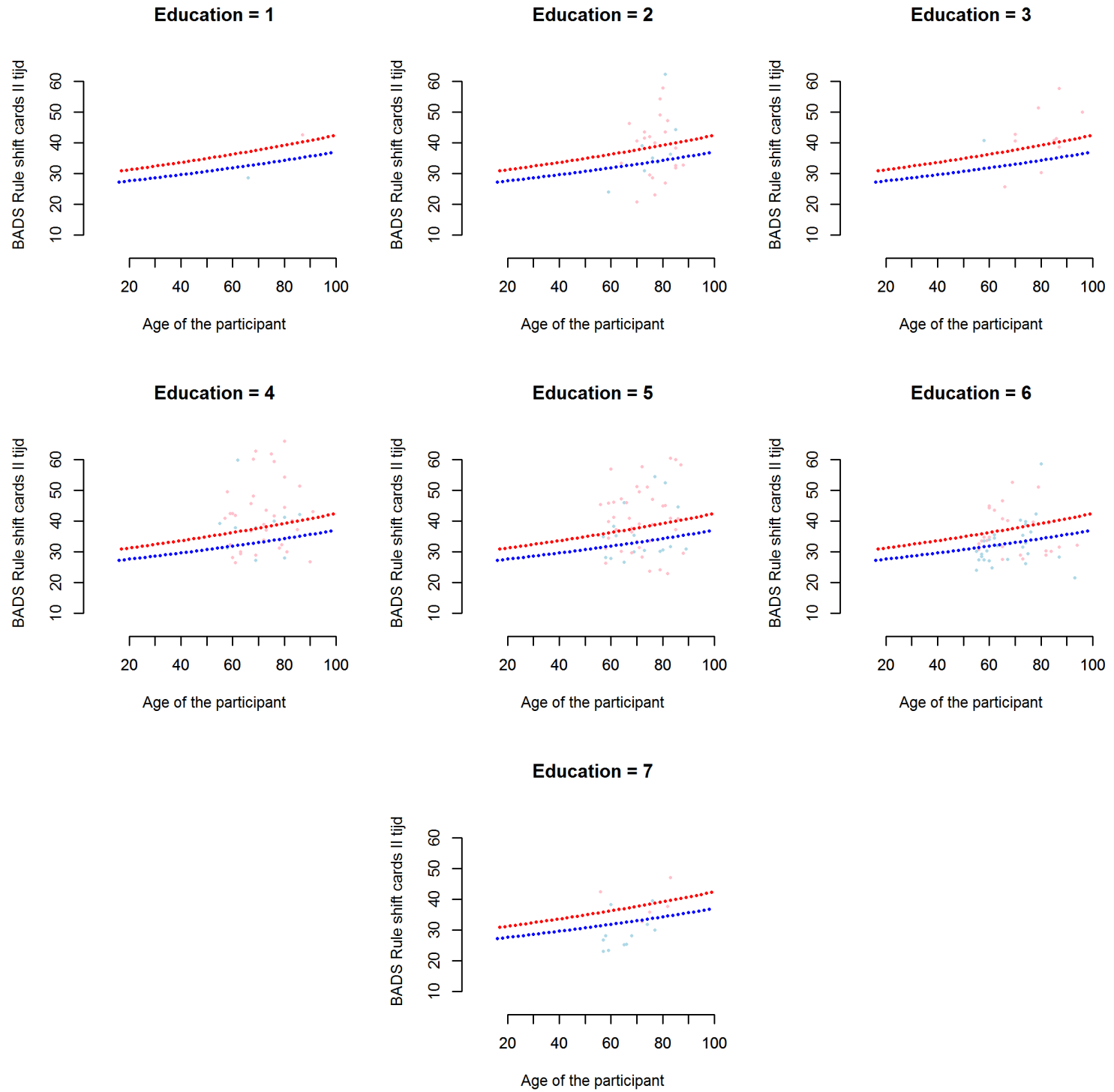
3. BADS - Rule shift cards I - time



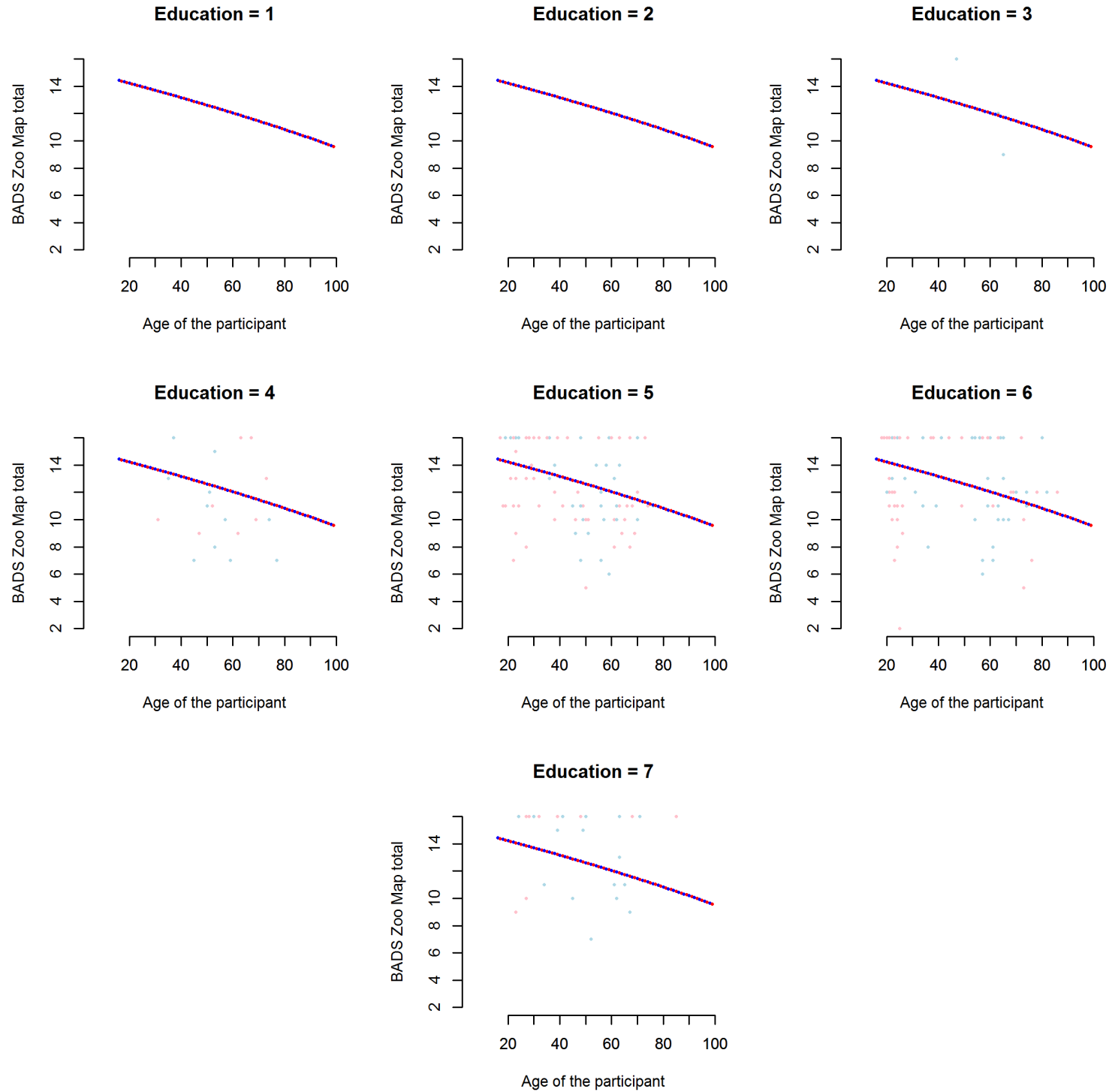
4. BADS - Rule shift cards II - score



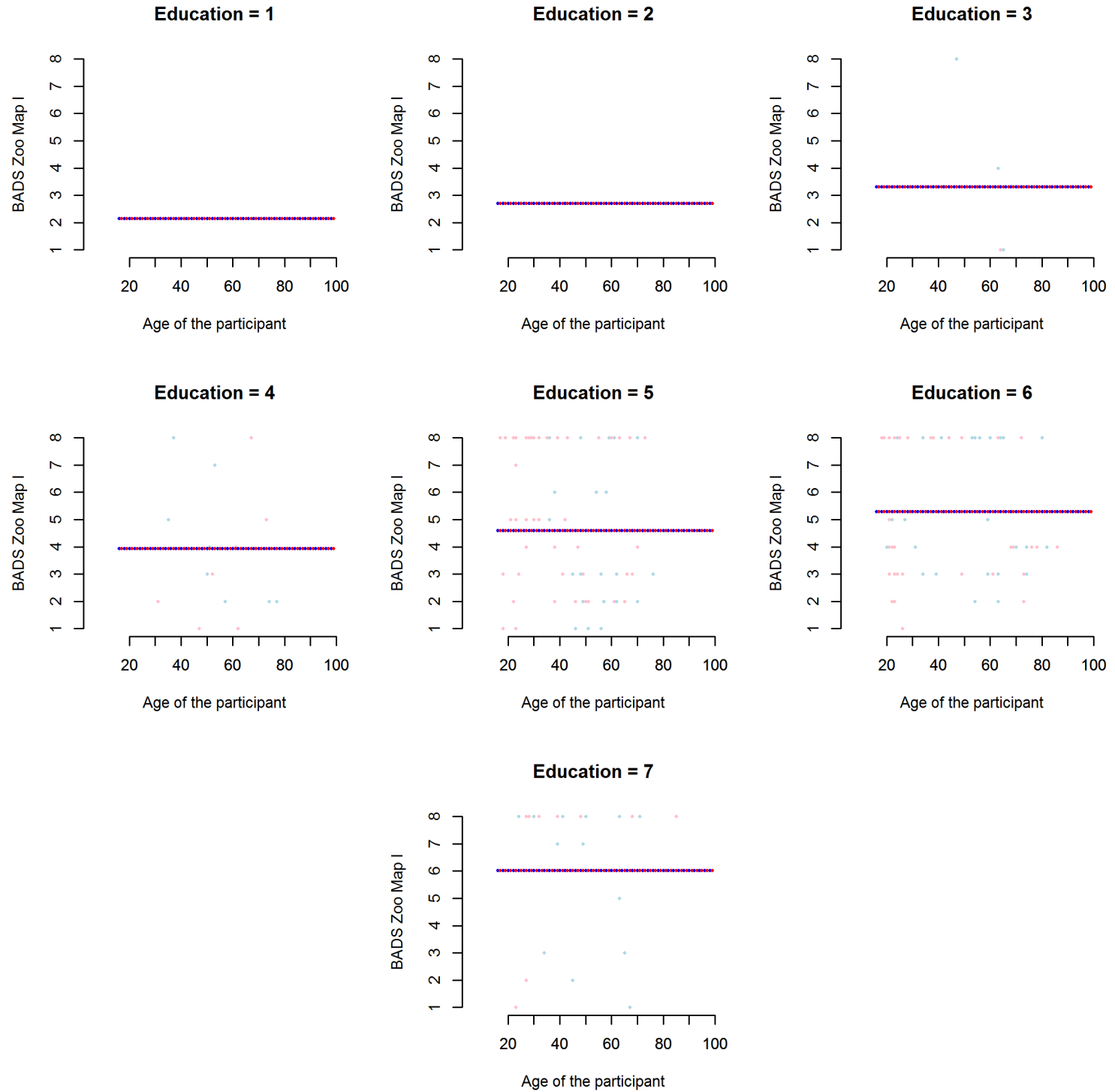
5. BADS - Rule shift cards II - time



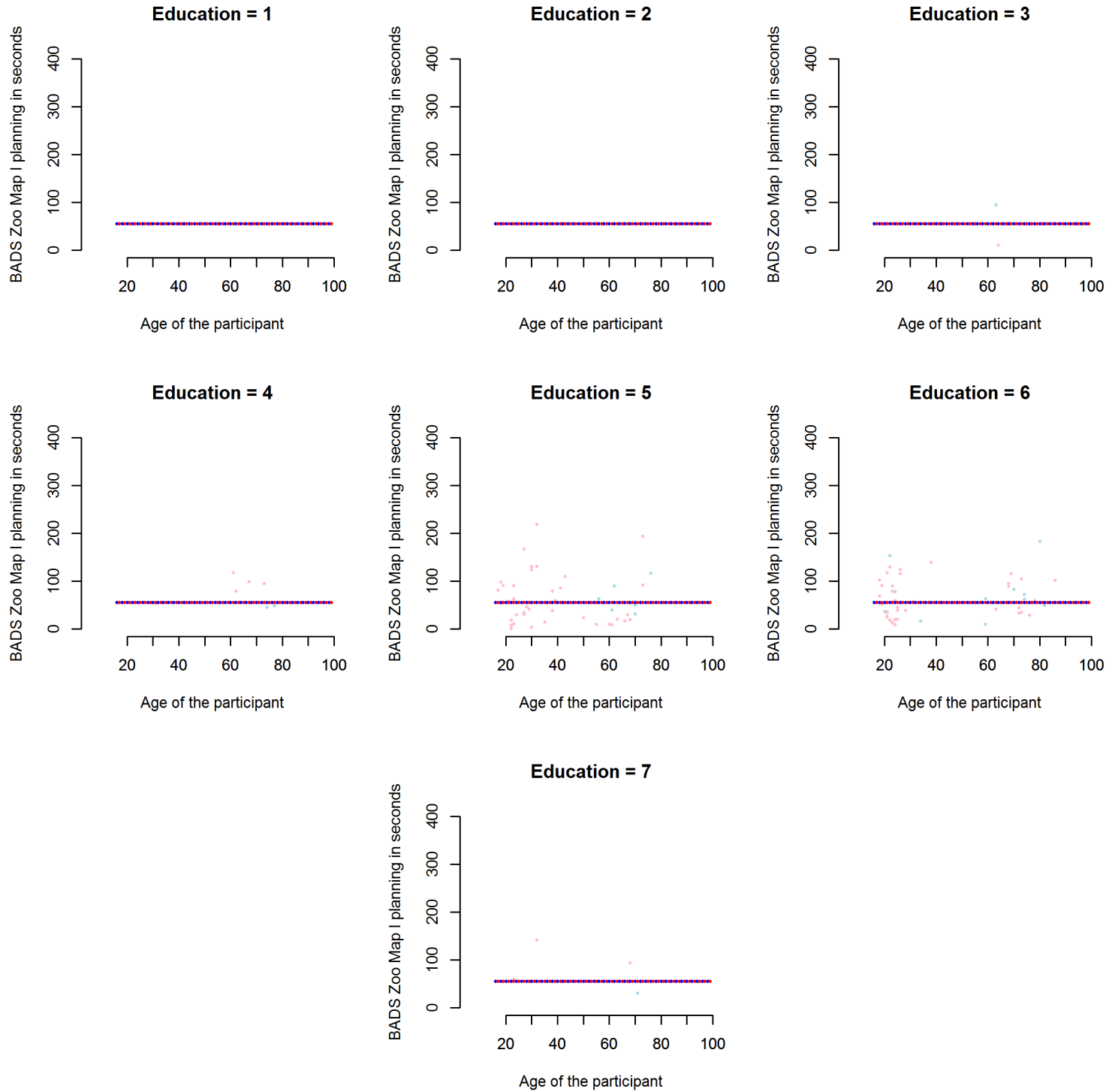
6. BADS - Zoo Map Total score



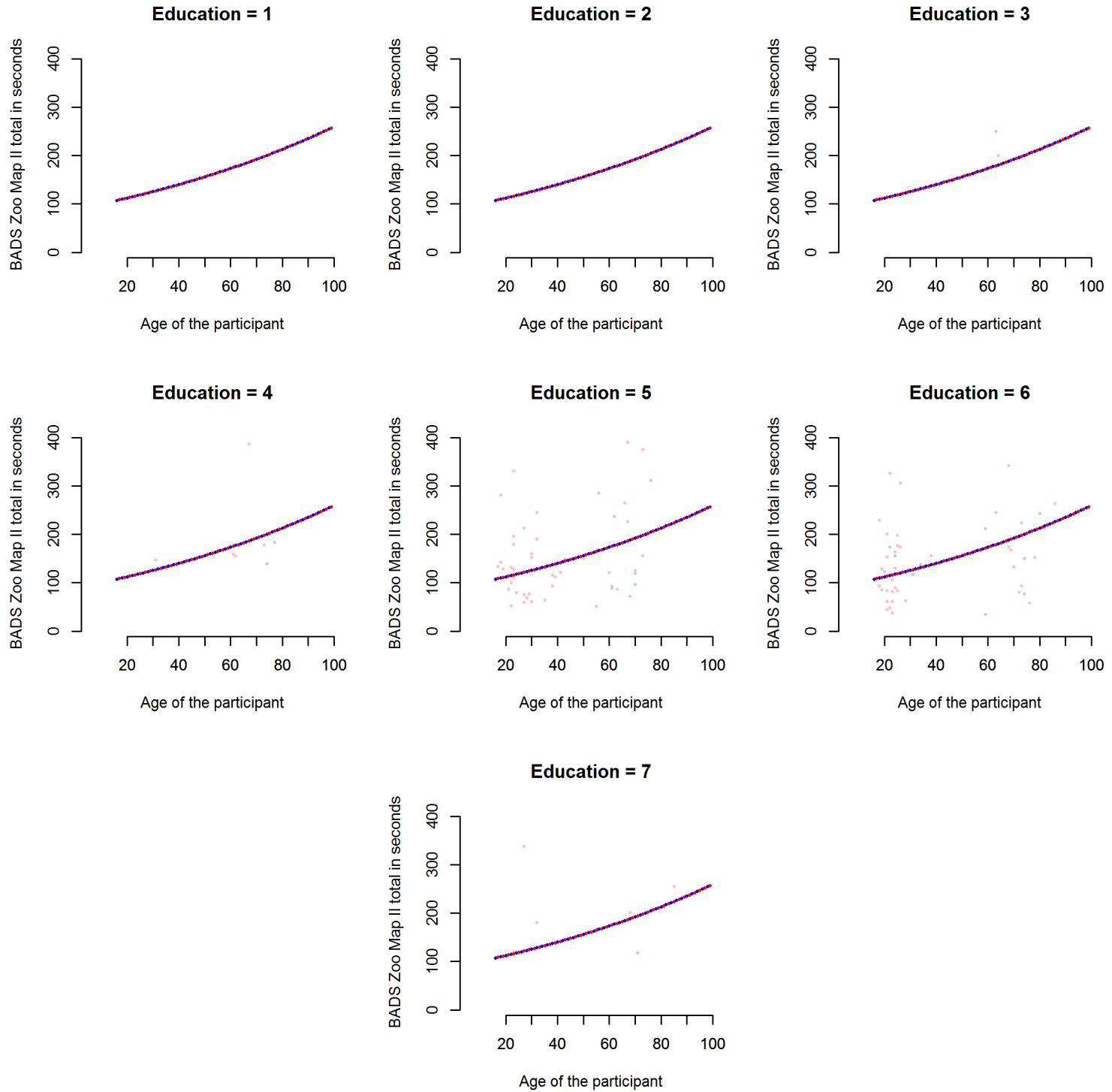
7. BADS - Zoo Map I score



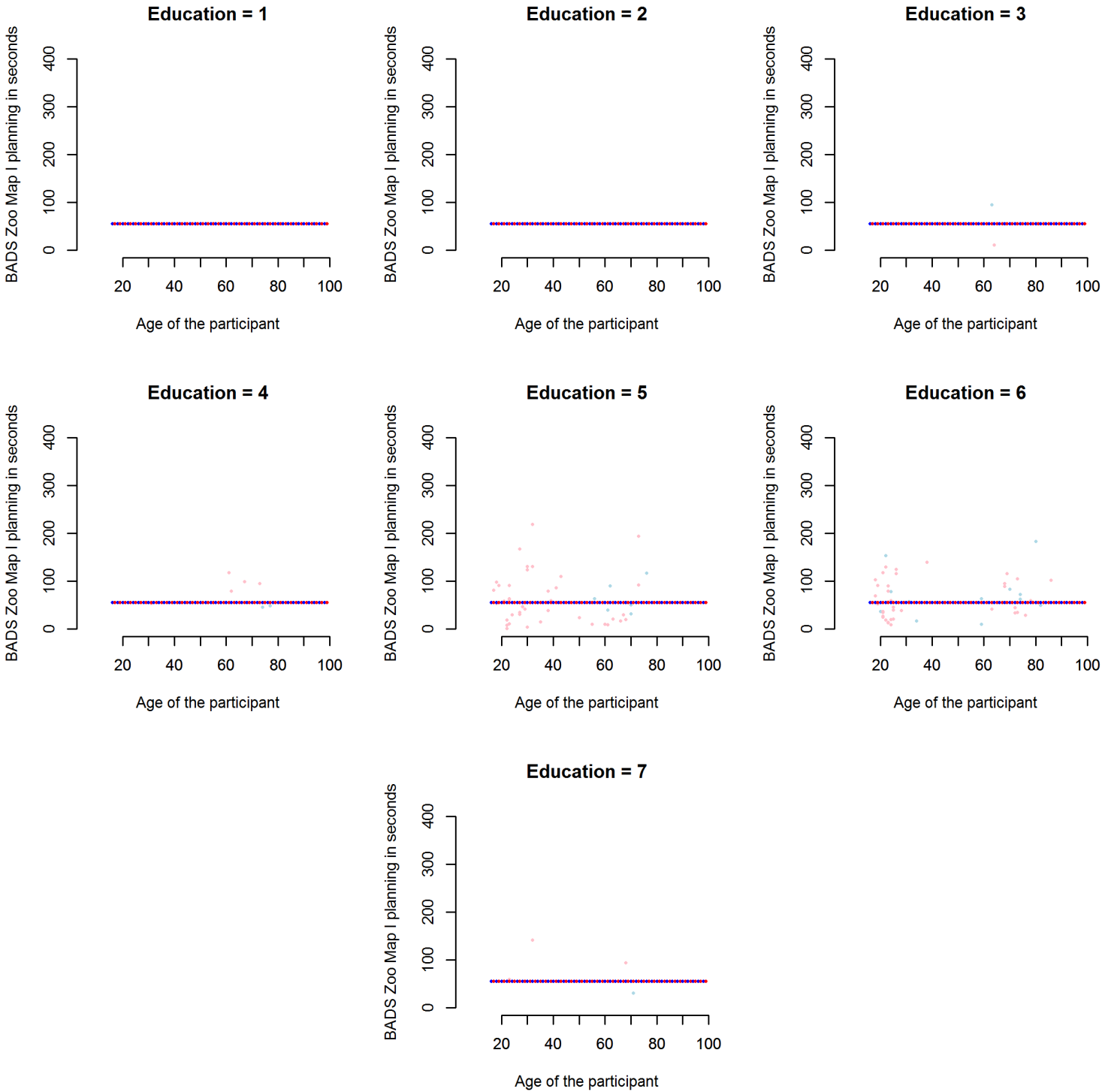
8. BADS - Zoo Map I planning in sec



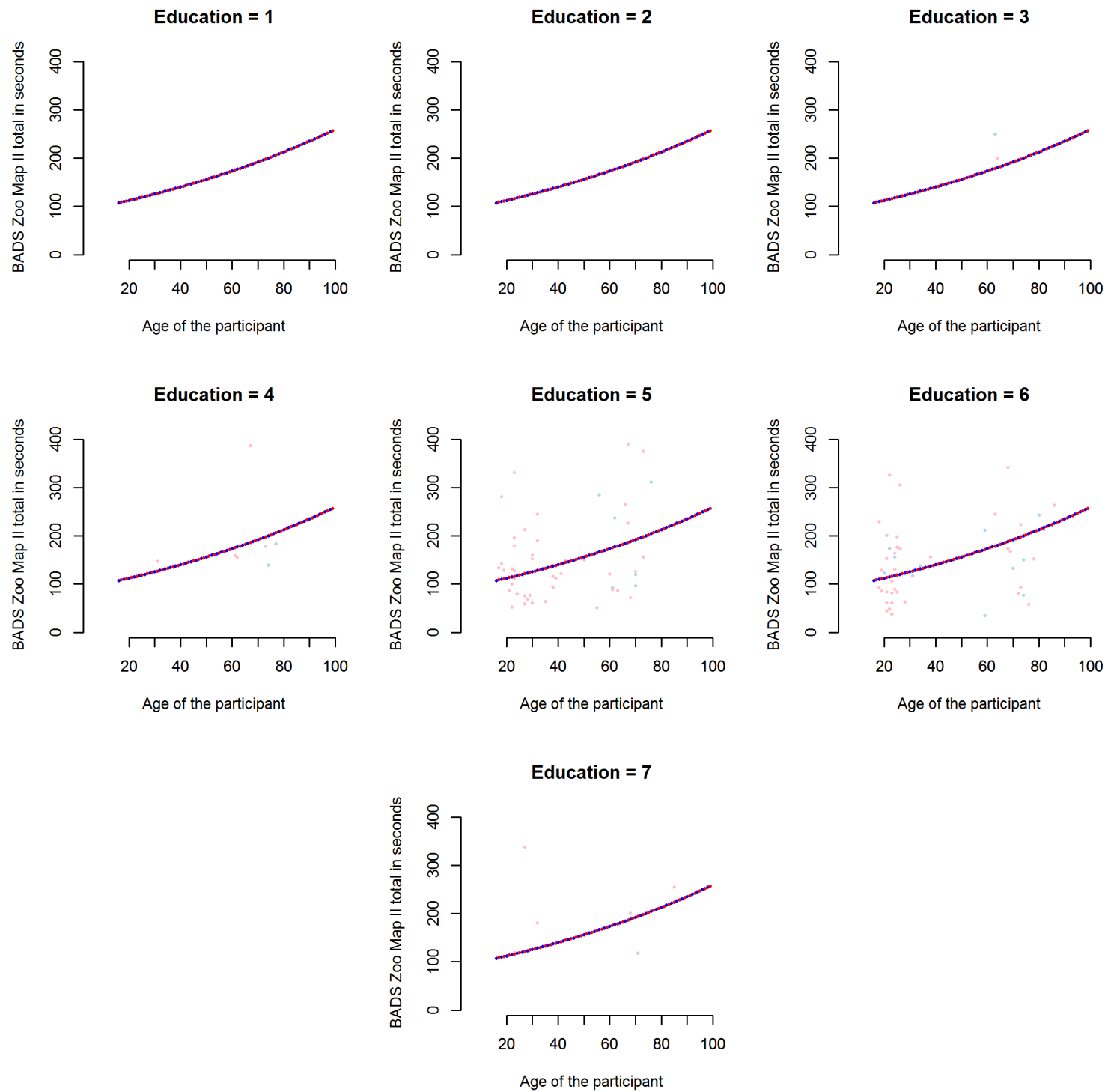
9. BADS - Zoo Map I total in sec



10. BADS - Zoo Map II planning in sec



11. BADS - Zoo Map II total in sec



6.3 Beck Depression Inventory (BDI)

6.3.1 Extreme Borders of the BDI

The table shows extreme minimum and maximum scores on all BDI variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
BDI total score	0	20	0.014 %

6.3.2 BIC Selection for BDI

The table shows the selection of the effects of demographic variables for the BDI.

Variable	Demographic Effects	BIC
BDI total score	Initially included terms	
	$s + a + e + s*a + s*e$	1673.5
	Dropped terms	
	$s*a$	1667.88
	$s*e$	1662.96
	a	1658.83
	s	1658.15
	Terms in the final model	
	e	1658.15

age = a, sex = s, education = e.

6.3.3 Best model fit of the BDI

The table shows the terms of the best models for the BDI variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
BDI total score	e	1

age = a, sex = s, education = e.

6.3.4 Box-Cox power transformation of the BDI

The table shows the best Box-Cox power transformation for the BDI variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
BDI total score	0.4	-0.342	2.525

6.3.5 Descriptive statistics for the BDI

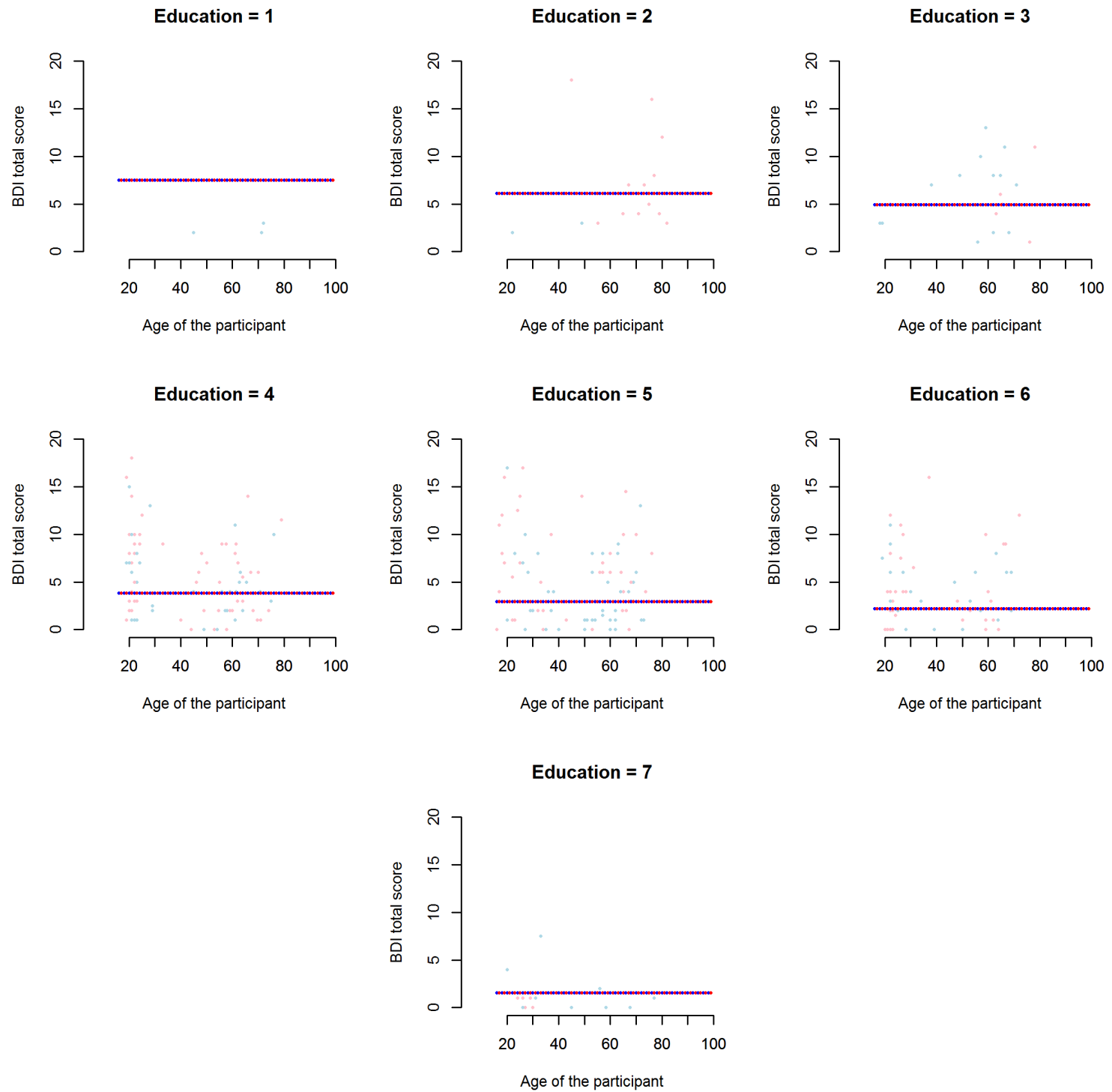
The table gives descriptives after outliers are removed on all BDI variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
BDI total score	0	3	17	127	18-77	0	4	18	160	16-82

6.3.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. BDI - Total score



6.4 Benton Face Recognition Test (BFRT)

6.4.1 Extreme Borders of the BFRT

The table shows extreme minimum and maximum scores on all BFRT variables. The last column shows the number of cases removed based on these criteria.

6.4.2 Extreme Borders of the BFRT

The table shows extreme minimum and maximum scores on all BFRT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
BFRT total short form	19	27	0.018 %

6.4.3 BIC Selection for BFRT

The table shows the selection of the effects of demographic variables for the BFRT.

Variable	Demographic Effects	BIC
BFRT total short form	Initially included terms	
	s + e + s*e	1812.9
	Dropped terms	
	s*e	1810.58
	Terms in the final model	
	s + e	1810.58

age = a, sex = s, education = e.

6.4.4 Best model fit of the BFRT

The table shows the terms of the best models for the BFRT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
BFRT total short form	s + e	0

age = a, sex = s, education = e.

6.4.5 Box-Cox power transformation of the BFRT

The table shows the best Box-Cox power transformation for the BFRT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
BFRT total short form	2.097	-0.031	2.42

6.4.6 Descriptive statistics for the BFRT

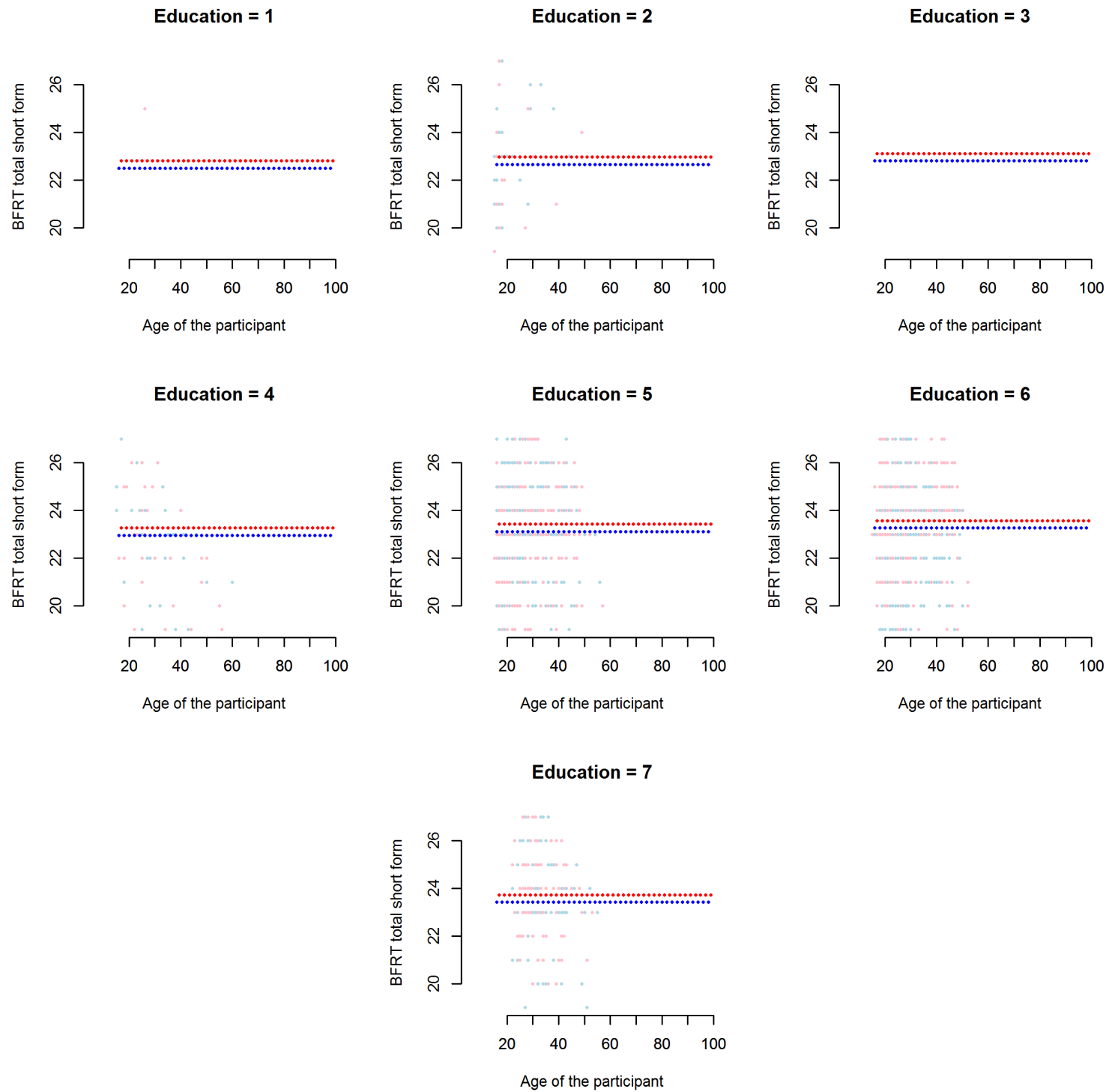
The table gives descriptives after outliers are removed on all BFRT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
BFRT total short form	19	23	27	645	15-60	19	24	27	693	15-57

6.4.7 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. BFRT - Total score on short form



6.5 Boston Naming Test

6.5.1 Extreme Borders of the BNT

The table shows extreme minimum and maximum scores on all BNT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Boston Naming Test; long version	30	60	0.005 %

6.5.2 BIC Selection for BNT

The table shows the selection of the effects of demographic variables for the BNT.

Variable	Demographic Effects	BIC
Boston Naming Test; long version	Initially included terms $s + a + e + s*a + s*e$	2642.55
	Dropped terms $s*a$	2636.48
	a	2632.5
	Terms in the final model $s + e + s*e$	2632.5

age = a, sex = s, education = e.

6.5.3 Best model fit of the BNT

The table shows the terms of the best models for the BNT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Boston Naming Test; long version	$s + e + s*e$	10

age = a, sex = s, education = e.

6.5.4 Box-Cox power transformation of the BNT

The table shows the best Box-Cox power transformation for the BNT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Boston Naming Test; long version	4.67	0.086	2.856

6.5.5 Descriptive statistics for the BNT

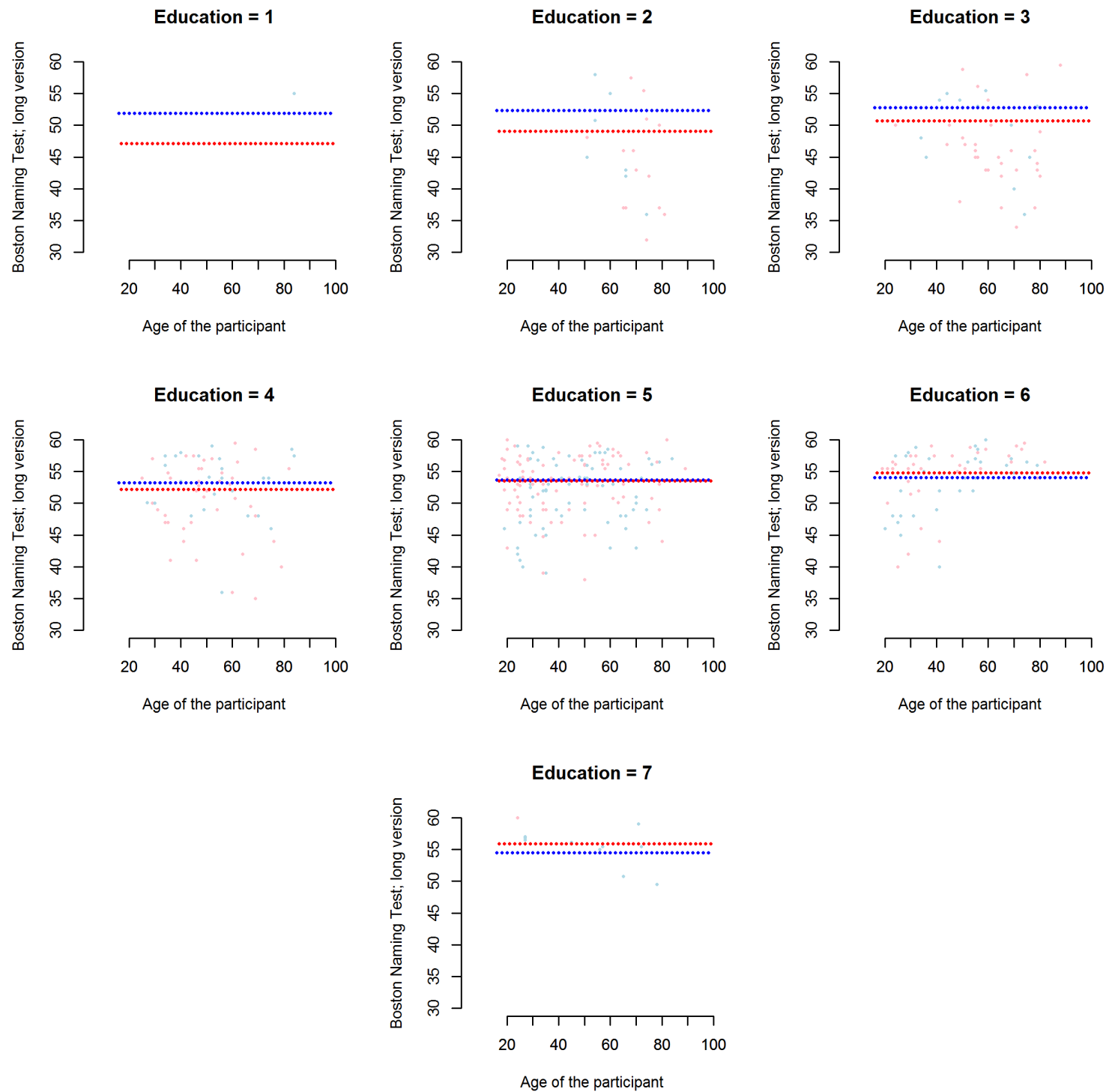
The table gives descriptives after outliers are removed on all BNT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Boston Naming Test; long version	36	54	60	173	19-84	32	53	60	254	17-89

6.5.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. BNT - Total score on long form



6.6 The Brixton Spatial Anticipation Test(BSAT)

6.6.1 Extreme Borders of the BSAT

The table shows extreme minimum and maximum scores on all BSAT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Brixton total score	8	50	0.011 %
Brixton number of errors	0	34	0.03 %

6.6.2 BIC Selection for BSAT

The table shows the selection of the effects of demographic variables for the BSAT.

Variable	Demographic Effects	BIC
Brixton total score	Initially included terms	
	$s + a + e + s*a + s*e$	1928.63
	Dropped terms	
	$s*a$	1923.1
	a	1919.05
	$s*e$	1915.63
	e	1910.29
	s	1905.82
	Terms in the final model	
	None	1905.82
Brixton number of errors	Initially included terms	
	$s + a + e$	1172.78
	Dropped terms	
	s	1169.67
	Terms in the final model	
	$a + e$	1169.67

age = a, sex = s, education = e.

6.6.3 Best model fit of the BSAT

The table shows the terms of the best models for the BSAT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Brixton total score		4
Brixton number of errors	$a + e$	1

age = a, sex = s, education = e.

6.6.4 Box-Cox power transformation of the BSAT

The table shows the best Box-Cox power transformation for the BSAT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Brixton total score	1.07	0.015	3.37
Brixton number of errors	0.57	0.121	2.513

6.6.5 Descriptive statistics for the BSAT

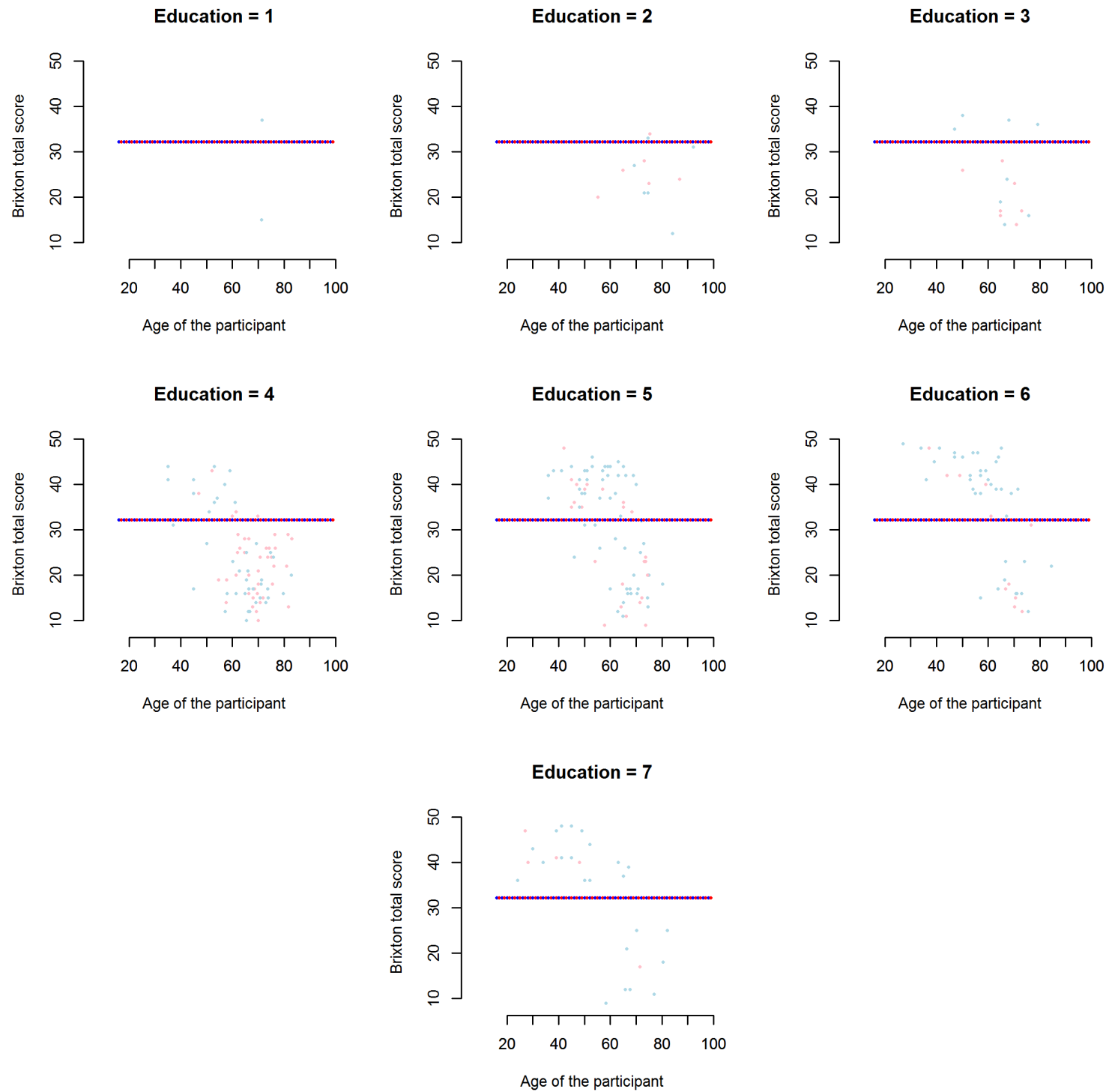
The table gives descriptives after outliers are removed on all BSAT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Brixton total score	9	36	49	178	24-92	9	24	48	97	27-87
Brixton number of errors	3	13	28	137	22-88	4	15	29	54	18-95

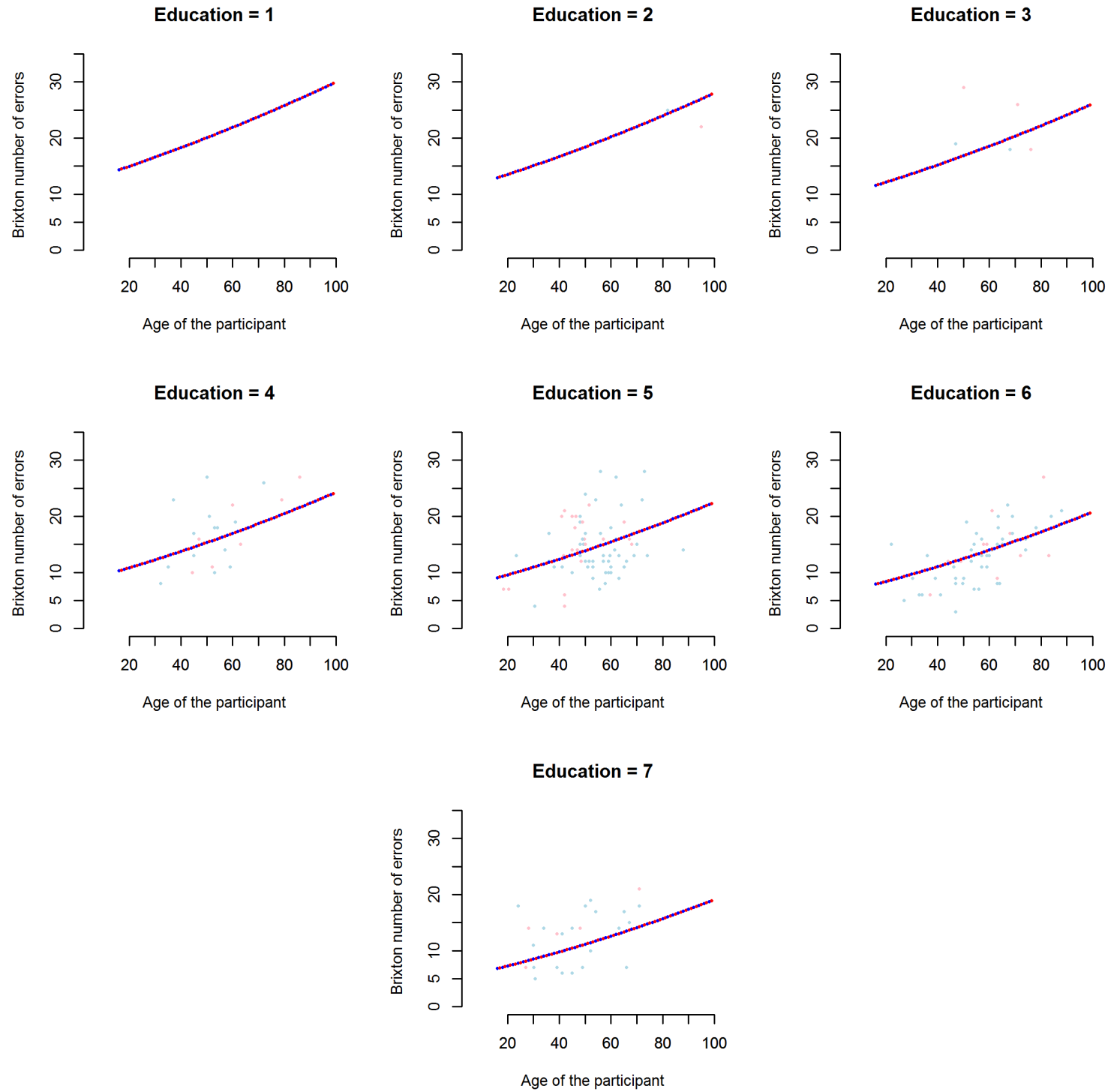
6.6.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. BSAT - Total score



2. BSAT - Number of errors



6.7 The Bourdon Wiersma Dot Cancellation Test

6.7.1 Extreme Borders of the BW

The table shows extreme minimum and maximum scores on all BW variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
BW row time	0	36	0 %
BW total time	5	20	0 %
BW number missed	0	60	0.003 %
BW number of errors	0	11	0.008 %

6.7.2 BIC Selection for BW

The table shows the selection of the effects of demographic variables for the BW.

Variable	Demographic Effects	BIC
BW row time	Initially included terms	
	s + a + e + s*a + s*e	809.34
	Dropped terms	
	s*a	803.51
	Terms in the final model	
BW total time	s + a + e + s*e	803.51
	Initially included terms	
	s + a + e + s*e	278.41
	Dropped terms	
	s*e	275.22
	s	270.15
	e	266.36
	Terms in the final model	
BW number missed	a	266.36
	Initially included terms	
	s + a + e + s*a + s*e	1749.75
	Dropped terms	
	s*a	1743.85
	s*e	1738.36
	s	1733.15
	e	1731.56
	Terms in the final model	
BW number of errors	a	1731.56
	Initially included terms	
	s + a + e + s*a + s*e	8.04
	Dropped terms	
	s*a	2.23
	s*e	-3.31
	e	-9.21
	s	-14.62
	Terms in the final model	
	a	-14.62

age = a, sex = s, education = e.

6.7.3 Best model fit of the BW

The table shows the terms of the best models for the BW variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
BW row time	s + a + e + s*e	5
BW total time	a	0
BW number missed	a	16
BW number of errors	a	59

age = a, sex = s, education = e.

6.7.4 Box-Cox power transformation of the BW

The table shows the best Box-Cox power transformation for the BW variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
BW row time	-0.032	-0.144	3.028
BW total time	0.727	-0.076	2.798
BW number missed	0.43	-0.319	2.994
BW number of errors	-22.942	12.071	149.962

6.7.5 Descriptive statistics for the BW

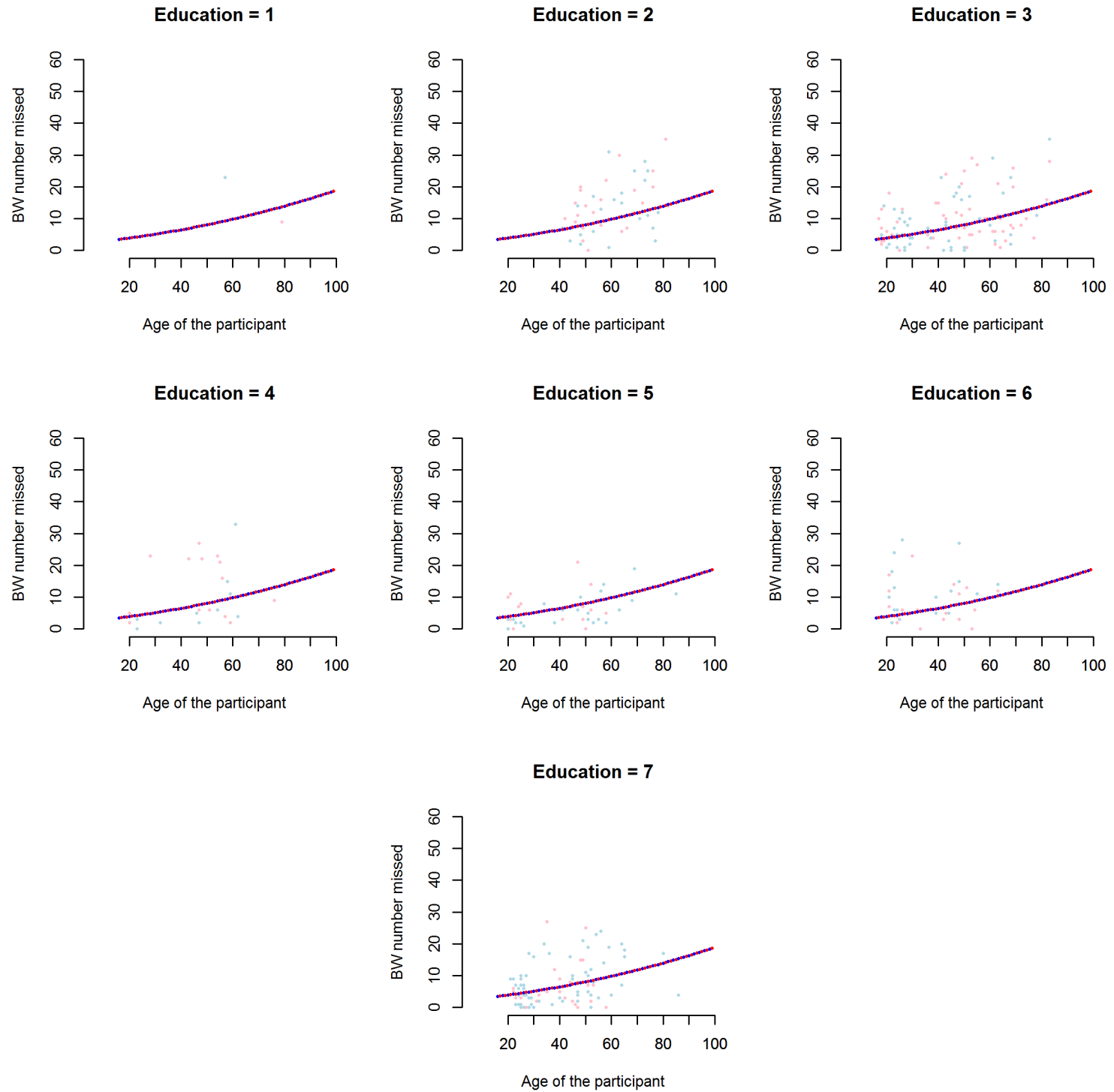
The table gives descriptives after outliers are removed on all BW variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
BW row time	8	13	22	202	18-85	7	13	23	173	17-83
BW total time	6	10	16	102	18-74	6	11	15	91	18-69
BW number missed	0	7	35	196	18-86	0	7	35	166	17-83
BW number of errors	0	0	0	171	18-86	0	0	1	146	17-83

6.7.6 Plots with raw data points and back-transformed predicted data points

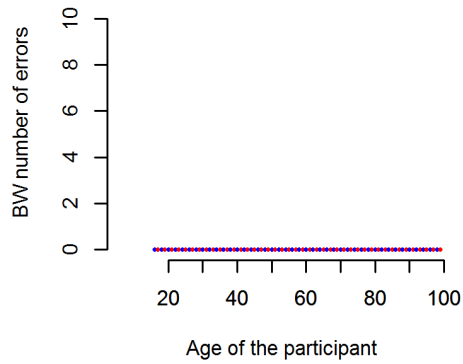
These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. BW - Number of items missed

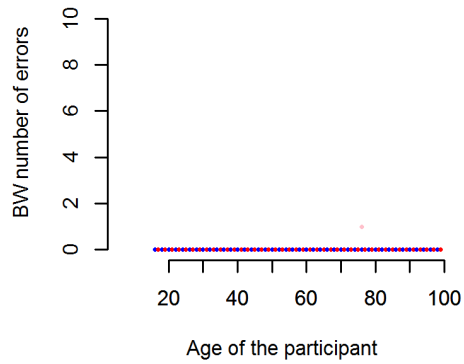


2. BW - Number of errors

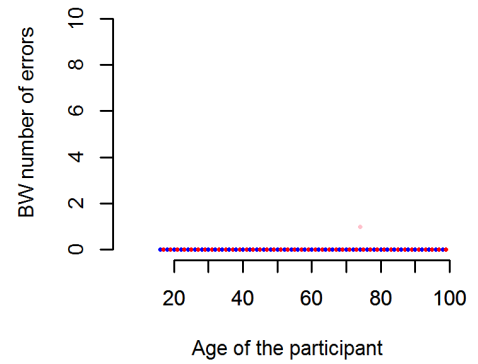
Education = 1



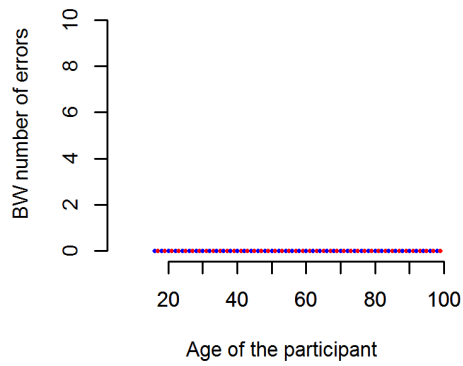
Education = 2



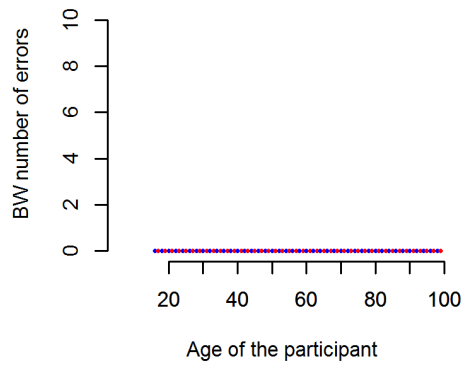
Education = 3



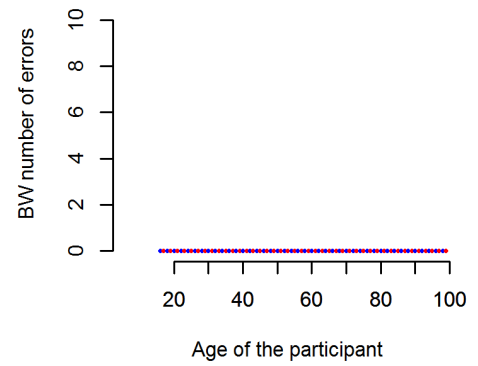
Education = 4



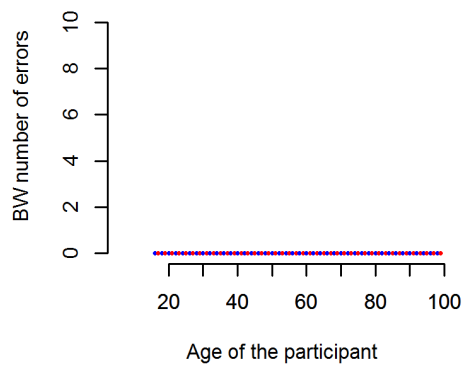
Education = 5



Education = 6

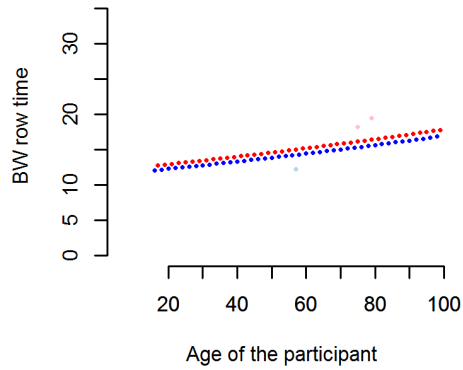


Education = 7

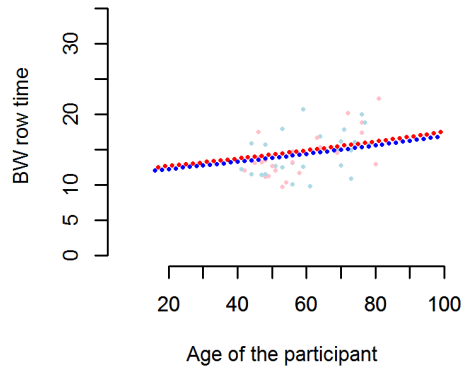


3. BW - Row time

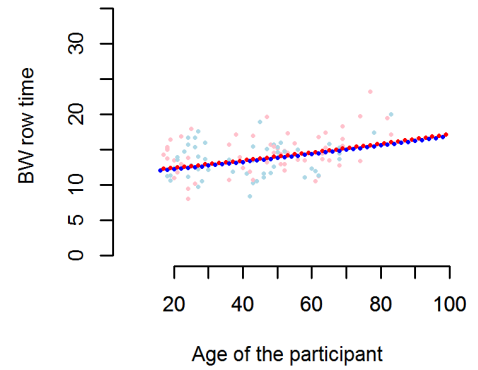
Education = 1



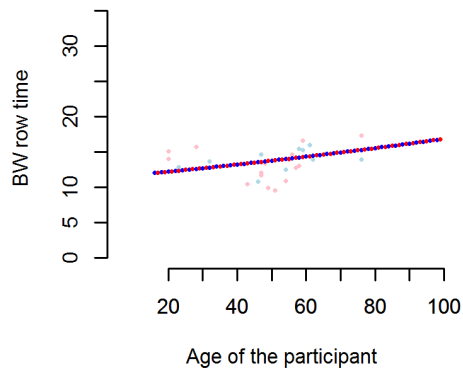
Education = 2



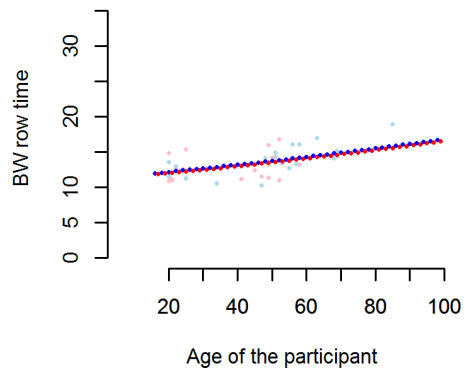
Education = 3



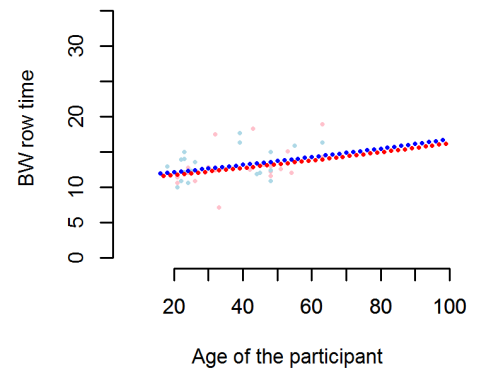
Education = 4



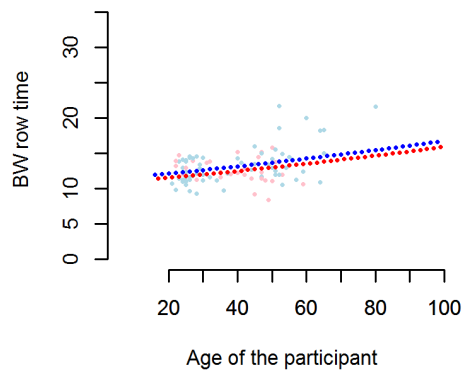
Education = 5



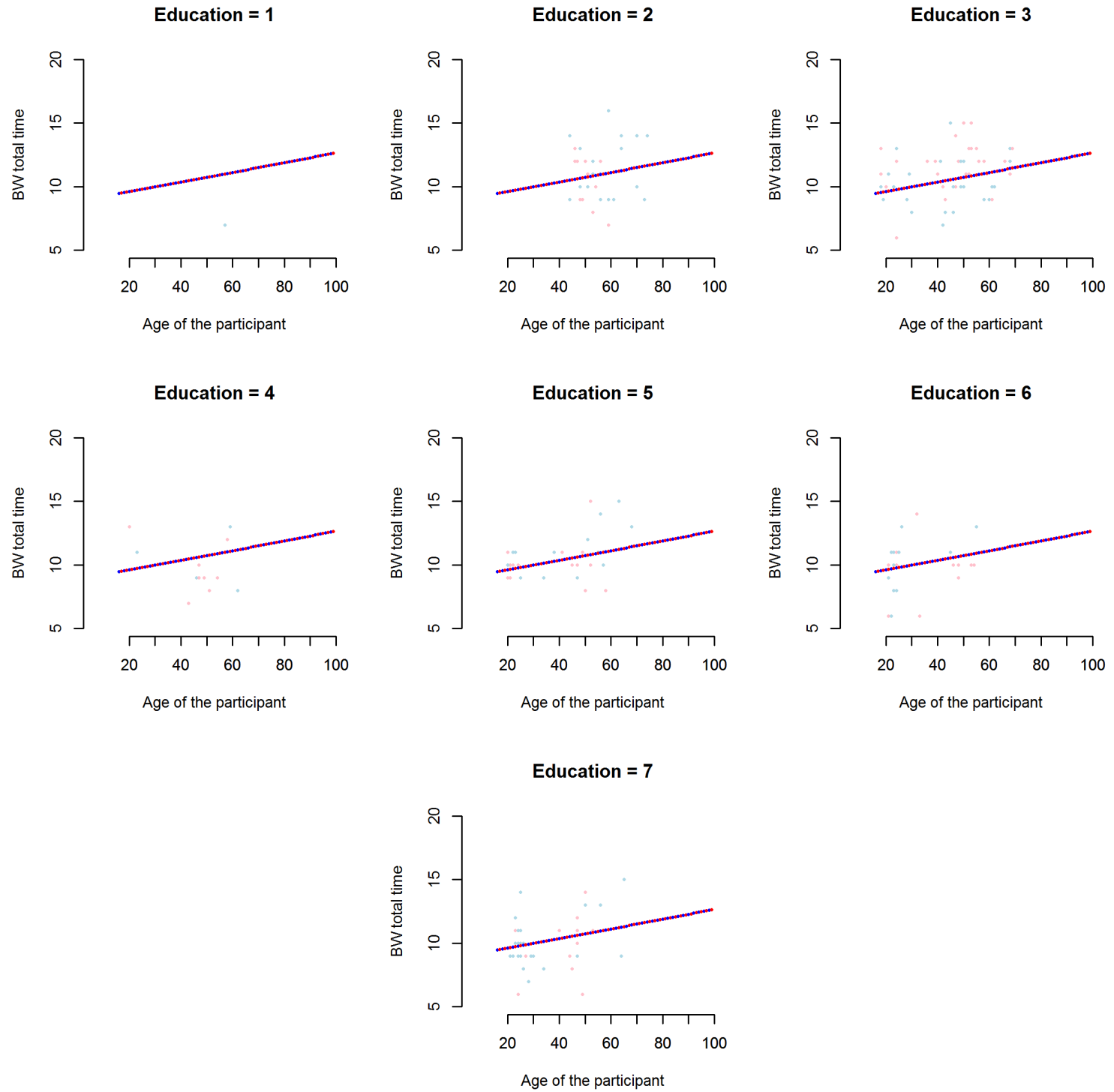
Education = 6



Education = 7



4. BW - Total time



6.8 Center for Epidemiologic Studies - Depression Scale (CESD)

Variable name	Min extreme border	Max extreme border	Percentage removed
CES D total score	0	40	0.003 %

6.8.1 BIC Selection for CESD

The table shows the selection of the effects of demographic variables for the CESD.

Variable	Demographic Effects	BIC
CES D total score	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	3994.6
	Dropped terms	
	$s*a*e$	3988.35
	$s*e$	3982.14
	$a*e$	3976.02
	$s*a$	3970.77
	e	3968.01
	Terms in the final model	
	$s + a$	3968.01

age = a, sex = s, education = e.

6.8.2 Best model fit of the CESD

The table shows the terms of the best models for the CESD variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
CES D total score	$s + a$	11

age = a, sex = s, education = e.

6.8.3 Box-Cox power transformation of the CESD

The table shows the best Box-Cox power transformation for the CESD variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
CES D total score	0.52	-0.166	3.274

6.8.4 Descriptive statistics for the CESD

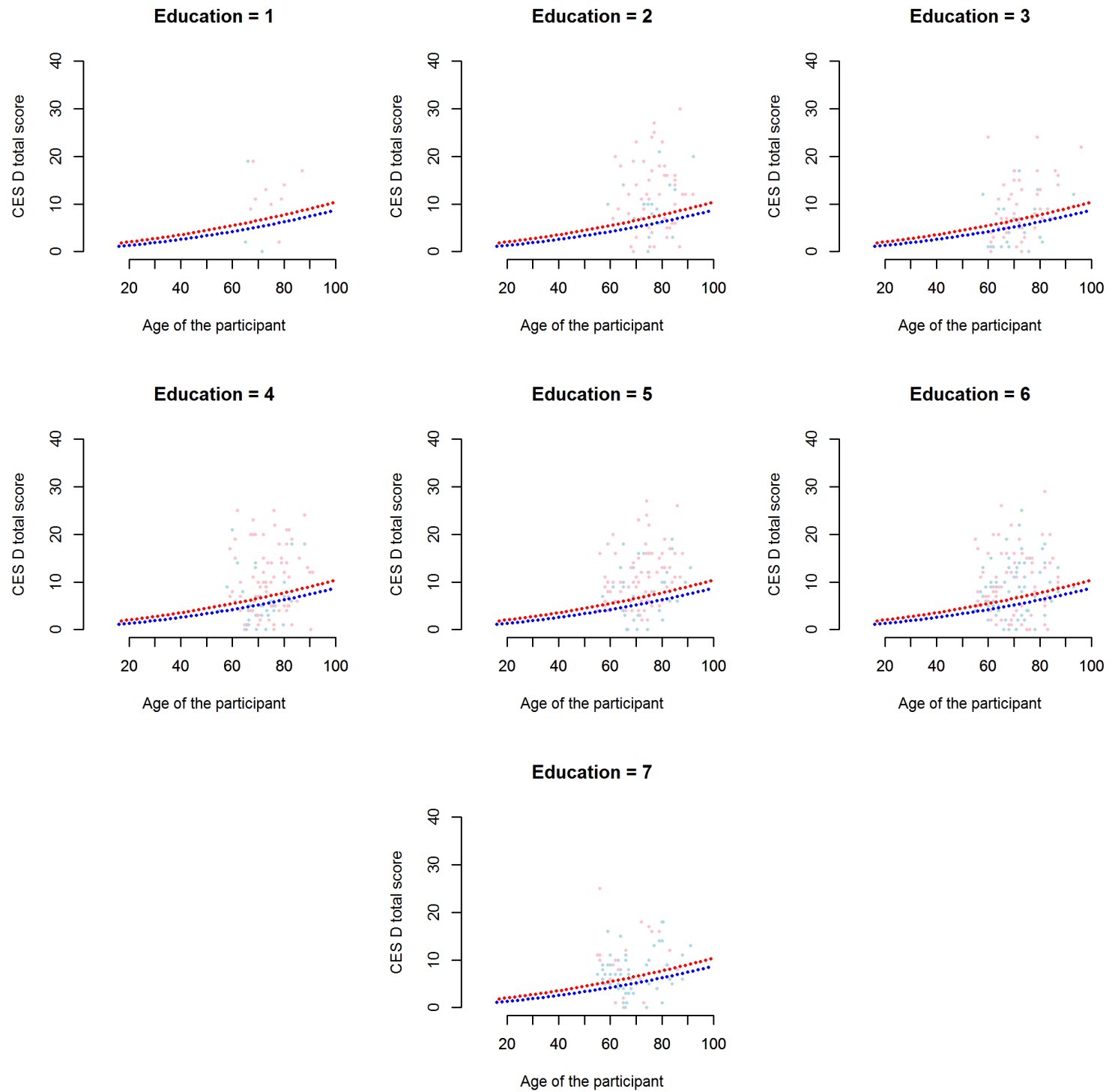
The table gives descriptives after outliers are removed on all CESD variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
CES D total score	0	7	25	248	55-93	0	9	30	359	55-96

6.8.5 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. CES-D -Total Score



6.9 Clock Drawing Test

6.9.1 Extreme Borders of the ClockDraw

The table shows extreme minimum and maximum scores on all ClockDraw variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Clock Drawing Task	8	15	0.035 %

6.9.2 BIC Selection for ClockDraw

The table shows the selection of the effects of demographic variables for the ClockDraw.

Variable	Demographic Effects	BIC
Clock Drawing Task	Initially included terms	
	$s + a + e + s*a + s*e$	619.12
	Dropped terms	
	$s*a$	614.25
	a	609.76
	$s*e$	608.85
	s	605.36
	Terms in the final model	
	e	605.36

age = a, sex = s, education = e.

6.9.3 Best model fit of the ClockDraw

The table shows the terms of the best models for the ClockDraw variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Clock Drawing Task	e	0

age = a, sex = s, education = e.

6.9.4 Box-Cox power transformation of the ClockDraw

The table shows the best Box-Cox power transformation for the ClockDraw variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Clock Drawing Task	3.39	0.141	2.476

6.9.5 Descriptive statistics for the ClockDraw

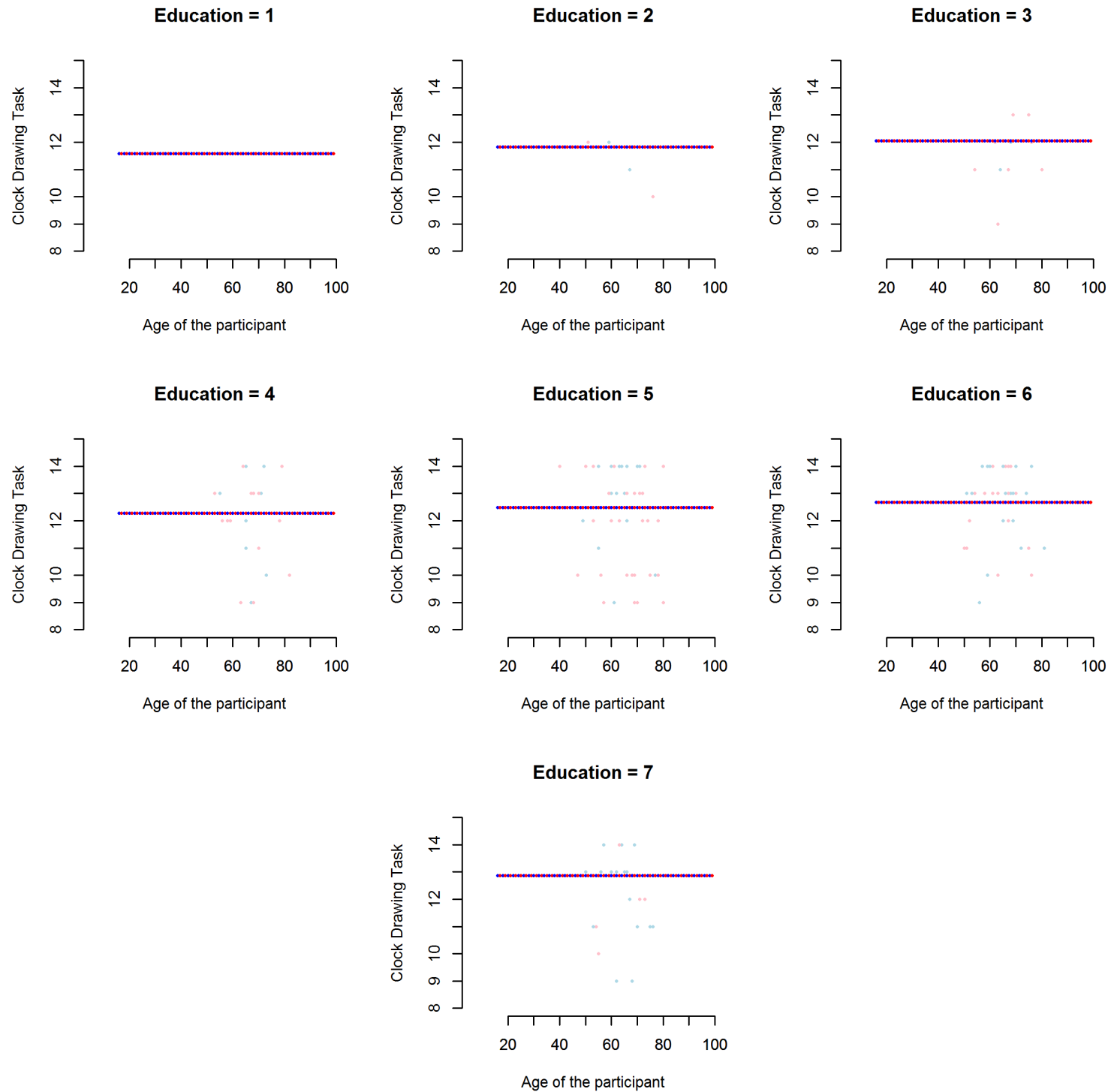
The table gives descriptives after outliers are removed on all ClockDraw variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Clock Drawing Task	9	13	14	77	49-81	9	12	14	90	40-82

6.9.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. Clock Drawing total score



6.10 Dutch Adult Reading Test (DART)

6.10.1 Extreme Borders of the DART

The table shows extreme minimum and maximum scores on all DART variables. The last column shows the number of cases removed based on these criteria.

6.10.2 Extreme Borders of the DART

The table shows extreme minimum and maximum scores on all DART variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Dart Raw	50	100	0.036 %
Dart IQ	70	140	0.018 %

6.10.3 BIC Selection for DART

The table shows the selection of the effects of demographic variables for the DART.

Variable	Demographic Effects	BIC
Dart Raw	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	15817.8
	Dropped terms	
	$s*a*e$	15813.86
	$s*a$	15806.25
Dart IQ	Terms in the final model	
	$s + a + e + s*e + a*e$	15806.25
	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	39059.44
	Dropped terms	
	$s*a*e$	39055.66
	$s*a$	39052.56
	Terms in the final model	
	$s + a + e + s*e + a*e$	39052.56

age = a, sex = s, education = e.

6.10.4 Best model fit of the DART

The table shows the terms of the best models for the DART variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Dart Raw	$s + a + e + s*e + a*e$	4
Dart IQ	$s + a + e + s*e + a*e$	1

age = a, sex = s, education = e.

6.10.5 Box-Cox power transformation of the DART

The table shows the best Box-Cox power transformation for the DART variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Dart Raw	3.27	-0.046	2.659
Dart IQ	1.21	0.072	2.89

6.10.6 Descriptive statistics for the DART

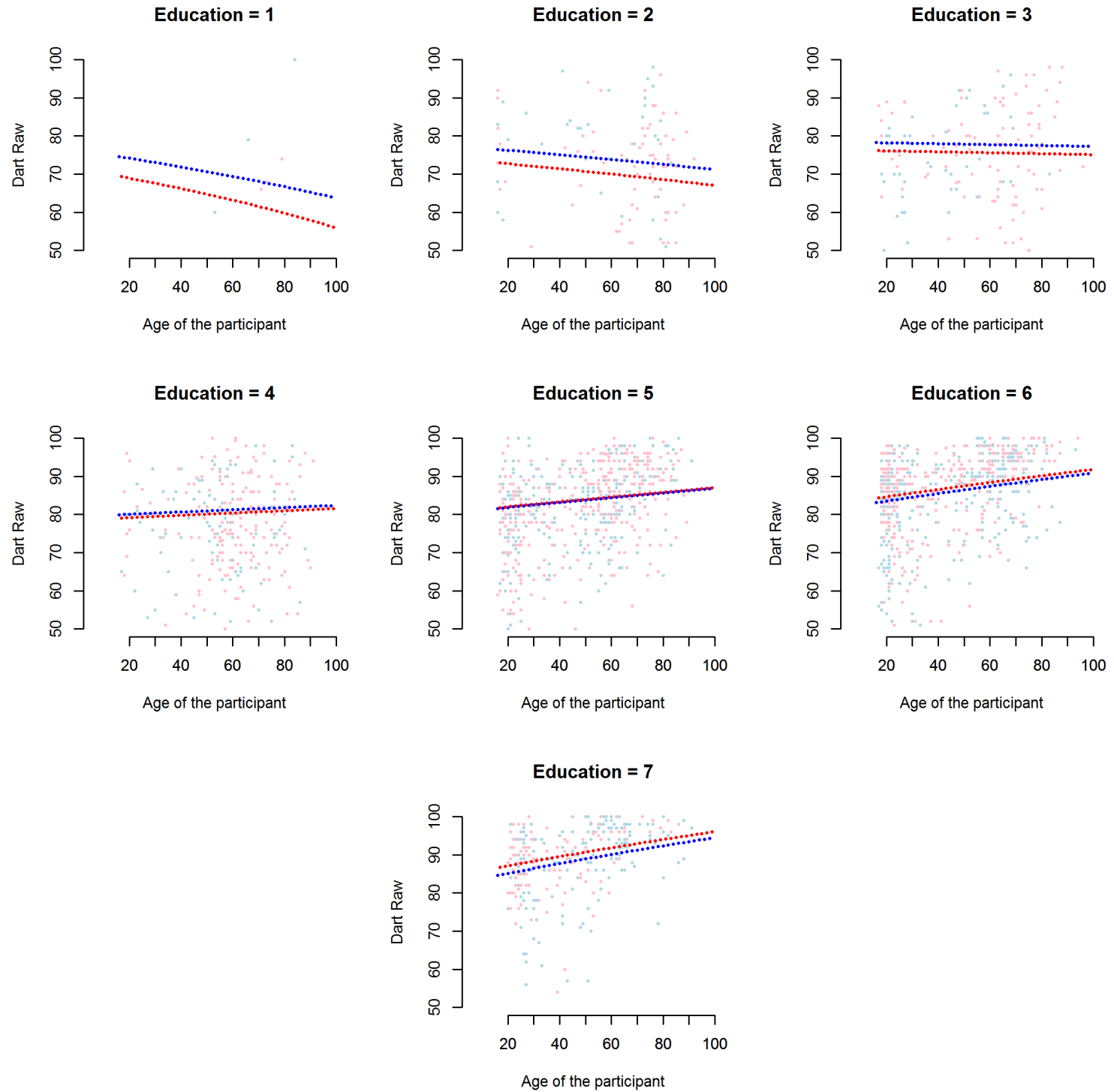
The table gives descriptives after outliers are removed on all DART variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Dart Raw	50	86	100	890	16-93	50	85	100	1246	16-96
Dart IQ	71	103	131	2095	18-93	72	100	140	3035	17-96

6.10.7 Plots with raw data points and back-transformed predicted data points

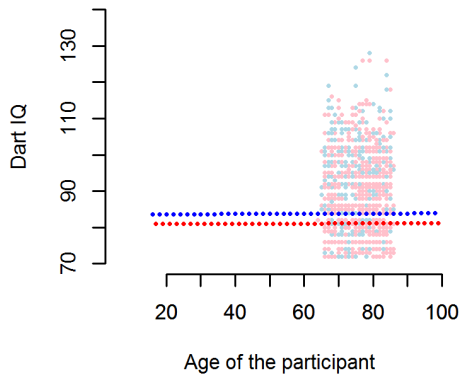
These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. DART raw score

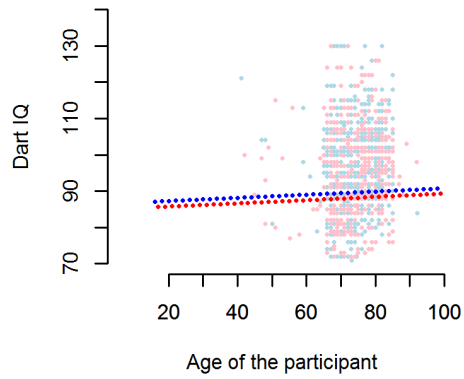


2. DART IQ

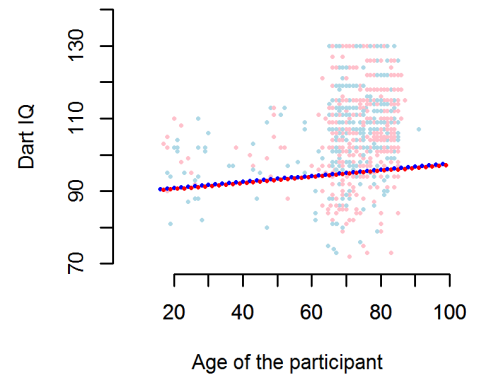
Education = 1



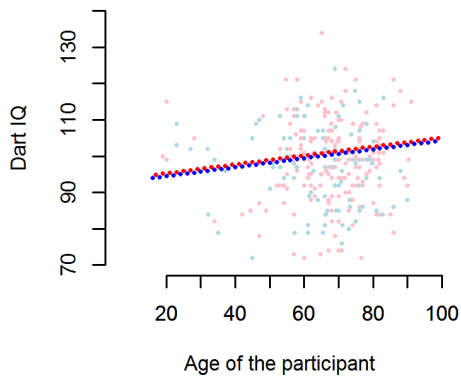
Education = 2



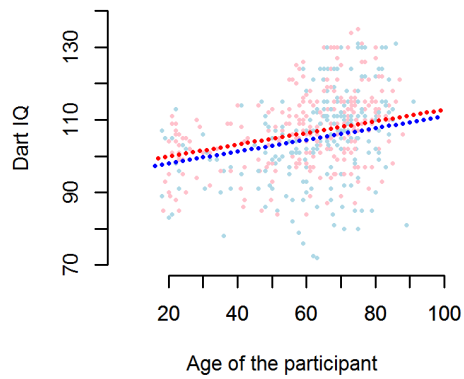
Education = 3



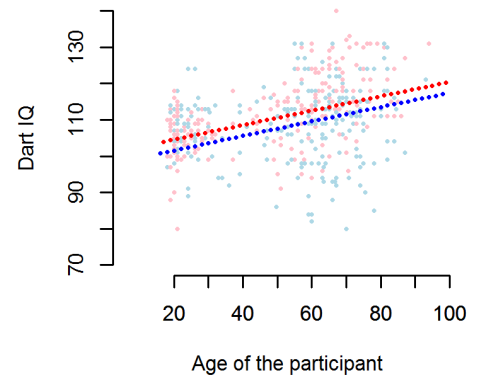
Education = 4



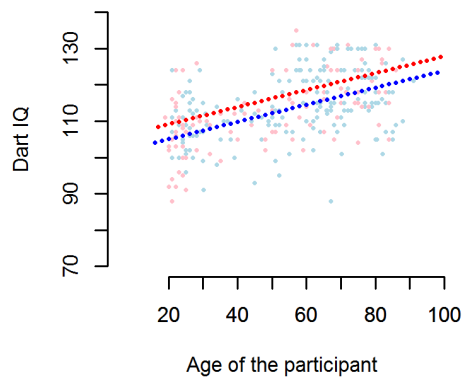
Education = 5



Education = 6



Education = 7



6.11 Groninger Intelligence Test - 1

6.11.1 Extreme Borders of the GIT1

The table shows extreme minimum and maximum scores on all GIT1 variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
GIT 1 Legkaarten	1	20	0 %
GIT 1 Cijferen	1	40	0 %
GIT 1 Matrijzen	1	20	0 %
GIT 1 IQ score	60	150	0 %

6.11.2 BIC Selection for GIT1

The table shows the selection of the effects of demographic variables for the GIT1.

Variable	Demographic Effects	BIC
GIT 1 Legkaarten	Initially included terms	
	$s + a + e + s*a$	829.85
	Dropped terms	
	$s*a$	826.37
	Terms in the final model	
GIT 1 Cijferen	$s + a + e$	826.37
	Initially included terms	
	s	202.48
	Dropped terms	
	s	199.42
GIT 1 Matrijzen	Terms in the final model	
	None	199.42
	Initially included terms	
	s	163.04
	Dropped terms	
GIT 1 IQ score	s	159.62
	Terms in the final model	
	None	159.62
	Initially included terms	
	s	368.91
	Dropped terms	
	s	365.07
	Terms in the final model	
	None	365.07

age = a, sex = s, education = e.

6.11.3 Best model fit of the GIT1

The table shows the terms of the best models for the GIT1 variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
GIT 1 Legkaarten	$s + a + e$	0
GIT 1 Cijferen		0
GIT 1 Matrijzen		0
GIT 1 IQ score		0

age = a, sex = s, education = e.

6.11.4 Box-Cox power transformation of the GIT1

The table shows the best Box-Cox power transformation for the GIT1 variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
GIT 1 Legkaarten	1.16	-0.334	2.752
GIT 1 Cijferen	0.838	-0.032	2.862
GIT 1 Matrijzen	1.119	-0.05	2.626
GIT 1 IQ score	2.185	-0.053	2.35

6.11.5 Descriptive statistics for the GIT1

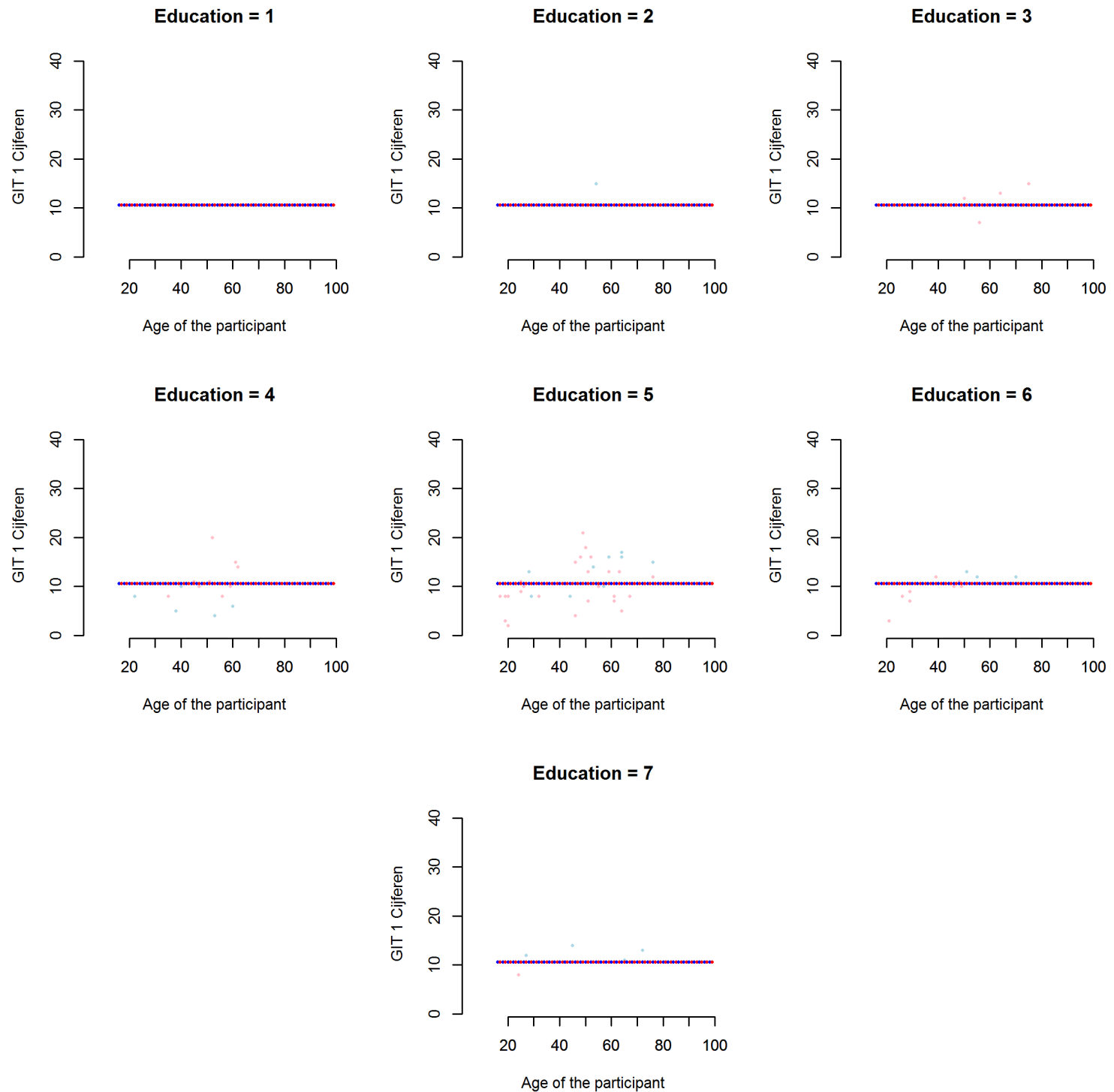
The table gives descriptives after outliers are removed on all GIT1 variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
GIT 1 Legkaarten	4	13	19	68	22-85	4	10	18	92	17-82
GIT 1 Cijferen	4	12	17	22	22-76	2	10	21	49	17-76
GIT 1 Matrijzen	4	12	18	22	22-76	5	11	17	49	17-76
GIT 1 IQ score	80	111	133	22	22-76	76	111	129	49	17-76

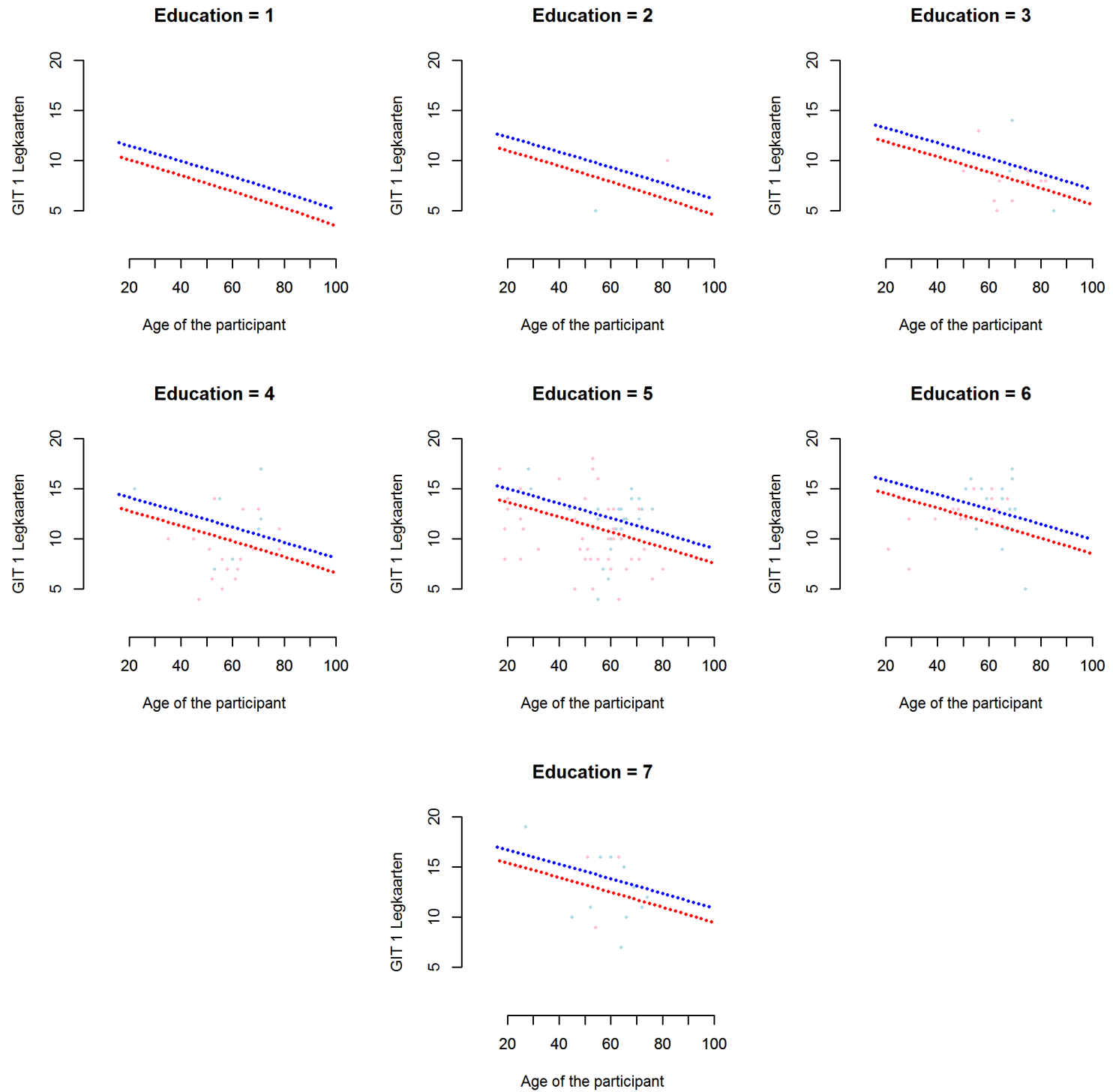
6.11.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

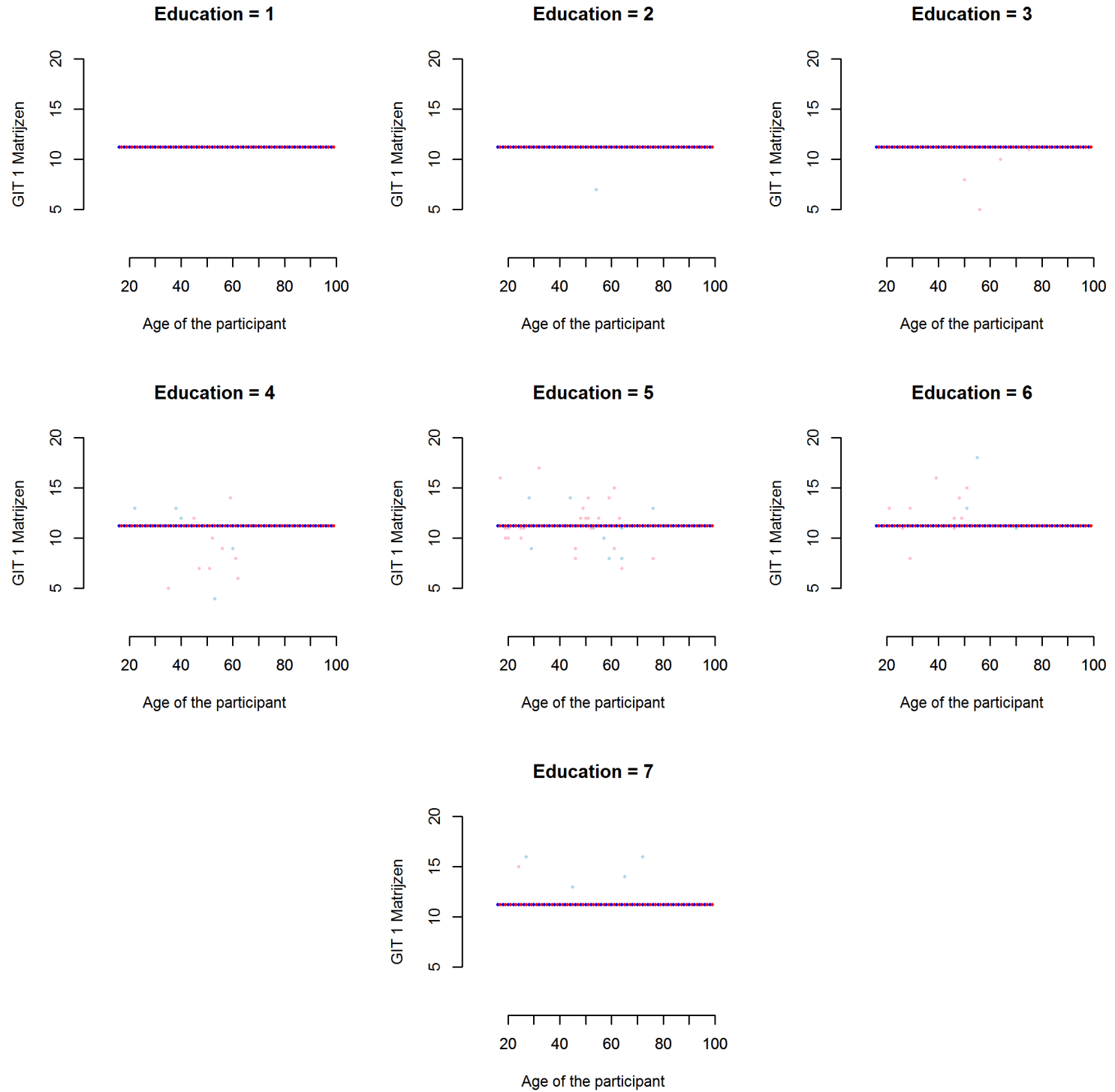
1. GIT1 - Cijferen / Numbers



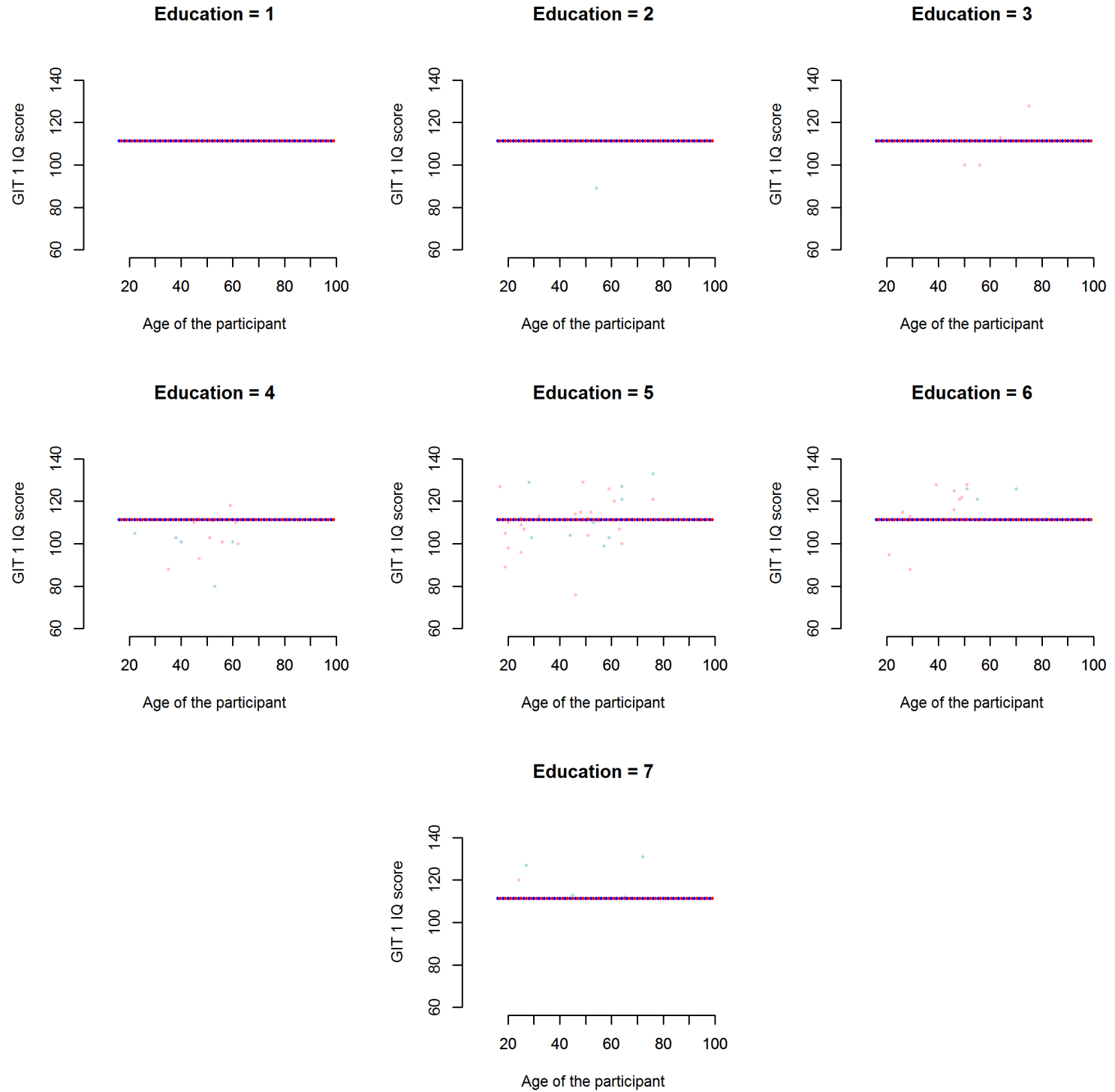
2. GIT1 - Legkaarten / Cards



3. GIT1 - Matrijzen / Matrices



3. GIT1 -IQ score



6.12 Hospital Anxiety and Depression Scale - HADS

6.12.1 Extreme Borders of the HADS

The table shows extreme minimum and maximum scores on all HADS variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
HADS anxiety score	0	9	0.057 %
HADS depression score	0	9	0.029 %
HADS total score	0	13	0.1 %

6.12.2 BIC Selection for HADS

The table shows the selection of the effects of demographic variables for the HADS.

Variable	Demographic Effects	BIC
HADS anxiety score	Initially included terms	
	s + a	104.5
	Dropped terms	
	s	100.31
	a	97.43
	Terms in the final model	
HADS depression score	None	97.43
	Initially included terms	
	s + a	102.81
	Dropped terms	
	s	98.62
	a	96.62
HADS total score	Terms in the final model	
	None	96.62
	Initially included terms	
	s + a	142.32
	Dropped terms	
	s	138.49
	Terms in the final model	
	a	138.49

age = a, sex = s, education = e.

6.12.3 Best model fit of the HADS

The table shows the terms of the best models for the HADS variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
HADS anxiety score		0
HADS depression score		0
HADS total score	a	0

age = a, sex = s, education = e.

6.12.4 Box-Cox power transformation of the HADS

The table shows the best Box-Cox power transformation for the HADS variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
HADS anxiety score	0.433	-0.03	2.595
HADS depression score	0.422	-0.56	2.663
HADS total score	0.494	-0.114	2.602

6.12.5 Descriptive statistics for the HADS

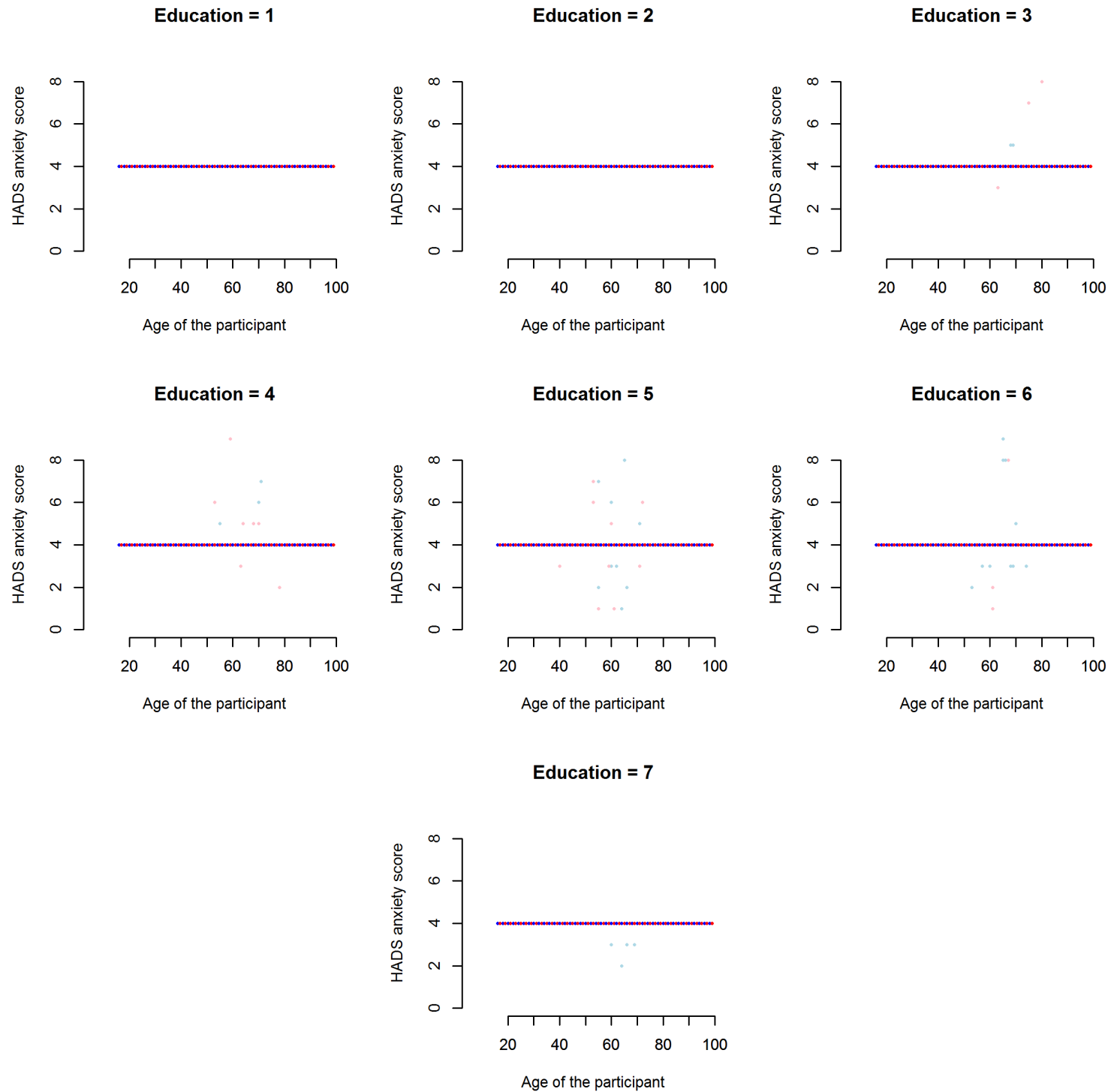
The table gives descriptives after outliers are removed on all HADS variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
HADS anxiety score	1	4	9	35	53-74	1	4	9	31	40-80
HADS depression score	0	2	7	35	53-74	0	2	7	33	40-80
HADS total score	2	5	12	32	53-74	1	6	13	31	40-80

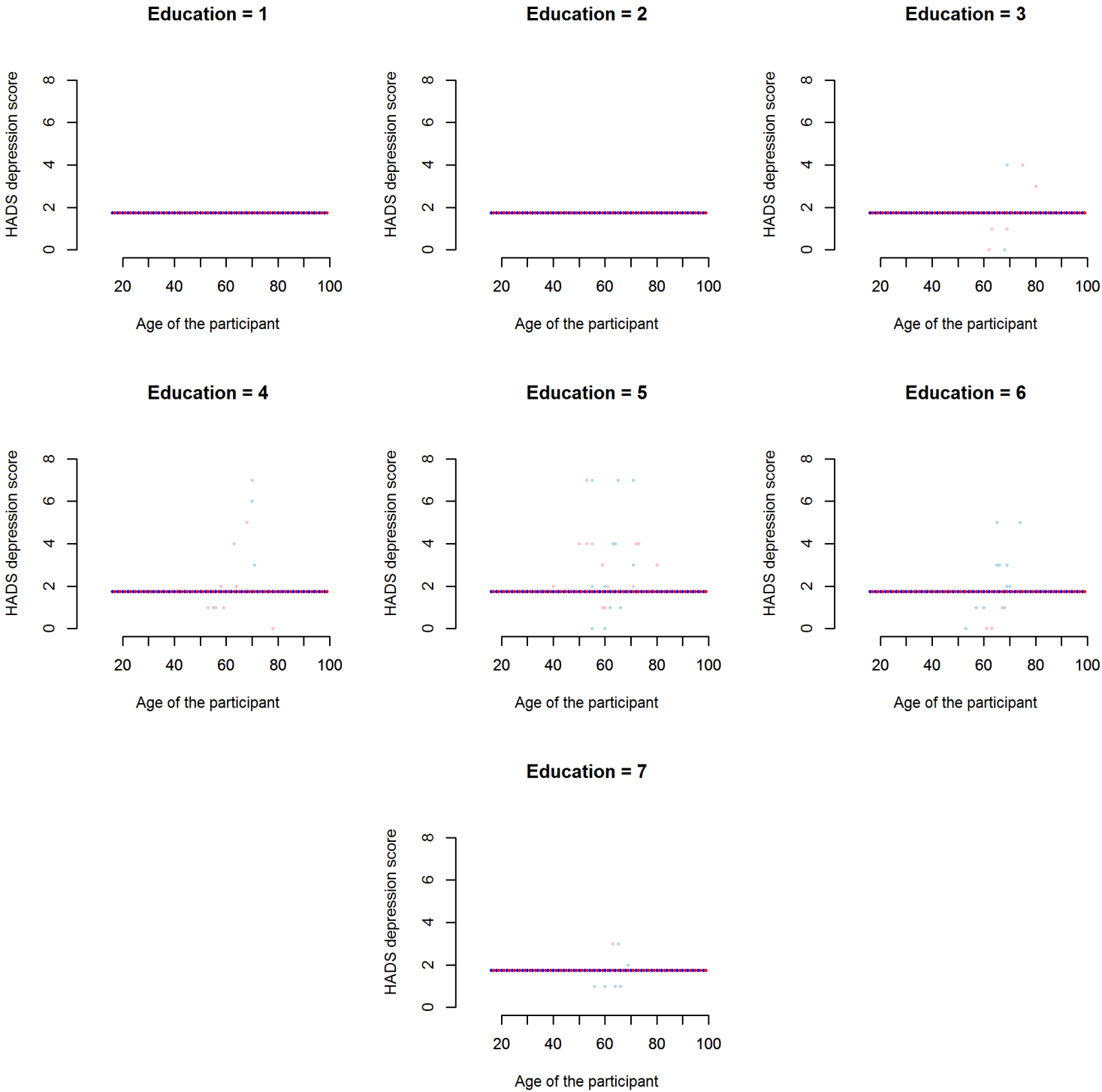
6.12.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. HADS - Anxiety score

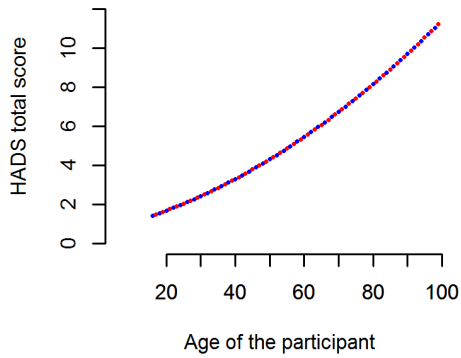


2. HADS - Depression score

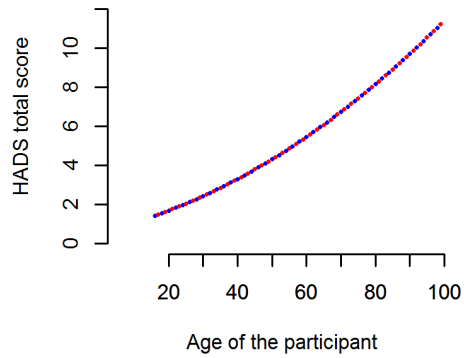


3. HADS - Total score

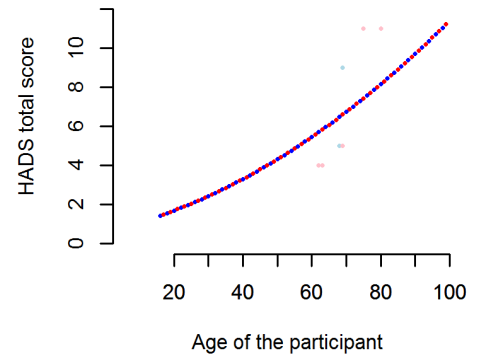
Education = 1



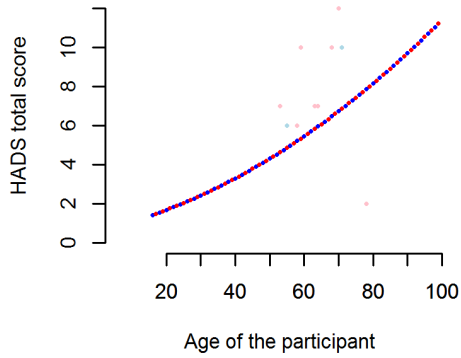
Education = 2



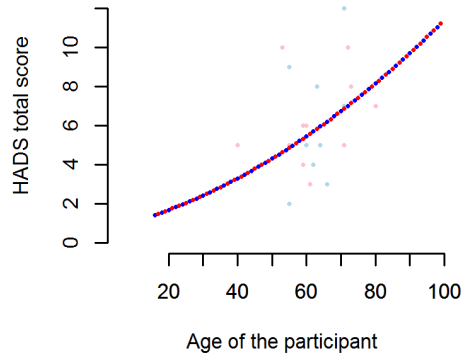
Education = 3



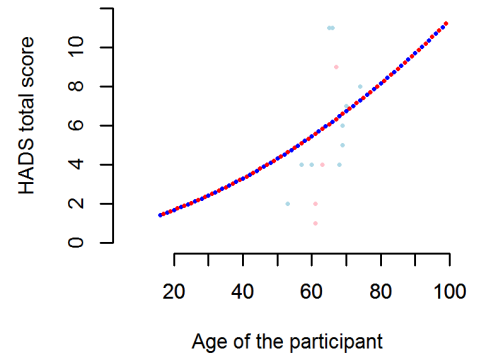
Education = 4



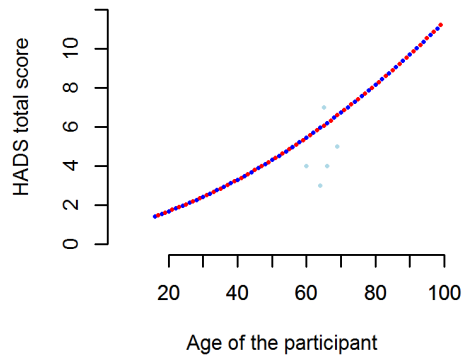
Education = 5



Education = 6



Education = 7



6.13 Hopkins Symptom Checklist (HSCL)

6.13.1 Extreme Borders of the HSCL

The table shows extreme minimum and maximum scores on all HSCL variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
HSCL Anxiety	0	40	0.005 %
HSCL Depression	0	40	0.023 %
HSCL total score	0	80	0 %

6.13.2 BIC Selection for HSCL

The table shows the selection of the effects of demographic variables for the HSCL.

Variable	Demographic Effects	BIC
HSCL Anxiety	Initially included terms	
	s + a + e + s*a	1575.07
	Dropped terms	
	e	1571.67
	s*a	1569.34
	a	1563.99
	s	1560.29
	Terms in the final model	
	None	1560.29
HSCL Depression	Initially included terms	
	s + a + e + s*a	1518.96
	Dropped terms	
	e	1513.6
	s*a	1508.34
	s	1503.81
	Terms in the final model	
	a	1503.81
	None	
HSCL total score	Initially included terms	
	s + a + e + s*a	2040.89
	Dropped terms	
	s*a	2037.06
	a	2031.47
	s	2027.91
	e	2024.96
	Terms in the final model	
	None	2024.96

age = a, sex = s, education = e.

6.13.3 Best model fit of the HSCL

The table shows the terms of the best models for the HSCL variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
HSCL Anxiety		14
HSCL Depression	a	4
HSCL total score		9

age = a, sex = s, education = e.

6.13.4 Box-Cox power transformation of the HSCL

The table shows the best Box-Cox power transformation for the HSCL variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
HSCL Anxiety	0.34	-0.75	2.406
HSCL Depression	0.36	-0.582	2.648
HSCL total score	0.42	-0.4	2.671

6.13.5 Descriptive statistics for the HSCL

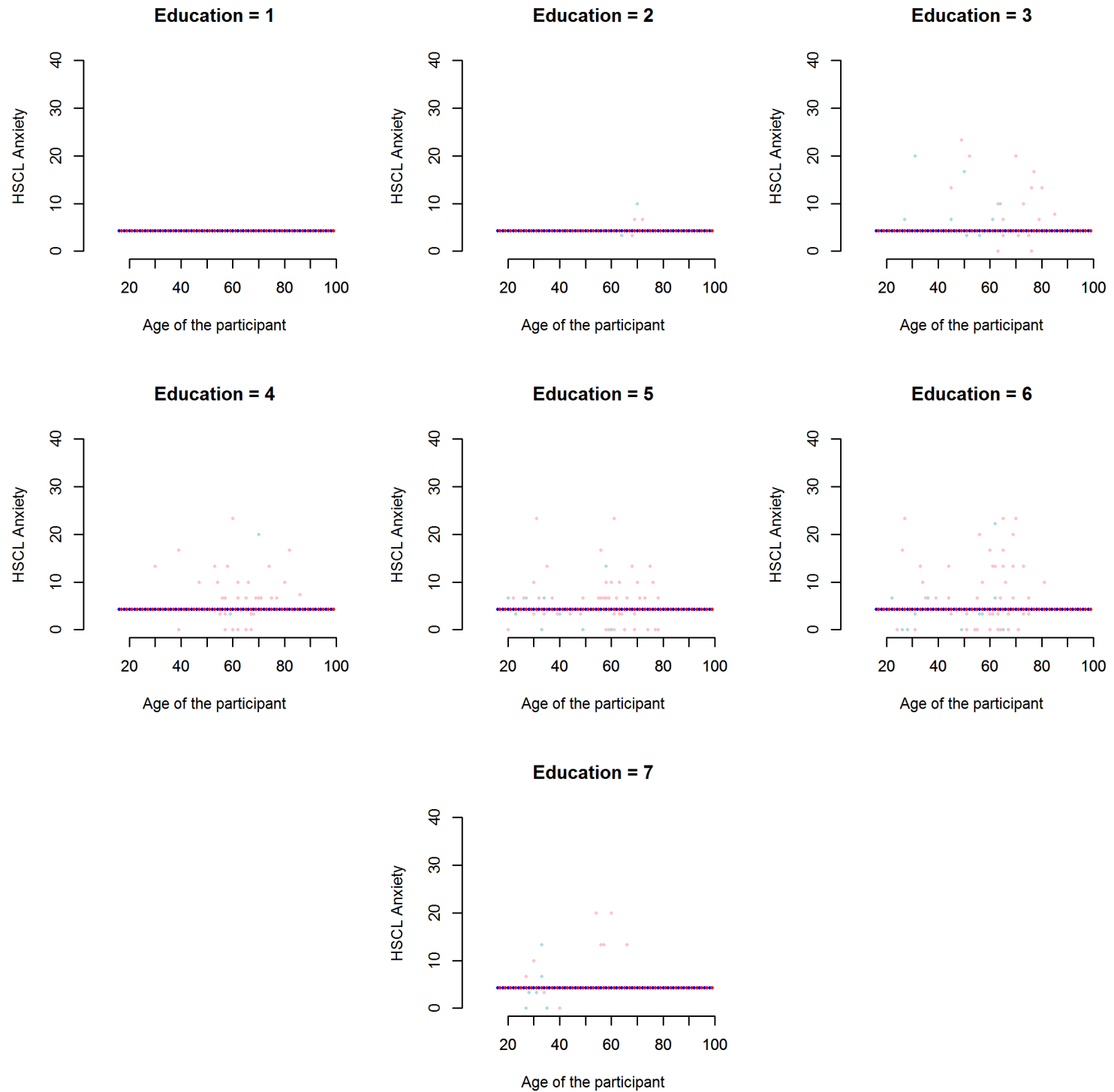
The table gives descriptives after outliers are removed on all HSCL variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
HSCL Anxiety	0	3	22	39	20-70	0	7	23	162	20-86
HSCL Depression	0	3	22	38	20-70	0	7	31	169	20-86
HSCL total score	0	4	25	39	20-70	0	7	31	229	19-86

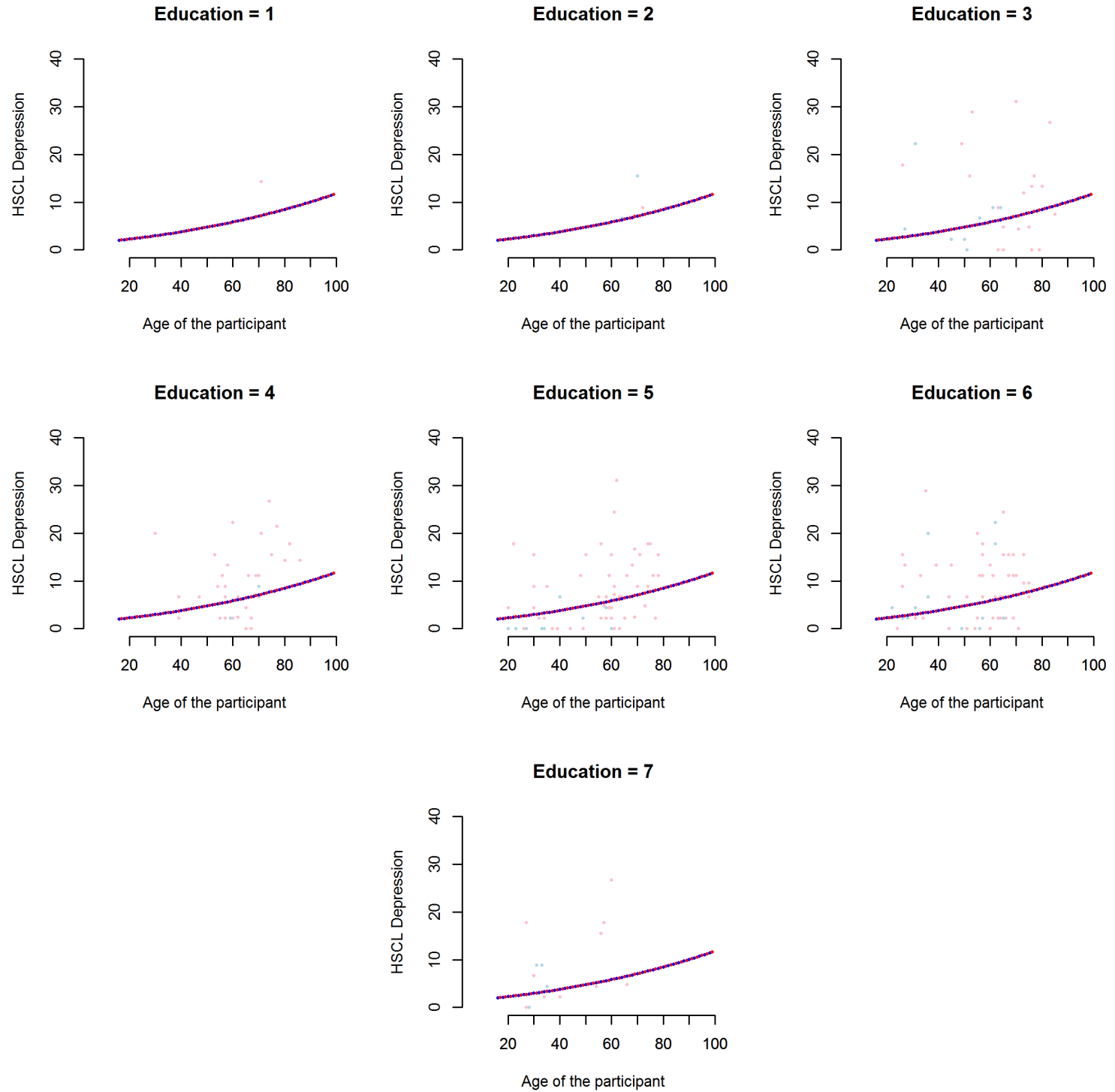
6.13.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

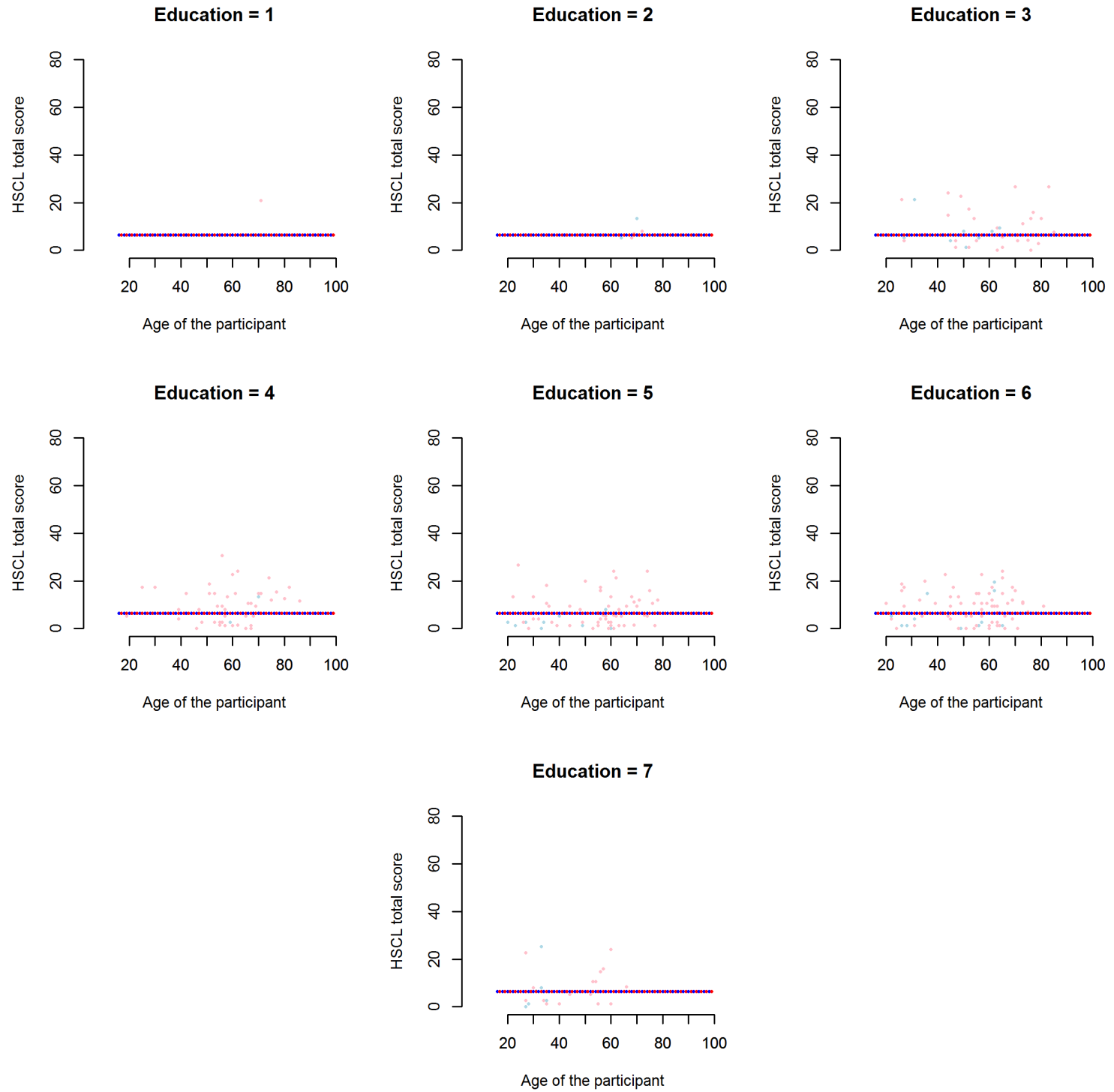
1. HSCL - Anxiety score



2. HSCL - Depression score



3. HADS - Total score



6.14 Judgement Of Line Orientation

6.14.1 Extreme Borders of the JOLO

The table shows extreme minimum and maximum scores on all JOLO variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Judgment of Line Orientation	8	30	0 %

6.14.2 BIC Selection for JOLO

The table shows the selection of the effects of demographic variables for the JOLO.

Variable	Demographic Effects	BIC
Judgment of Line Orientation	Initially included terms	
	s + a	195.21
	Dropped terms	
	a	192.35
	Terms in the final model	
	s	192.35

age = a, sex = s, education = e.

6.14.3 Best model fit of the JOLO

The table shows the terms of the best models for the JOLO variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Judgment of Line Orientation	s	3

age = a, sex = s, education = e.

6.14.4 Box-Cox power transformation of the JOLO

The table shows the best Box-Cox power transformation for the JOLO variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Judgment of Line Orientation	3.443	-0.094	2.222

6.14.5 Descriptive statistics for the JOLO

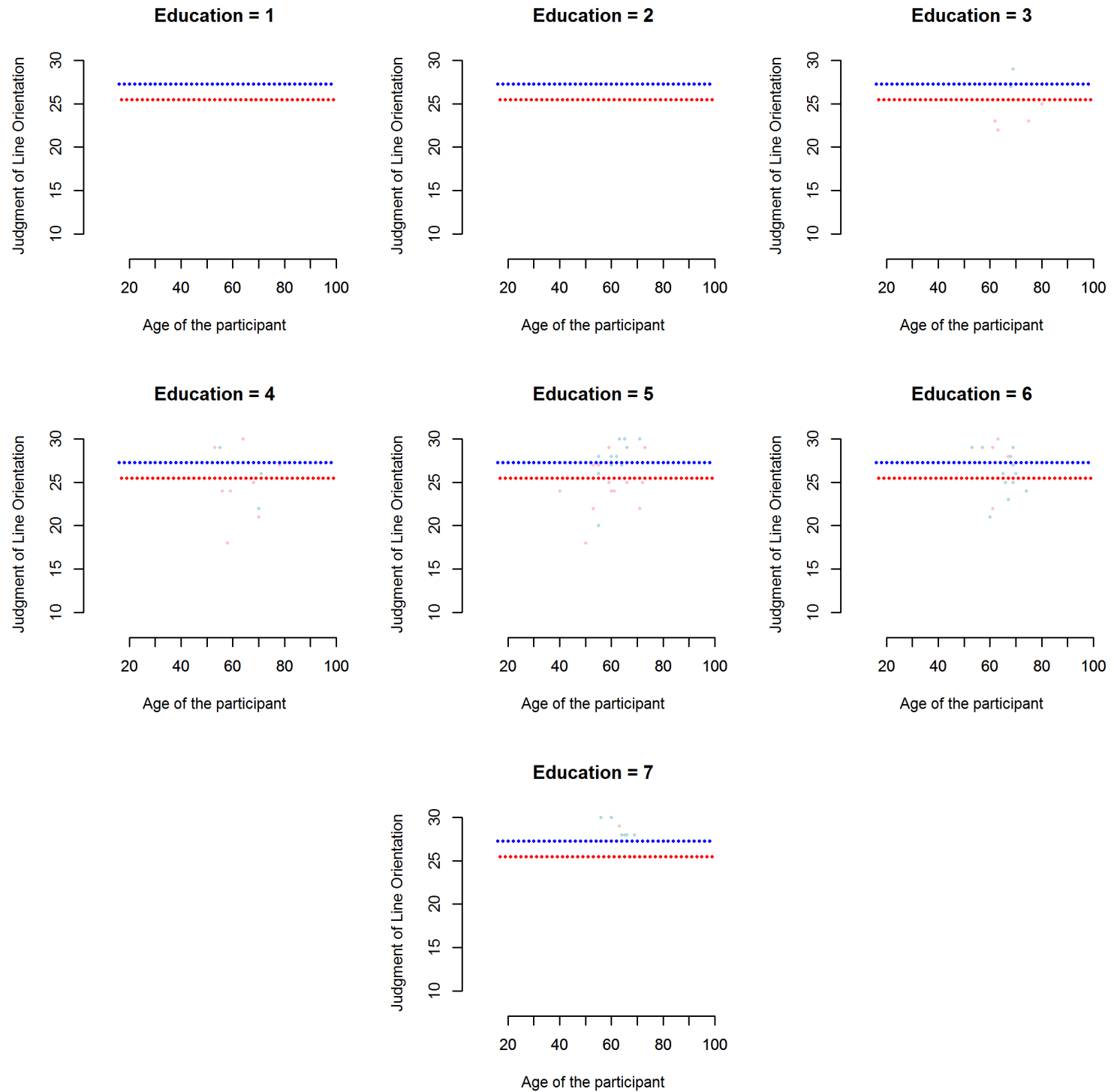
The table gives descriptives after outliers are removed on all JOLO variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Judgment of Line Orientation	20	28	30	37	53-74	18	25	30	30	40-80

6.14.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. Judgement of Line Orientation score



6.15 Letter Fluency (LF)

6.15.1 Extreme Borders of the LF

The table shows extreme minimum and maximum scores on all LF variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
1st letter	3	30	0.009 %
2nd letter	3	30	0.013 %
3rd letter	3	30	0.005 %
Total letter fluency	10	90	0.006 %

6.15.2 BIC Selection for LF

The table shows the selection of the effects of demographic variables for the LF.

Variable	Demographic Effects	BIC
1st letter	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	13306.12
	Dropped terms	
	$s*a*e$	13298.4
	$a*e$	13290.92
	$s*a$	13283.57
	$s*e$	13278.48
	s	13273.91
	Terms in the final model	
	$a + e$	13273.91
2nd letter	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	12488.93
	Dropped terms	
	$s*a*e$	12481.66
	$s*e$	12474.89
	$s*a$	12468.32
	$a*e$	12462.99
	a	12458.52
	Terms in the final model	
	$s + e$	12458.52
3rd letter	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	11794.64
	Dropped terms	
	$s*a*e$	11786.99
	$a*e$	11780.14
	$s*e$	11774.58
	$s*a$	11769.22
	a	11764.41
	Terms in the final model	
	$s + e$	11764.41
Total letter fluency	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	16241.16
	Dropped terms	
	$s*a*e$	16233.55
	$a*e$	16226.07
	$s*a$	16219.57
	$s*e$	16213.97
	a	16213.15
	Terms in the final model	
	$s + e$	16213.15

6.15.3 Best model fit of the LF

The table shows the best Box-Cox power transformation for the LF variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best model fit	Number of cases removed
1st letter	a + e	3
2nd letter	s + e	3
3rd letter	s + e	1
Total letter fluency	s + e	4

age = a, age squared = a², sex = s, education = e.

6.15.4 Box-Cox power transformation of the LF

The table shows the best Box-Cox power transformation for the LF variables and the skewness and kurtosis after the power transformation.

Variable name	Best power transformation	Skewness	Kurtosis
1st letter	0.68	-0.043	2.716
2nd letter	0.67	-0.028	2.763
3rd letter	0.69	0.013	2.911
Total letter fluency	0.7	-0.014	2.882

6.15.5 Descriptive statistics for the LF

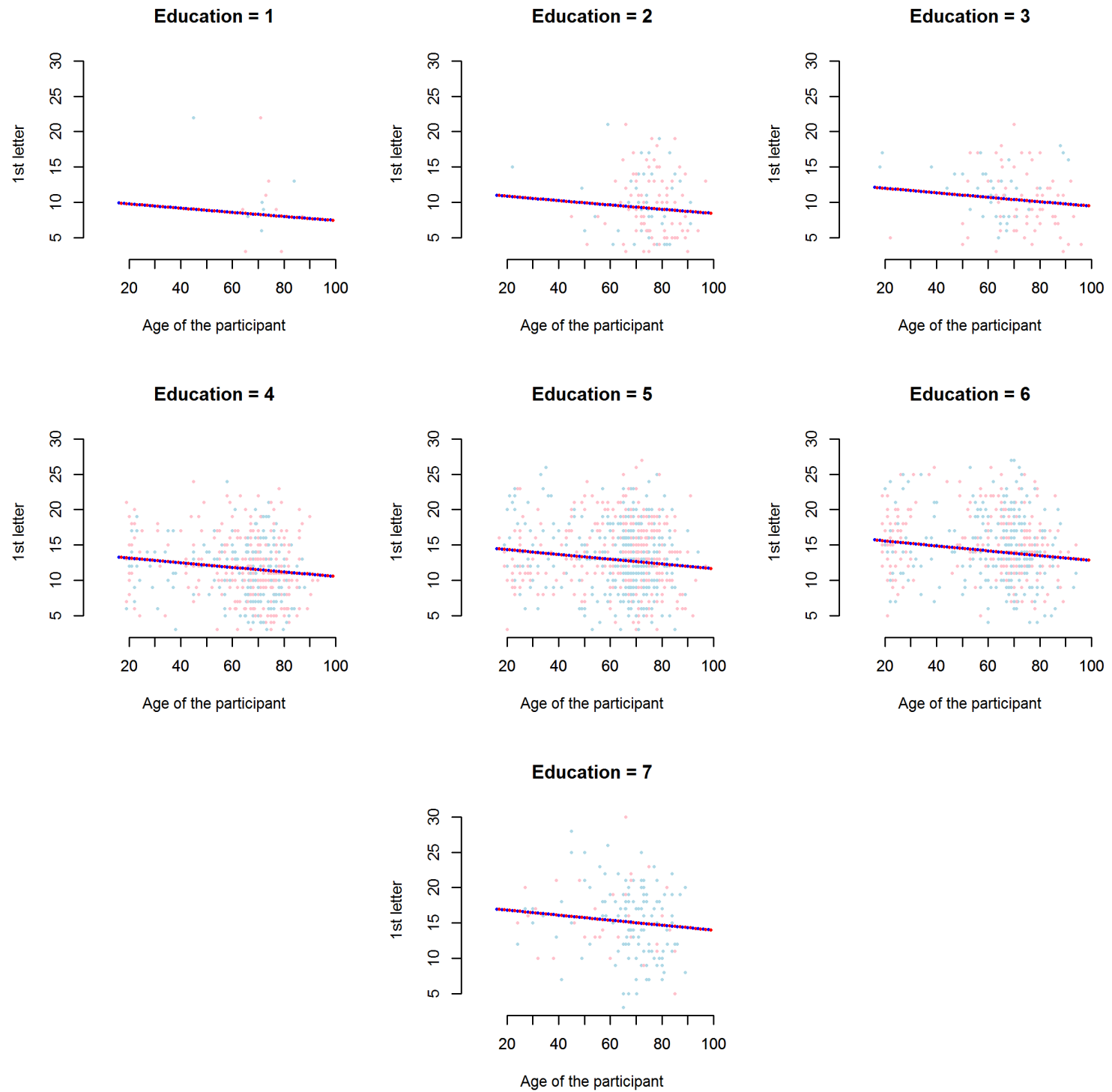
The table gives descriptives on all LF variables, for men and women separately.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
1st letter	3	13	28	1094	18-94	3	13	30	1174	17-97
2nd letter	3	11	26	1091	18-94	3	11	23	1164	17-97
3rd letter	3	12	28	1013	18-94	3	12	25	1096	17-97
Total letter fluency	10	36	78	1032	18-94	10	37	72	1108	17-97

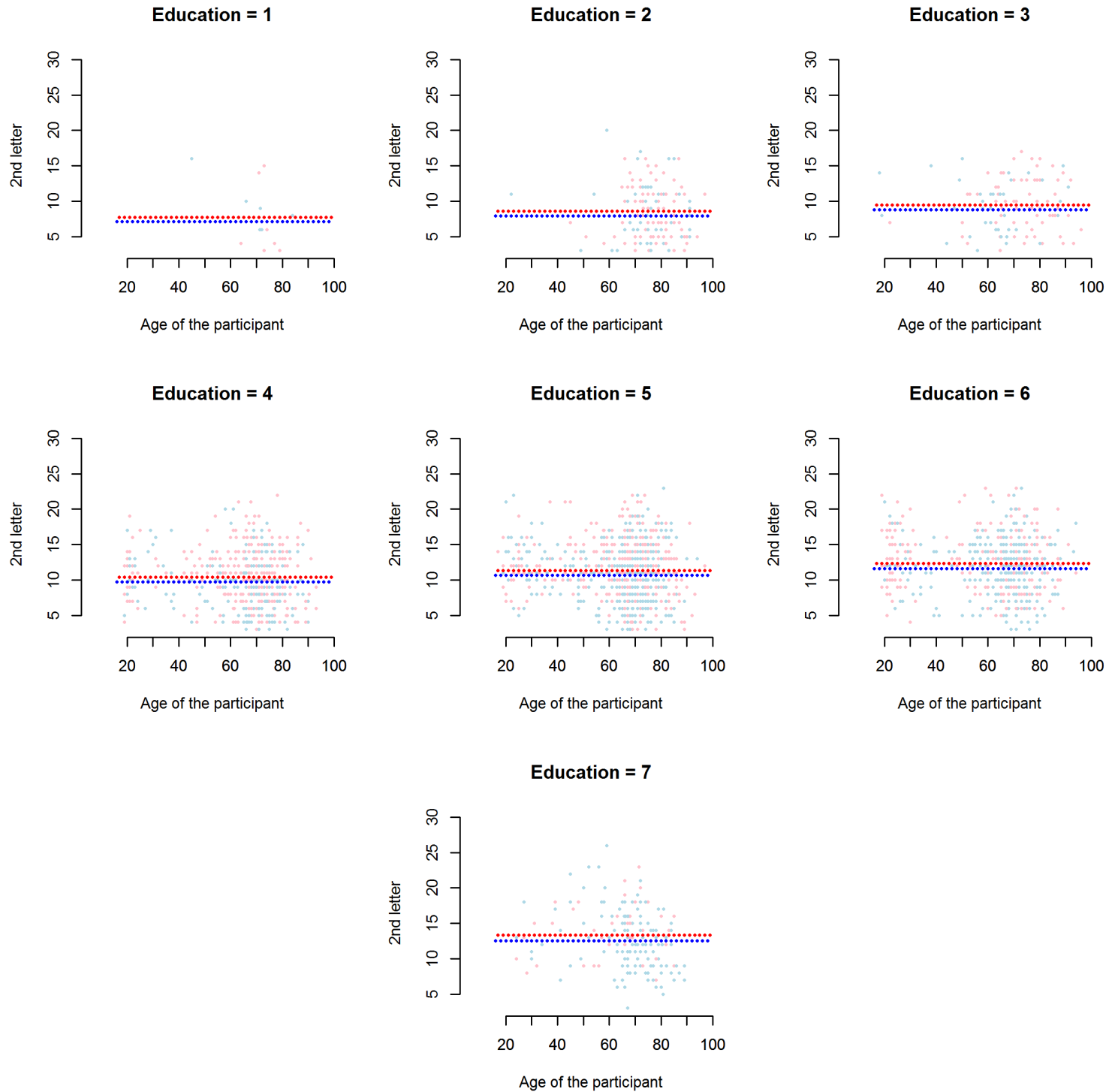
6.15.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

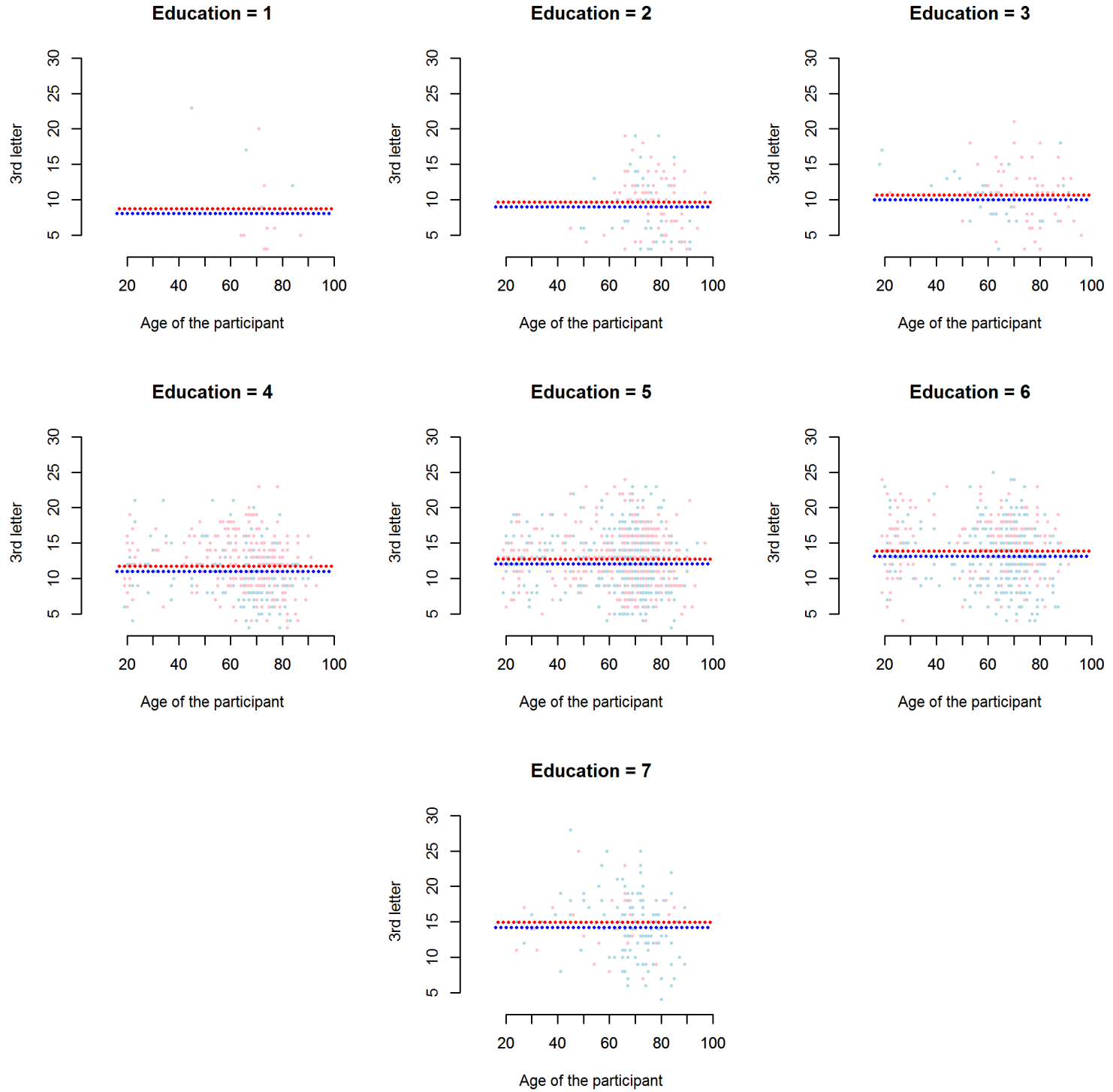
1. LF - Letter 1



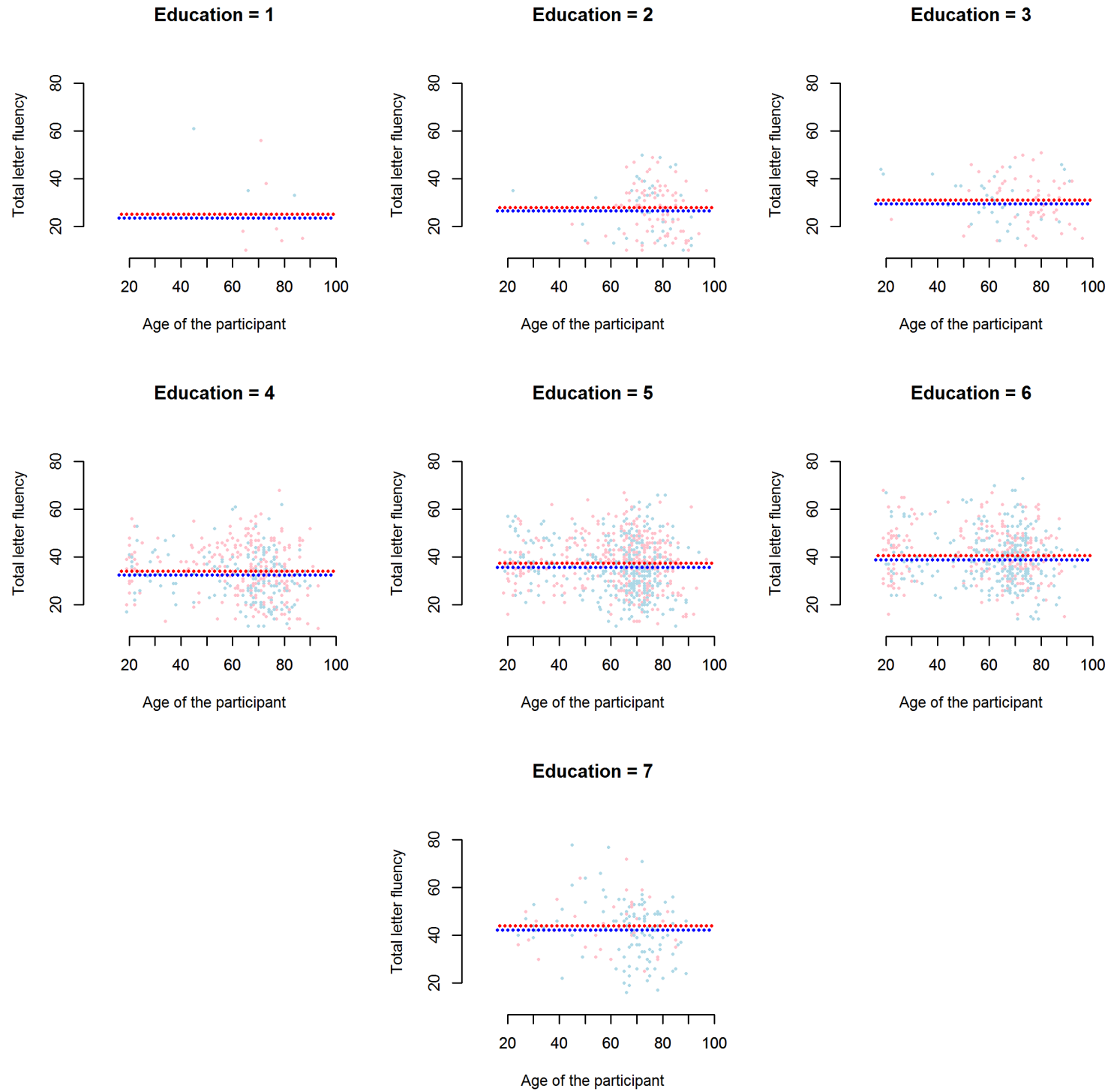
2. LF - Letter 2



3. LF - Letter 2



4. LF - total letter 1 2 and 3



6.16 Location Learning Test

6.16.1 Extreme Borders of the LLT

The table shows extreme minimum and maximum scores on all LLT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
LLT - Total Displacement Score	0	90	0.02 %
LLT - Learning Index	0	1	0 %

6.16.2 BIC Selection for LLT

The table shows the selection of the effects of demographic variables for the LLT.

Variable	Demographic Effects	BIC
LLT - Total Displacement Score	Initially included terms	
	$s + a + e + s*a$	1317.79
	Dropped terms	
	$s*a$	1315.1
	a	1310.12
	s	1306.73
	e	1305.95
	Terms in the final model	
	None	1305.95
	Initially included terms	
LLT - Learning Index	$s + a + e + s*a$	86.86
	Dropped terms	
	$s*a$	82.33
	s	77.43
	a	74.49
	Terms in the final model	
	e	74.49

age = a, sex = s, education = e.

6.16.3 Best model fit of the LLT

The table shows the terms of the best models for the LLT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
LLT - Total Displacement Score		0
LLT - Learning Index	e	0

age = a, sex = s, education = e.

6.16.4 Box-Cox power transformation of the LLT

The table shows the best Box-Cox power transformation for the LLT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
LLT - Total Displacement Score	0.45	-0.156	2.658
LLT - Learning Index	0.49	-0.003	1.952

6.16.5 Descriptive statistics for the LLT

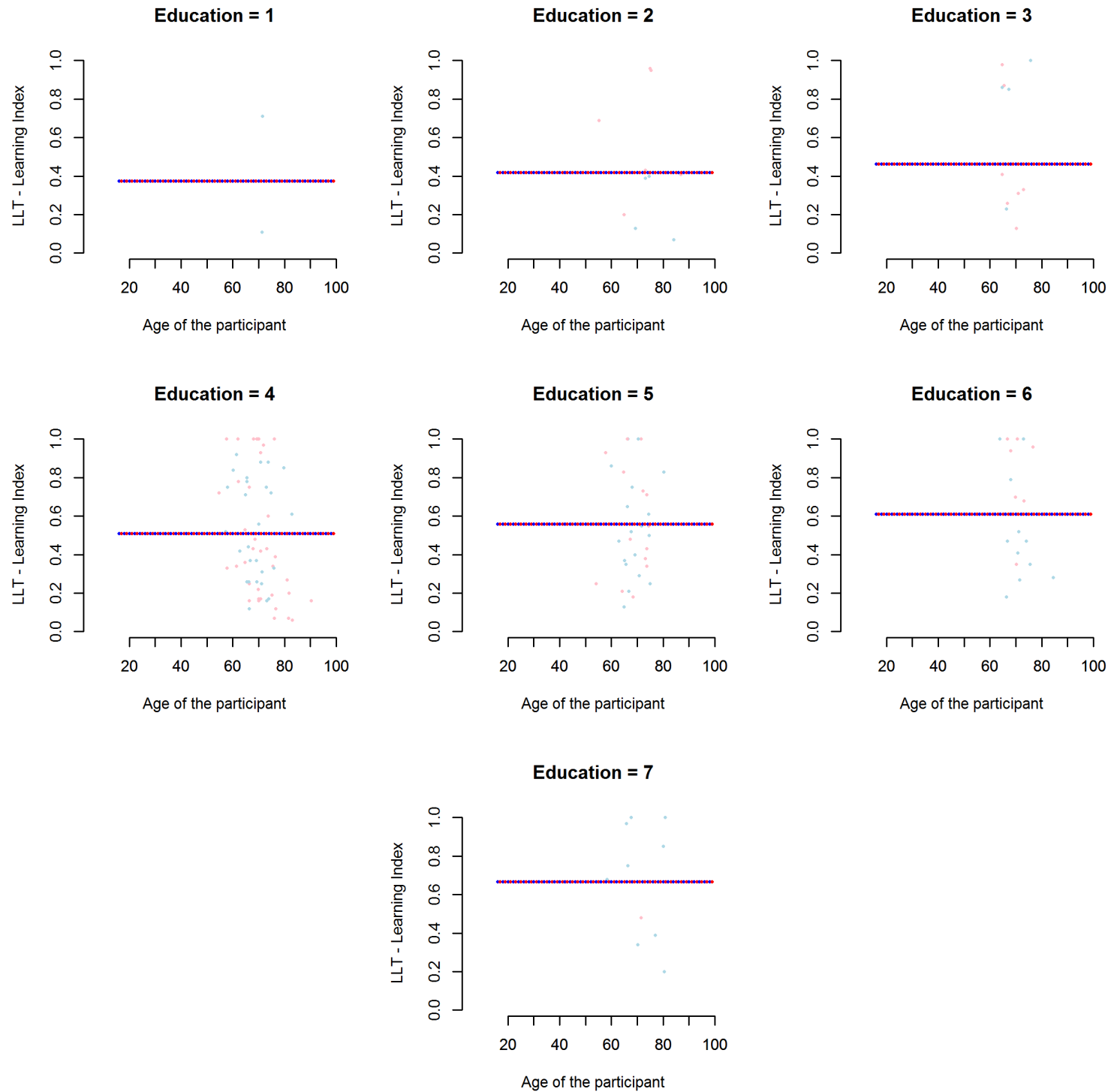
The table gives descriptives after outliers are removed on all LLT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

	Male					Female				
Variable name	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
LLT - Total Displacement Score	0	29	83	76	57-84	0	24	79	70	54-87
LLT - Learning Index	0	0	1	76	57-84	0	0	1	73	54-90

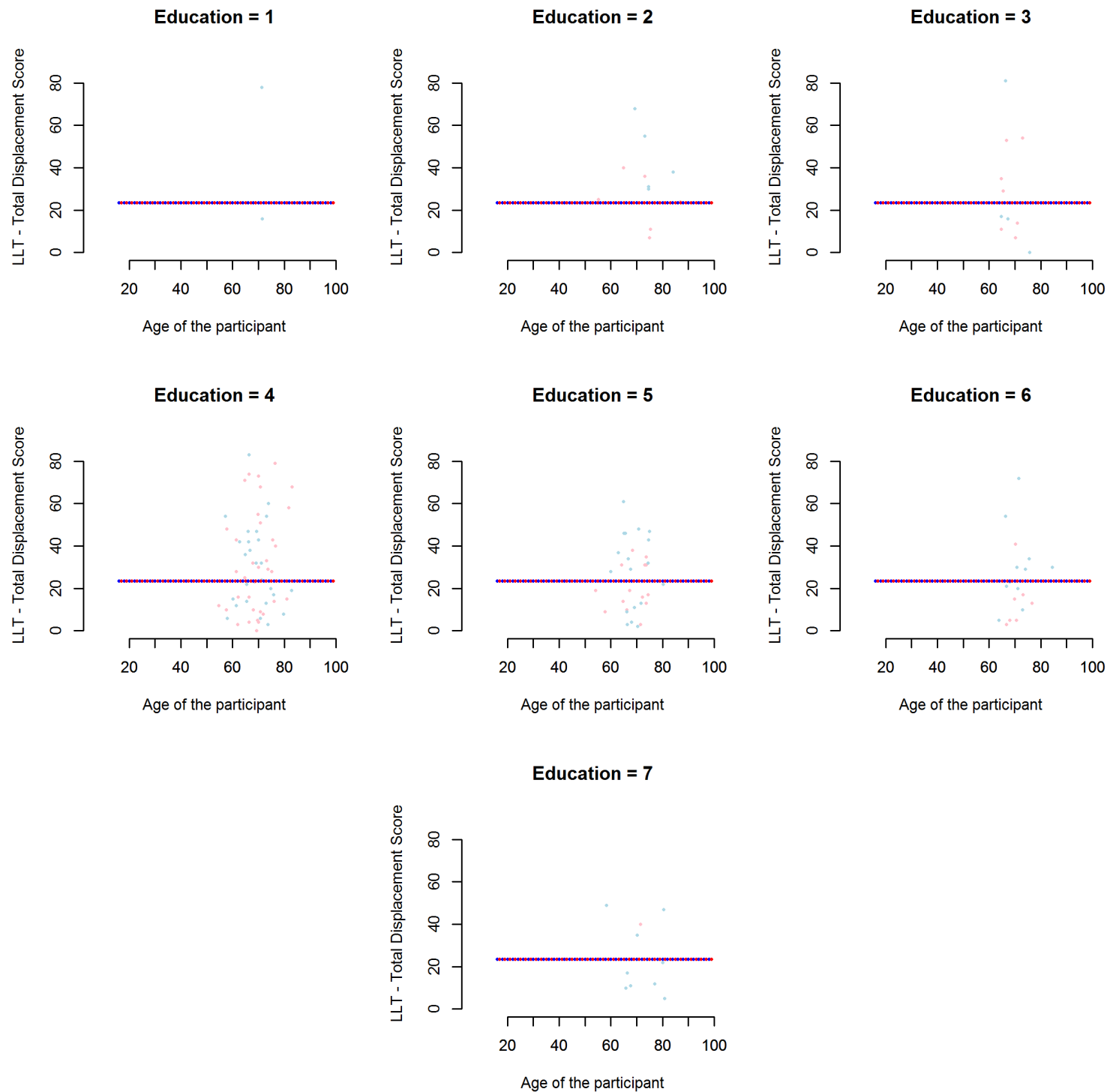
6.16.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. LLT - Learning Index



2. LLT - Total Displacement Score



6.17 Mini- Mental State Examination (MMSE)

6.17.1 Extreme Borders of the MMSE

The table shows extreme minimum and maximum scores on all MMSE variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
MMSE Total	22	30	0.022 %

6.17.2 BIC Selection for MMSE

The table shows the selection of the effects of demographic variables for the MMSE.

Variable	Demographic Effects	BIC
MMSE Total	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	62832.55
	Terms in the final model	
	$s + a + e + s*a + s*e + a*e + s*a*e$	62832.55

age = a, sex = s, education = e.

6.17.3 Best model fit of the MMSE

The table shows the terms of the best models for the MMSE variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
MMSE Total	$s + a + e + a*s + e*s + e*a + e*a*s$	136

age = a, sex = s, education = e.

6.17.4 Box-Cox power transformation of the MMSE

The table shows the best Box-Cox power transformation for the MMSE variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
MMSE Total	6.94	-0.079	2.283

6.17.5 Descriptive statistics for the MMSE

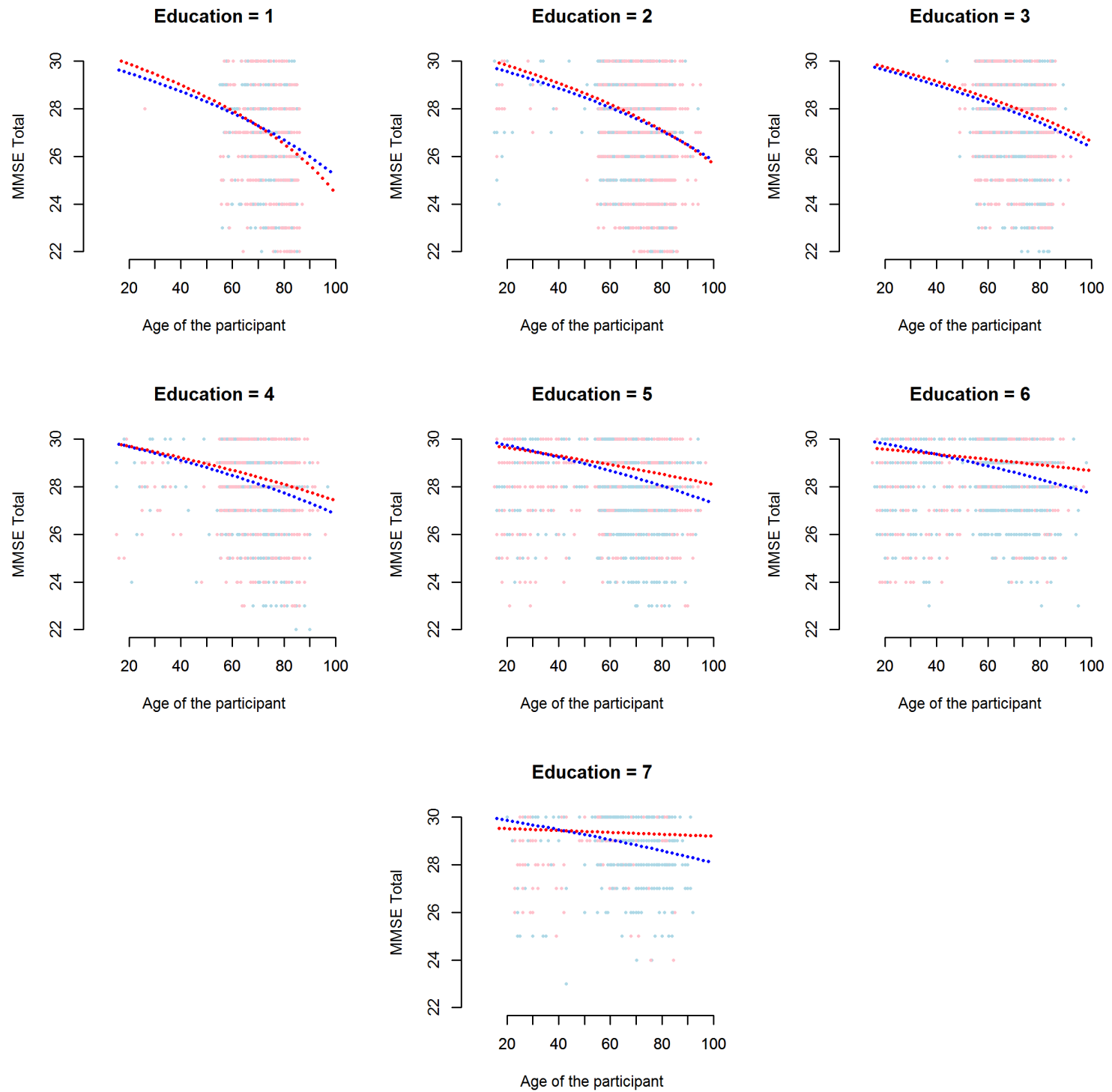
The table gives descriptives after outliers are removed on all MMSE variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
MMSE Total	22	28	30	7262	15-98	22	28	30	8868	15-97

6.17.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. MMSE - Total



6.18 Paced Auditory Serial Addition Test

6.18.1 Extreme Borders of the PASAT

The table shows extreme minimum and maximum scores on all PASAT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
PASAT 1.6	10	60	0.019 %
PASAT 2.0	15	60	0.014 %
PASAT 2.4	20	60	0.579 %
PASAT 2.8	30	60	0.019 %
PASAT 3.2	40	60	0.053 %

6.18.2 BIC Selection for PASAT

The table shows the selection of the effects of demographic variables for the PASAT.

Variable	Demographic Effects	BIC
PASAT 1.6	Initially included terms	
	s + e	760.79
	Dropped terms	
	s	758.11
	Terms in the final model	
PASAT 2.0	e	758.11
	Initially included terms	
	s + e	1040.4
	Dropped terms	
	s	1036.05
PASAT 2.4	Terms in the final model	
	e	1036.05
	Initially included terms	
	s + e	1141.68
	Dropped terms	
PASAT 2.8	s	1138.72
	Terms in the final model	
	e	1138.72
	Initially included terms	
	s	375.12
PASAT 3.2	Dropped terms	
	s	371.18
	Terms in the final model	
	None	371.18
	Initially included terms	
PASAT 3.2	None	69.08
	Terms in the final model	
	None	69.08

age = a, sex = s, education = e.

6.18.3 Best model fit of the PASAT

The table shows the terms of the best models for the PASAT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
PASAT 1.6	e	0
PASAT 2.0	e	0
PASAT 2.4	e	0
PASAT 2.8		0
PASAT 3.2		3

age = a, sex = s, education = e.

6.18.4 Box-Cox power transformation of the PASAT

The table shows the best Box-Cox power transformation for the PASAT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
PASAT 1.6	0.83	-0.248	2.794
PASAT 2.0	1.07	-0.038	2.484
PASAT 2.4	2.06	-0.103	1.886
PASAT 2.8	2.71	-0.166	1.846
PASAT 3.2	11.302	-0.177	2.493

6.18.5 Descriptive statistics for the PASAT

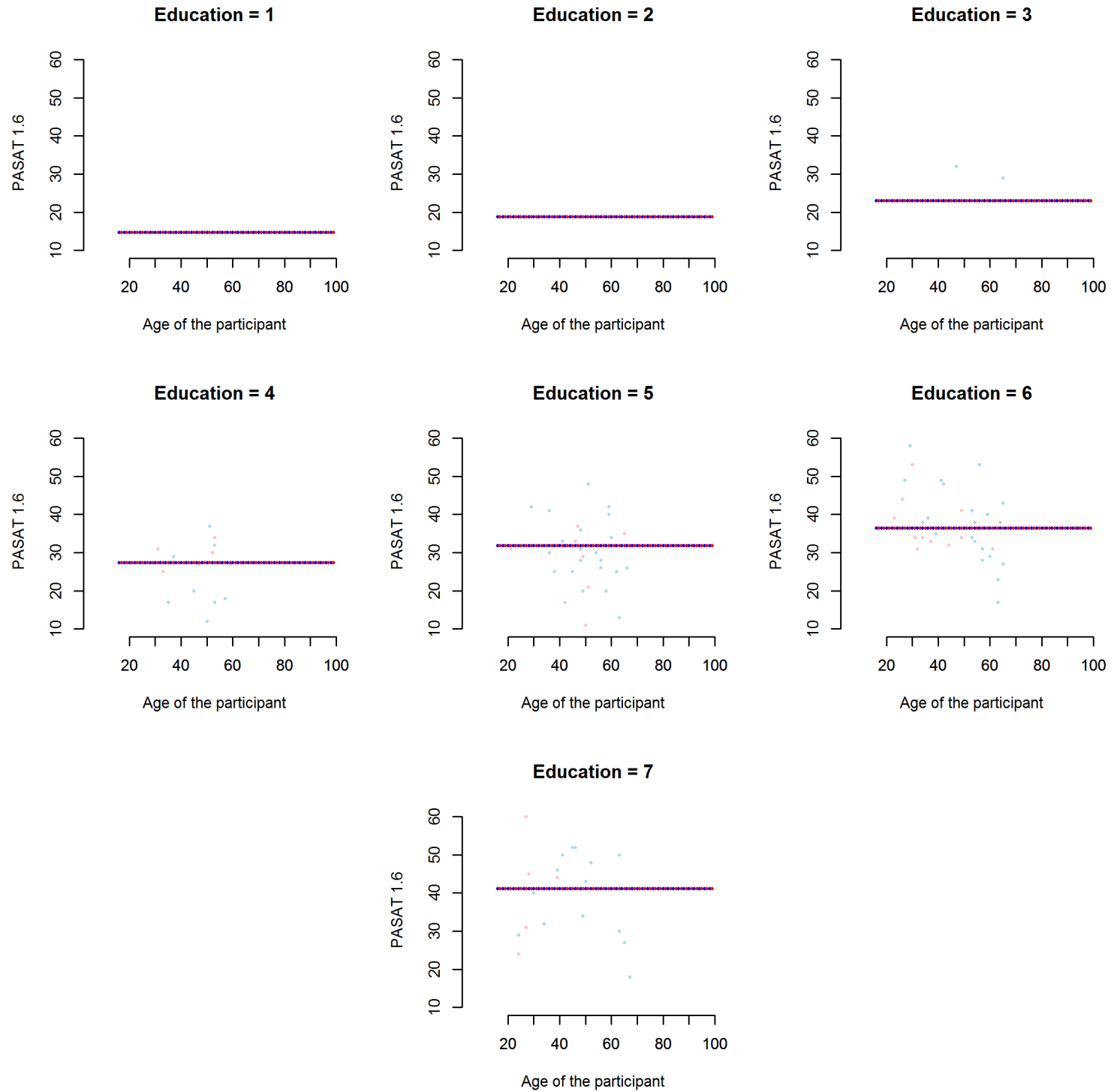
The table gives descriptives after outliers are removed on all PASAT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
PASAT 1.6	12	33	58	71	24-67	11	33	60	31	21-65
PASAT 2.0	16	40	60	93	22-67	17	40	60	43	18-65
PASAT 2.4	22	48	60	82	18-65	21	46	60	72	18-59
PASAT 2.8	32	51	60	26	22-64	33	50	59	26	18-59
PASAT 3.2	57	58	60	5	29-46	50	56	59	10	21-53

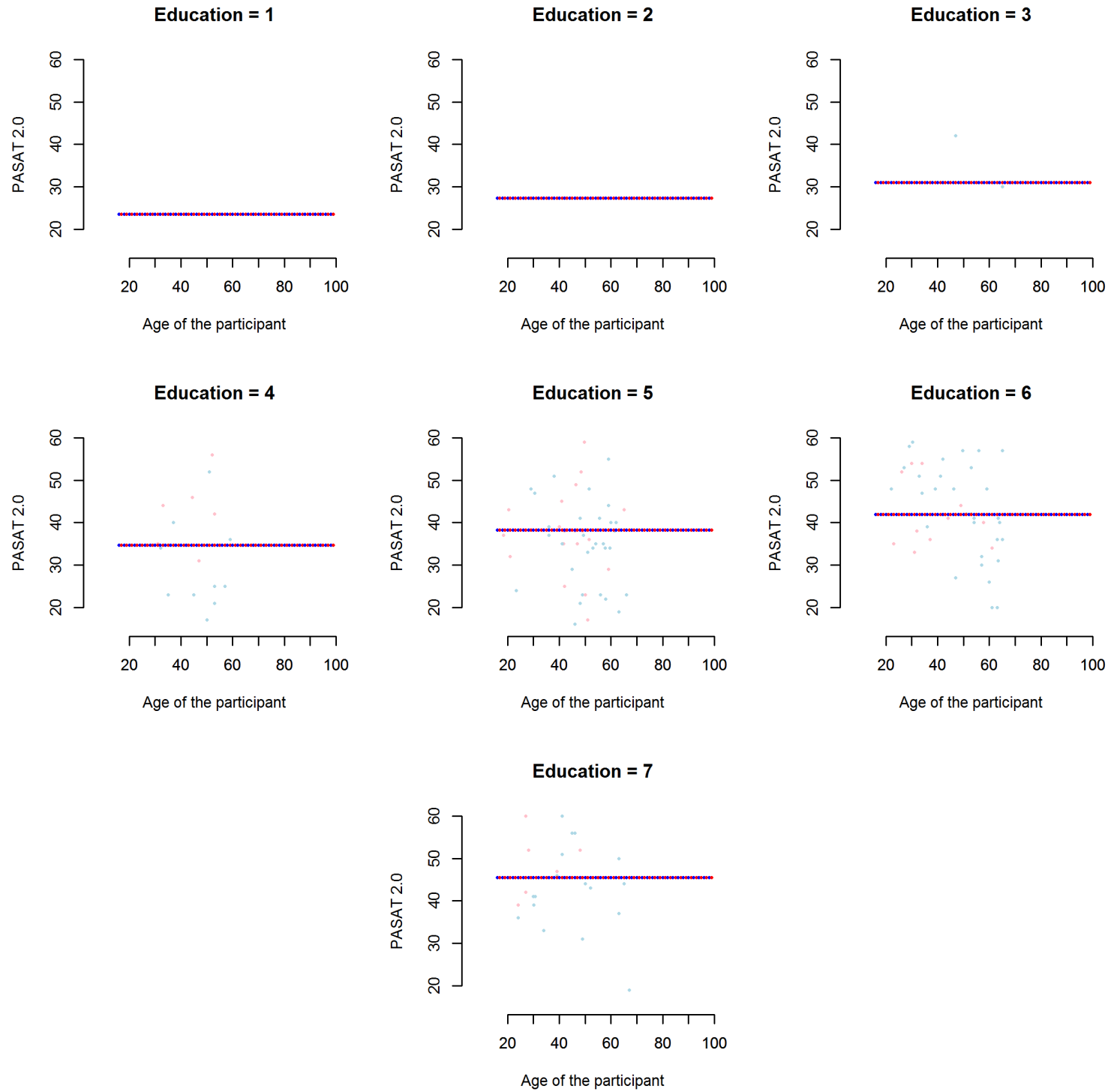
6.18.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

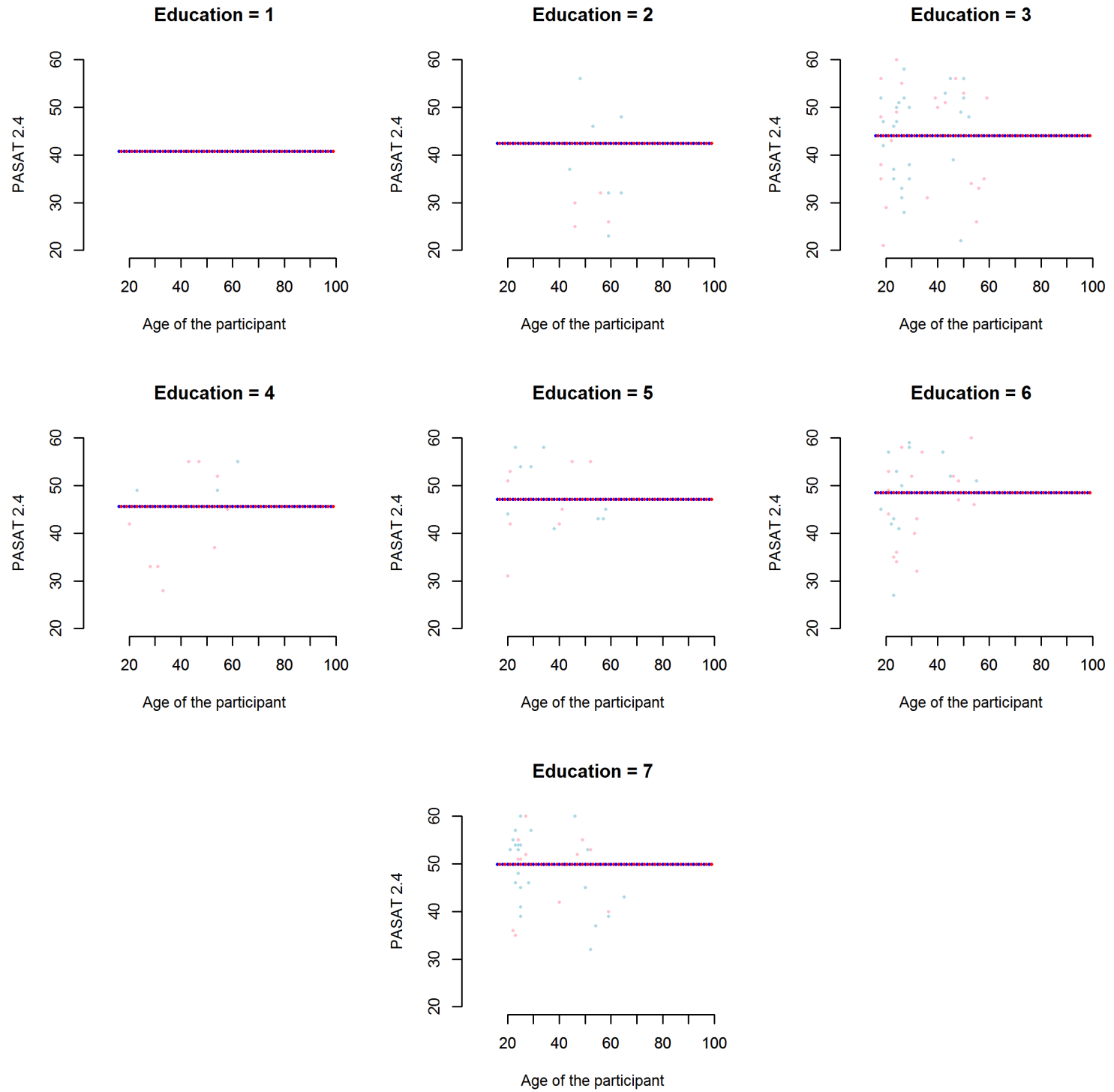
1. PASAT - 1.6



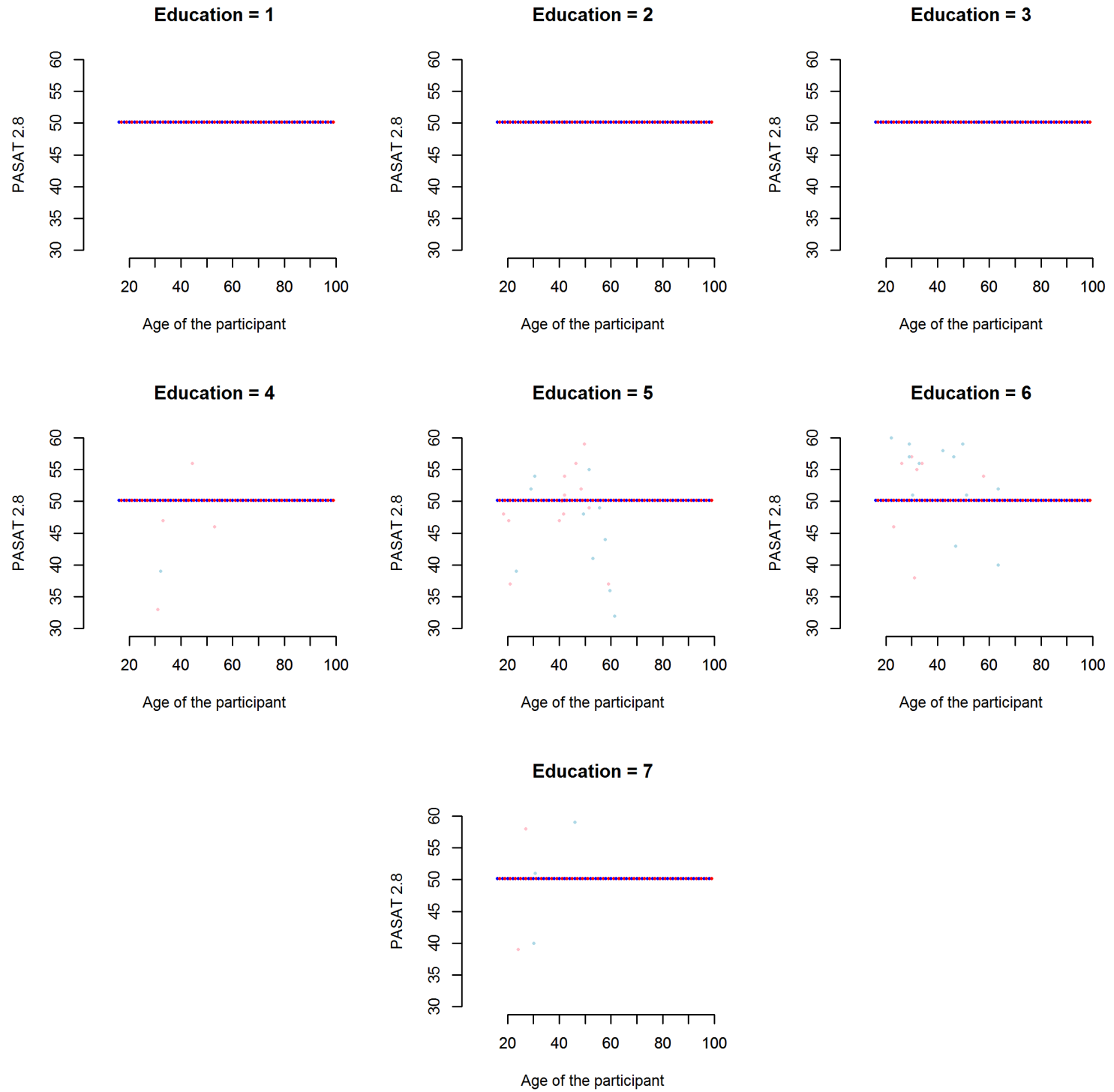
2. PASAT - 2.0



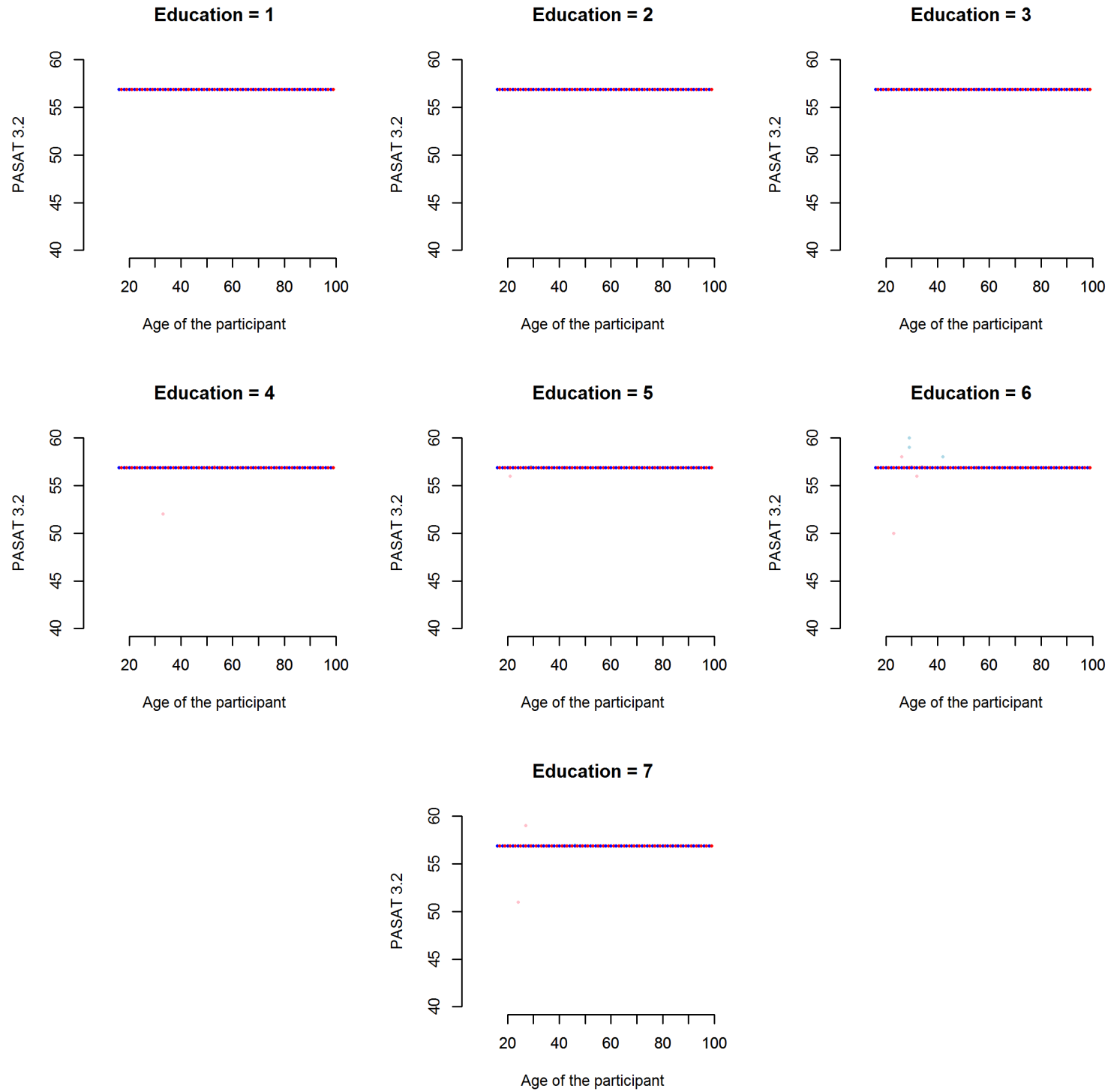
3. PASAT - 2.4



4. PASAT - 2.8



5. PASAT - 3.2



6.19 RAND 36-Item Health Survey (RAND)

Variable name	Min extreme border	Max extreme border	Percentage removed
RAND 36 physical functioning	0	100	0 %
RAND 36 social functioning	13	100	0 %
RAND 36 mental health	45	100	0 %
RAND 36 vitality	21	100	0 %
RAND 36 pain	15	100	0 %
RAND overall health	19	100	0.023 %

6.19.1 BIC Selection for RAND

The table shows the selection of the effects of demographic variables for the RAND.

Variable	Demographic Effects	BIC
RAND 36 physical functioning	Initially included terms	
	s	255.49
	Dropped terms	
	s	251.84
RAND 36 social functioning	Terms in the final model	
	None	251.84
	Initially included terms	
	s	253.93
RAND 36 mental health	Dropped terms	
	s	251.18
	Terms in the final model	
	None	251.18
RAND 36 vitality	Initially included terms	
	s	219.64
	Dropped terms	
	s	215.87
RAND 36 pain	Terms in the final model	
	None	215.87
	Initially included terms	
	s	226.43
RAND overall health	Dropped terms	
	s	222.71
	Terms in the final model	
	None	222.71
	Initially included terms	
	s	284.77
	Dropped terms	
	s	281.09
	Terms in the final model	
	None	281.09
	Initially included terms	
	s	250.42
	Dropped terms	
	s	246.96
	Terms in the final model	
	None	246.96

age = a, sex = s, education = e.

6.19.2 Best model fit of the RAND

The table shows the terms of the best models for the RAND variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
RAND 36 physical functioning		3
RAND 36 social functioning		0
RAND 36 mental health		0
RAND 36 vitality		0
RAND 36 pain		2
RAND overall health		0

age = a, sex = s, education = e.

6.19.3 Box-Cox power transformation of the RAND

The table shows the best Box-Cox power transformation for the RAND variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
RAND 36 physical functioning	6.797	-0.332	1.73
RAND 36 social functioning	3.077	-0.374	1.724
RAND 36 mental health	0.251	-0.009	2.218
RAND 36 vitality	1.393	0.075	3.886
RAND 36 pain	2.751	-0.466	1.463
RAND overall health	1.534	-0.071	2.634

6.19.4 Descriptive statistics for the RAND

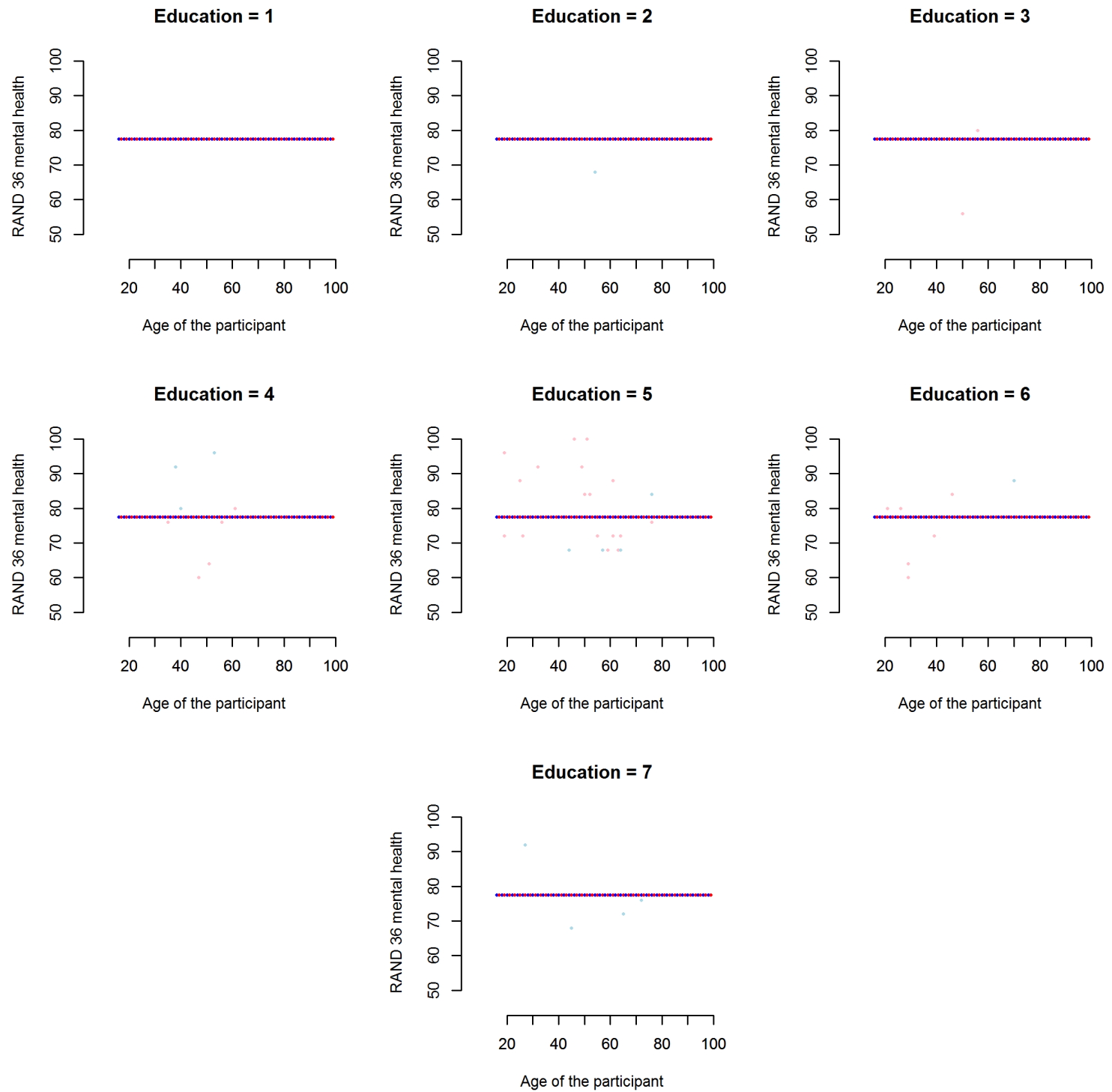
The table gives descriptives after outliers are removed on all RAND variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
RAND 36 physical functioning	80	95	100	12	27-76	70	95	100	29	19-76
RAND 36 social functioning	62	88	100	13	27-76	25	88	100	31	19-76
RAND 36 mental health	68	76	96	13	27-76	56	76	100	31	19-76
RAND 36 vitality	30	70	85	13	27-76	50	65	100	31	19-76
RAND 36 pain	57	100	100	12	27-76	39	90	100	30	19-76
RAND overall health	50	70	95	13	27-76	25	70	100	30	19-76

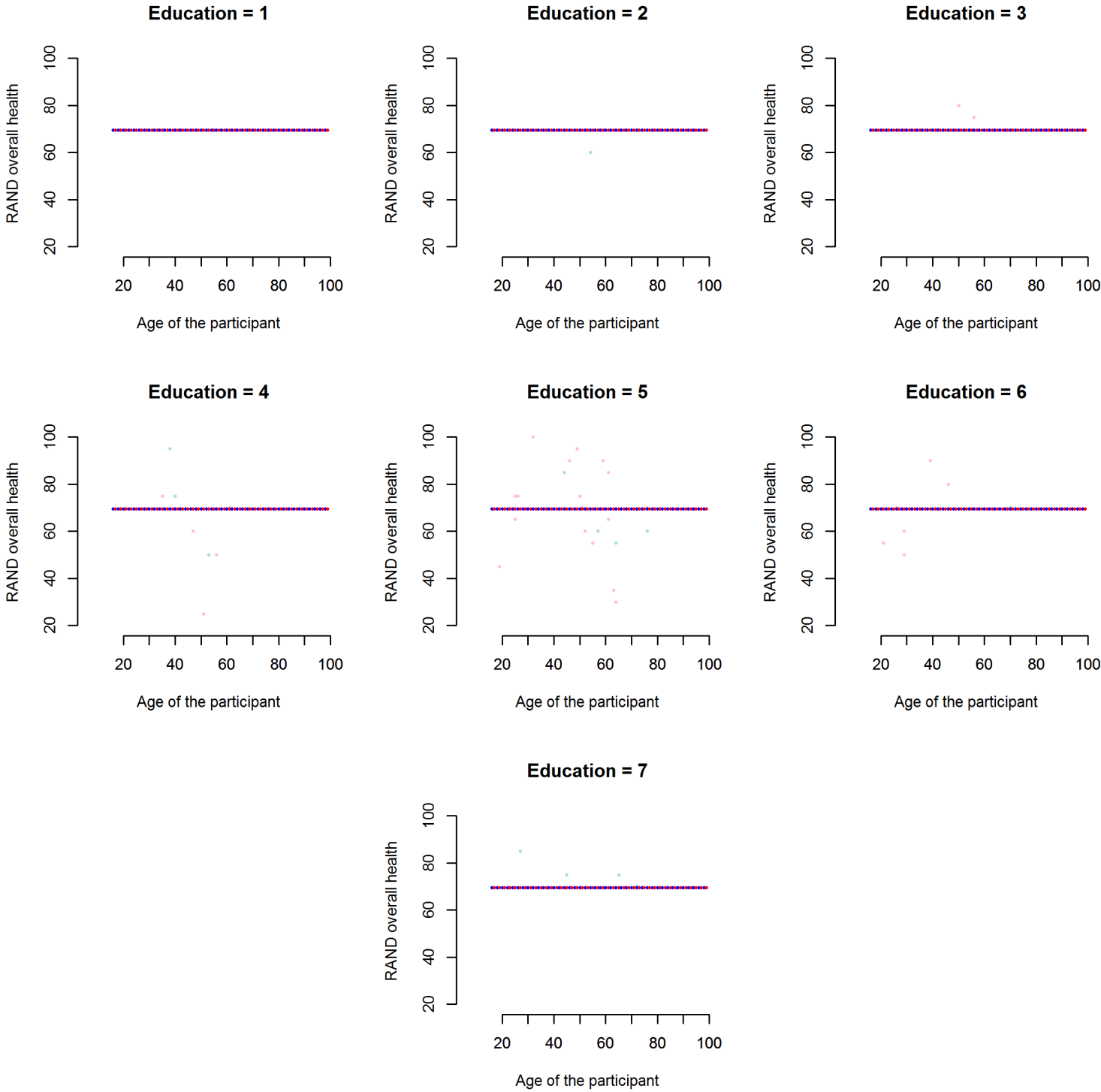
6.19.5 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

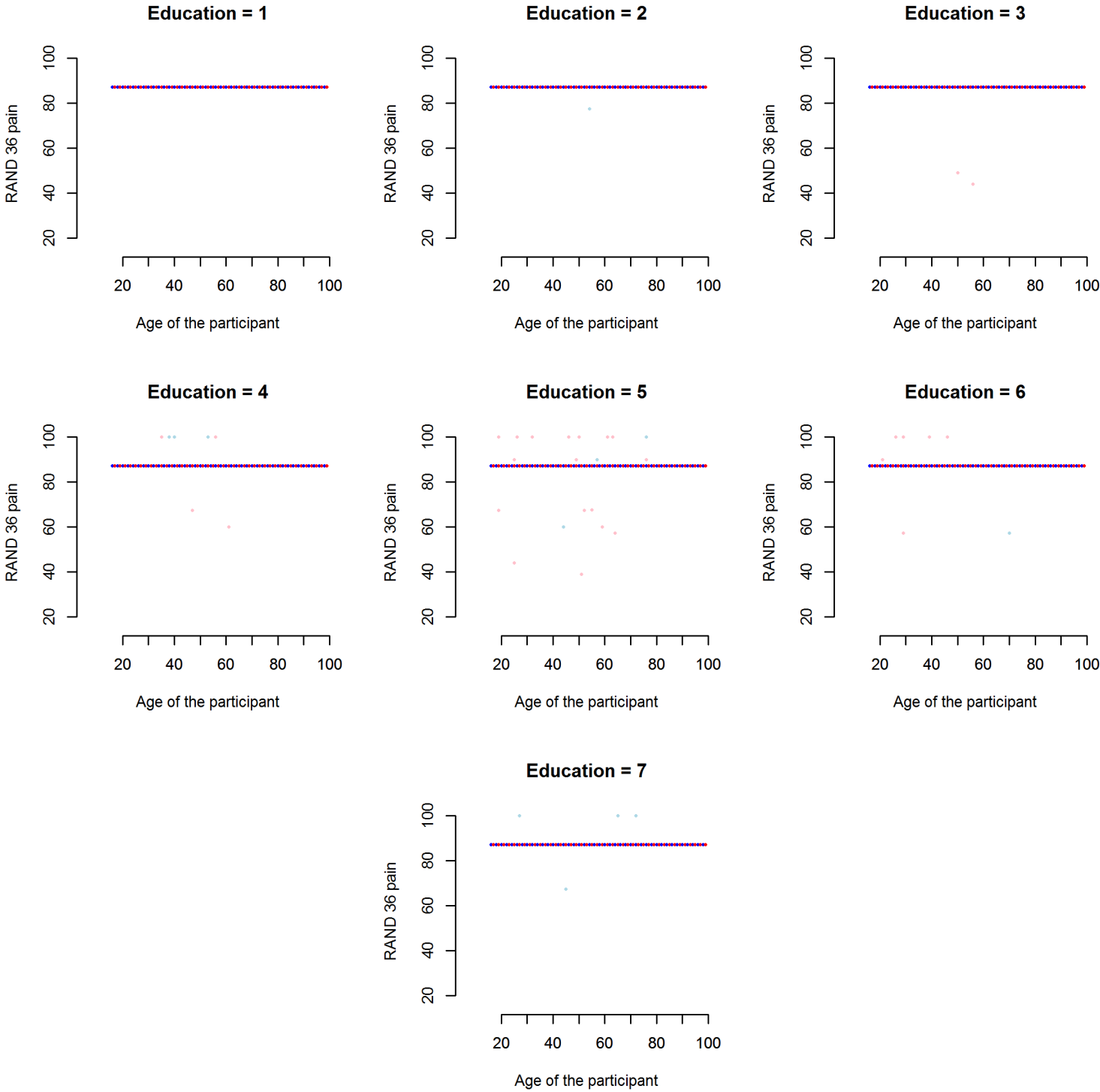
1. RAND-36 - Mental health



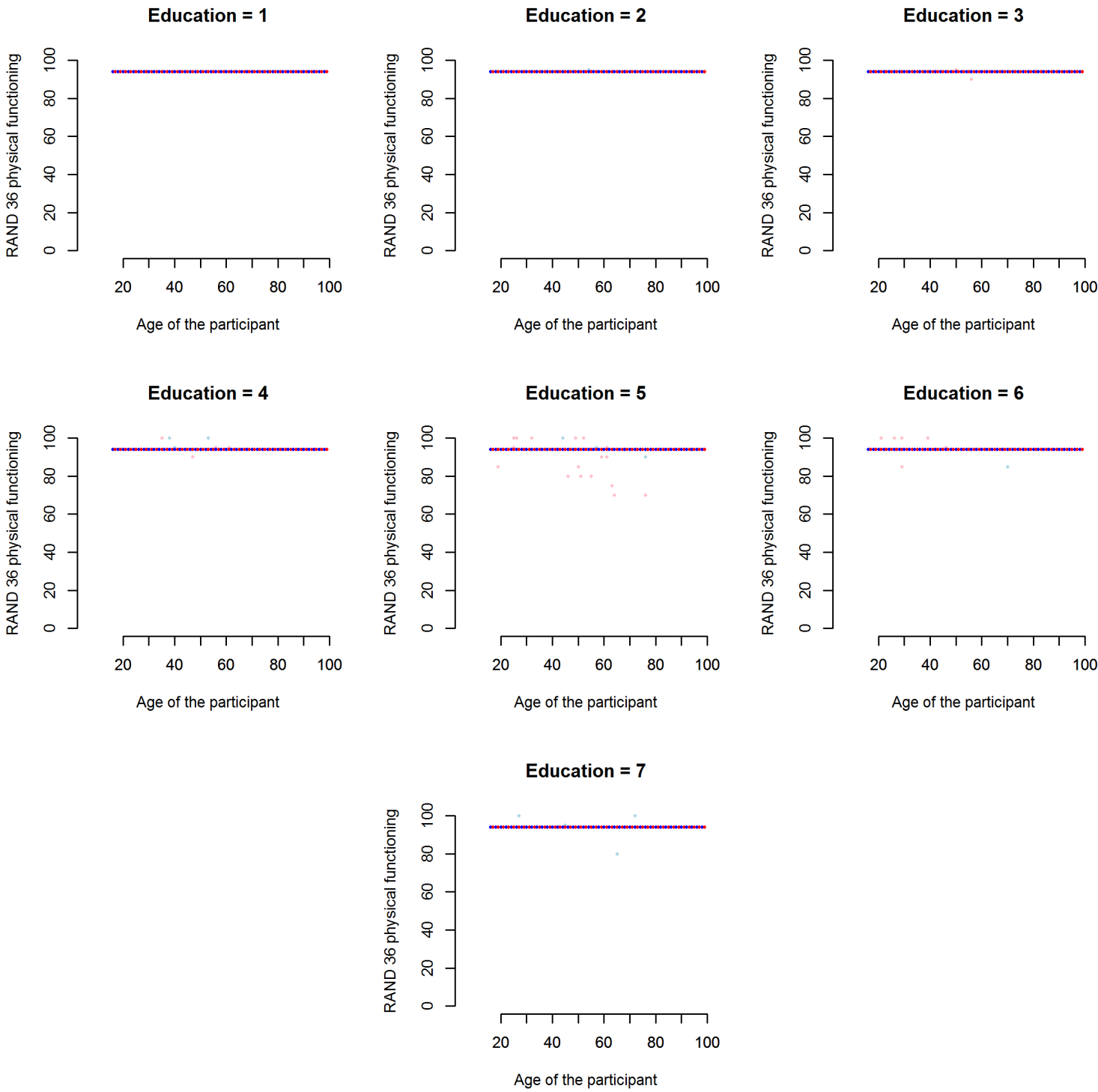
2. RAND-36 - Overall health



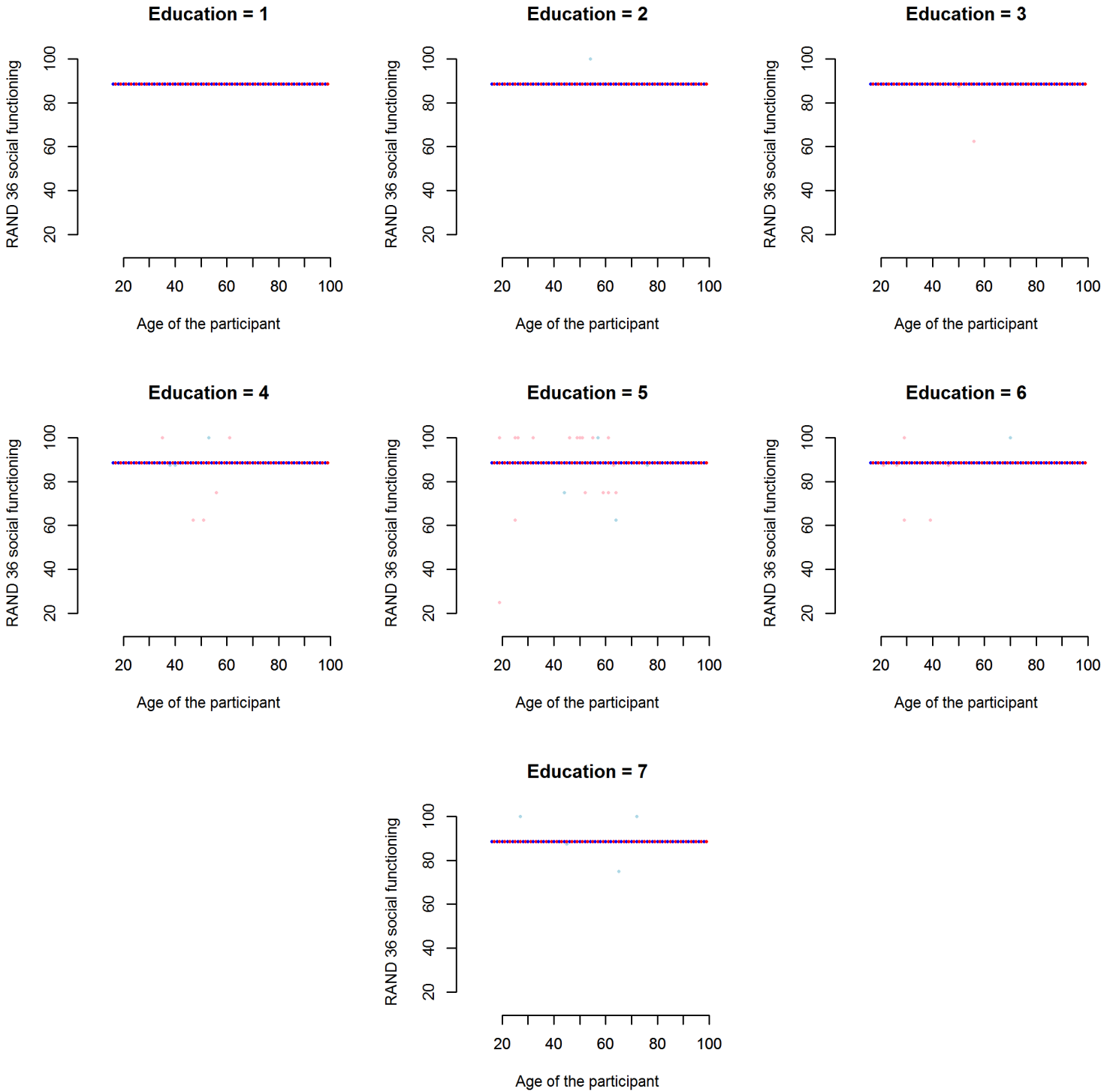
3. RAND-36 - Pain



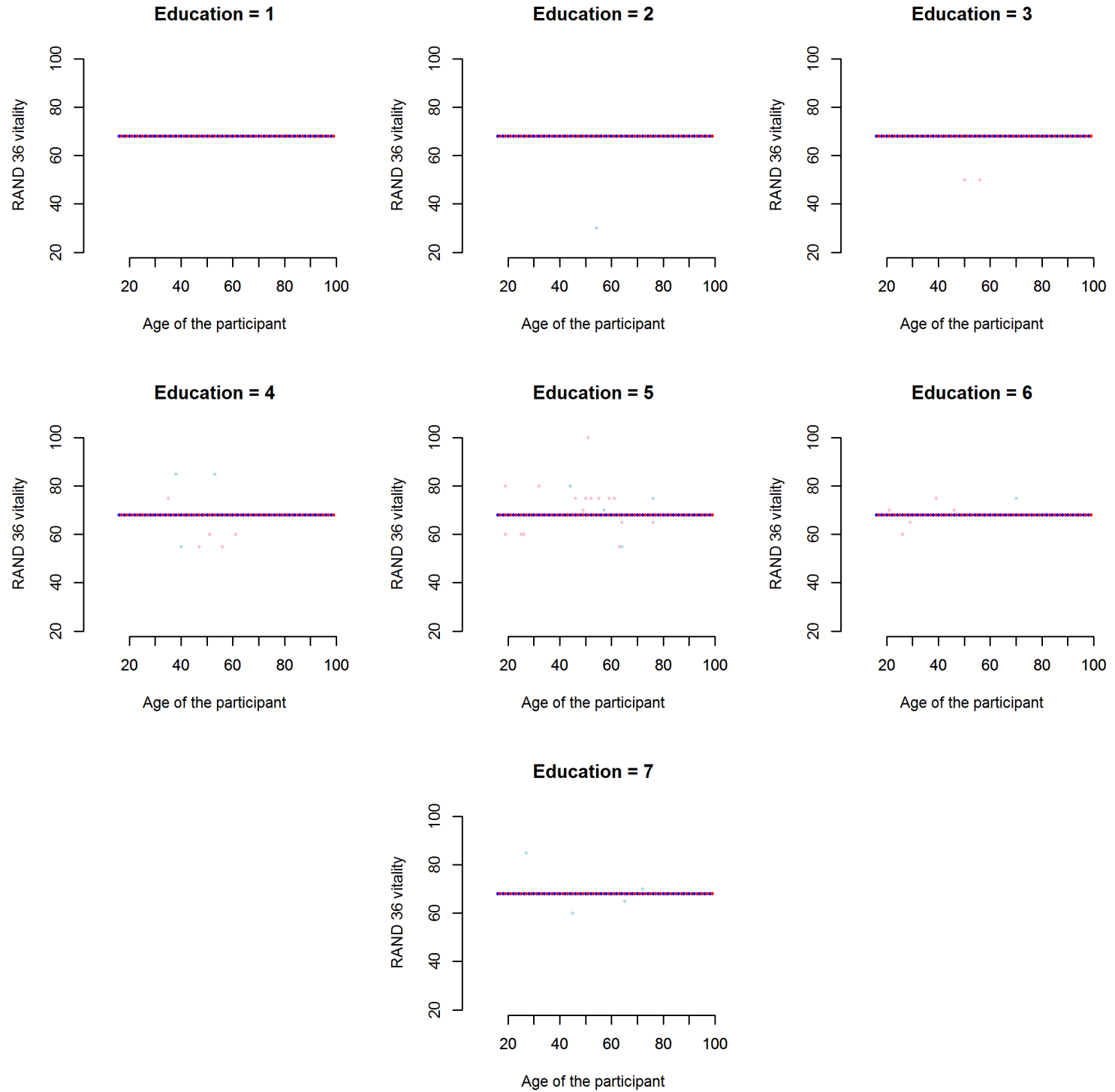
4. RAND-36 - Physical functioning



5. RAND-36 - Social functioning



6. RAND-36 - Vitality



6.20 Raven Progressive Matrices (RAVEN)

6.20.1 Extreme Borders of the Raven

The table shows extreme minimum and maximum scores on all Raven variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
RCPM total serie a and b	8	24	0.016 %
RSPM total series b c and d	25	60	0 %
RAPM 12 item short form	3	12	0.006 %

6.20.2 BIC Selection for Raven

The table shows the selection of the effects of demographic variables for the Raven.

Variable	Demographic Effects	BIC
RCPM total serie a and b	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	21058.11
	Dropped terms	
	$s*a*e$	21049.82
	$s*e$	21041.65
	$a*e$	21033.97
	$s*a$	21029.66
	s	21022.41
	Terms in the final model	
	$a + e$	21022.41
RSPM total series b c and d	Initially included terms	
	s	172.3
	Dropped terms	
	s	169.13
	Terms in the final model	
RAPM 12 item short form	None	169.13
	Initially included terms	
	$s + a$	10820.29
	Dropped terms	
	a	10813.82
	Terms in the final model	
	s	10813.82

age = a, sex = s, education = e.

6.20.3 Best model fit of the Raven

The table shows the terms of the best models for the Raven variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
RCPM total serie a and b	$a + e$	1
RSPM total series b c and d		2
RAPM 12 item short form	s	116

age = a, sex = s, education = e.

6.20.4 Box-Cox power transformation of the Raven

The table shows the best Box-Cox power transformation for the Raven variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
RCPM total serie a and b	1.95	-0.082	2.591
RSPM total series b c and d	-0.275	-0.003	3.44
RAPM 12 item short form	7.03	-0.505	1.799

6.20.5 Descriptive statistics for the Raven

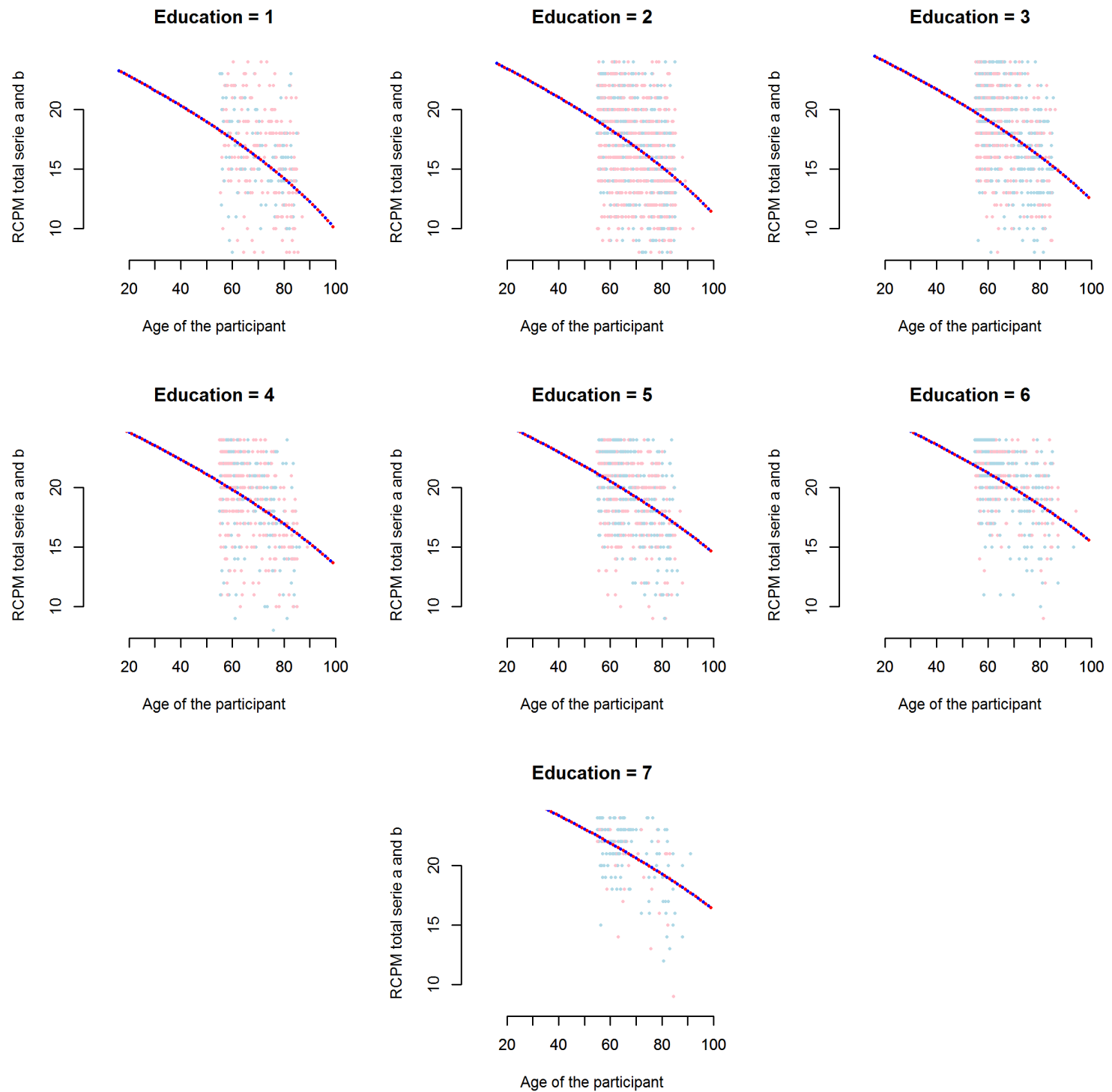
The table gives descriptives after outliers are removed on all Raven variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
RCPM total serie a and b	8	19	24	1914	55-93	8	18	24	2106	55-94
RSPM total series b c and d	42	50	59	16	20-49	38	47	58	27	20-58
RAPM 12 item short form	4	12	12	815	17-77	4	12	12	1993	-8-74

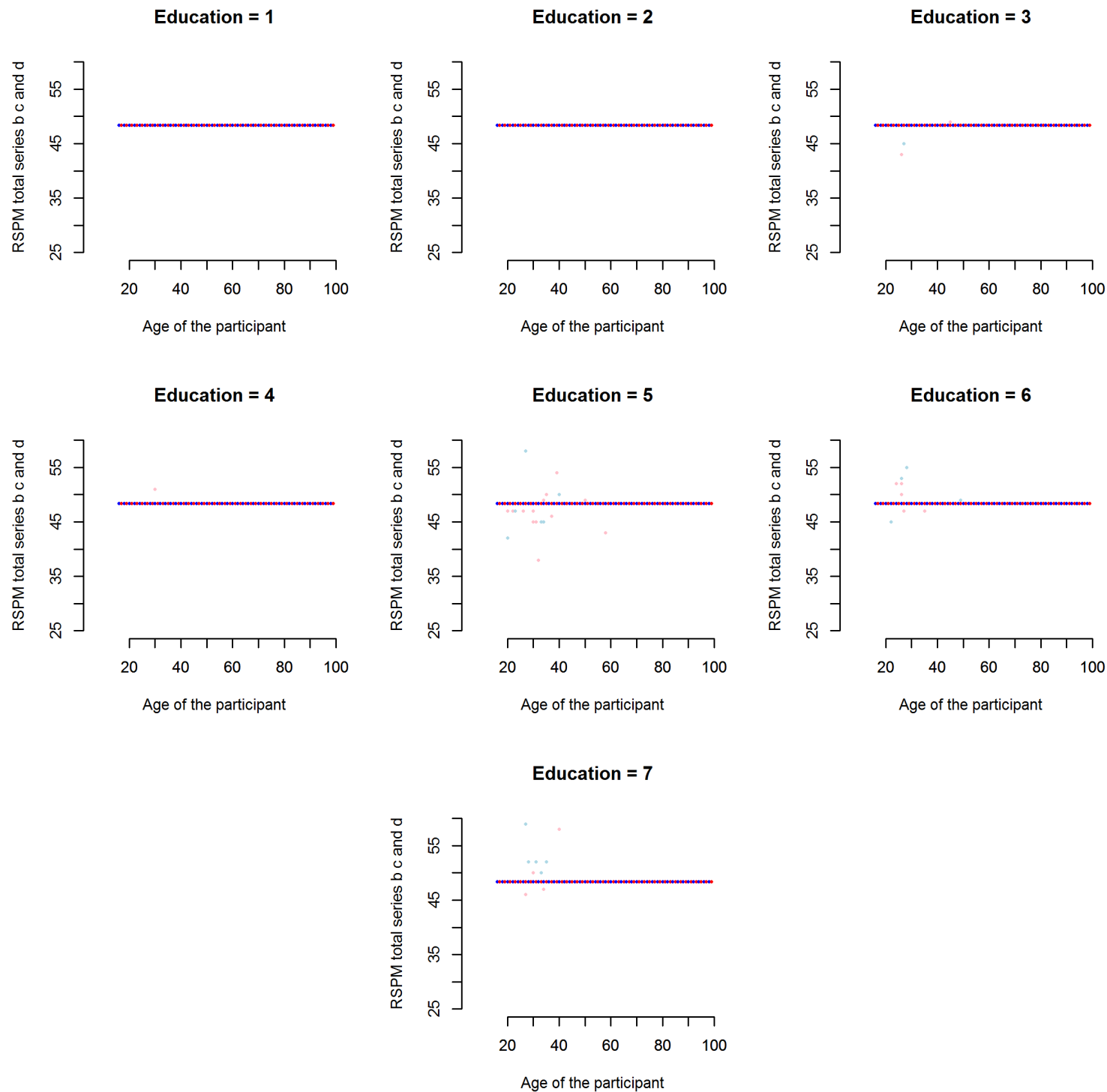
6.20.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

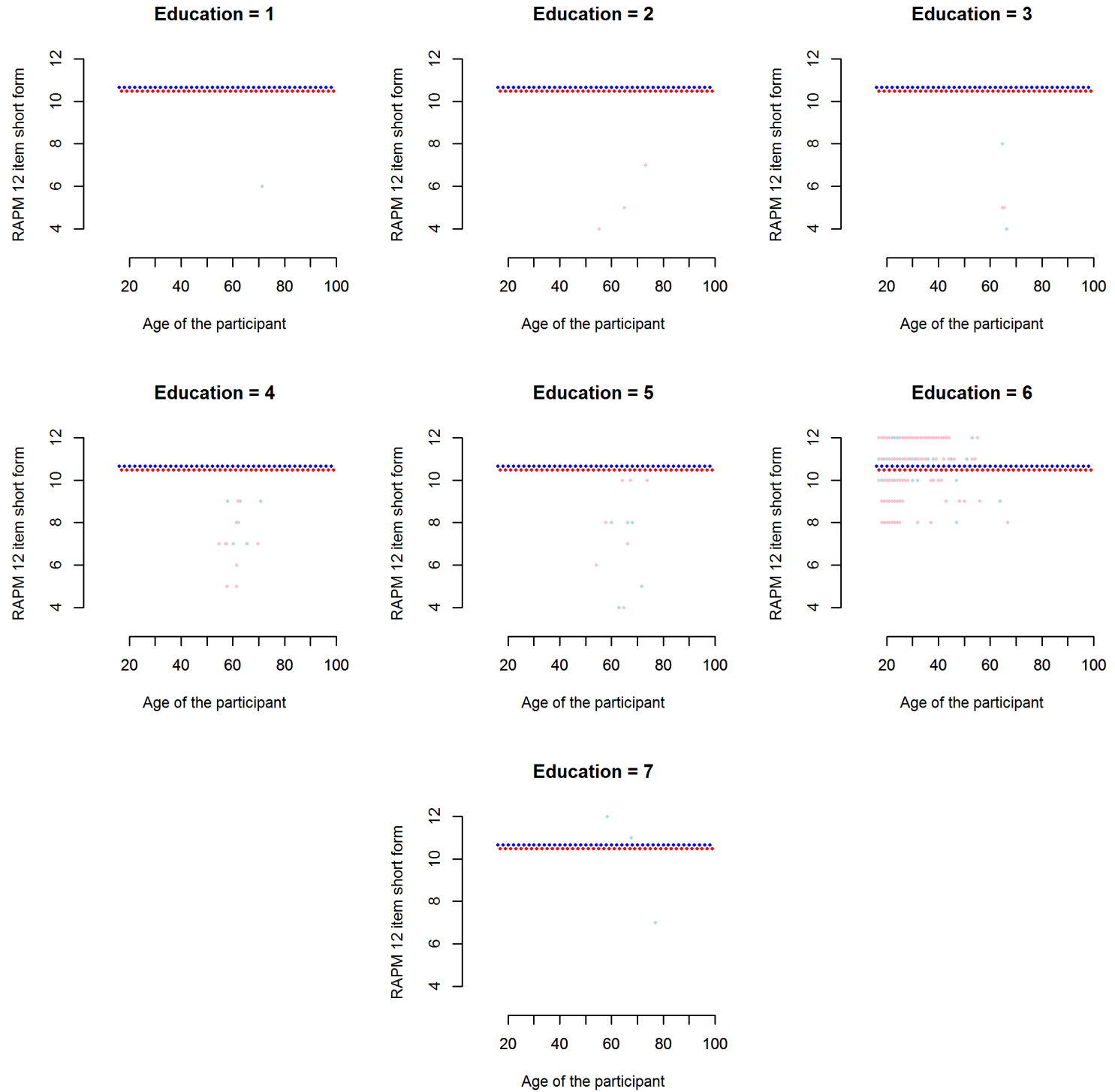
1. Raven Colored Progressive Matrices total serie a and b



2. Raven Standard Progressive Matrices total series b, c and d



3. Raven Advanced Progressive Matrices - 12 item short form



6.21 Rivermead Behavioural Memory Test

6.21.1 Extreme Borders of the RBMT

The table shows extreme minimum and maximum scores on all RBMT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Story 1 immediate recall	5	42	0.057 %
Story 1 delayed recall	2	42	0.053 %
Story 2 immediate recall	5	42	0.055 %
Story 2 delayed recall	2	42	0.014 %
Story 1 + 2 immediate recall	10	84	0.173 %

6.21.2 BIC Selection for RBMT

The table shows the selection of the effects of demographic variables for the RBMT.

Variable	Demographic Effects	BIC
Story 1 immediate recall	Initially included terms	
	$s + a + e + s*a + s*e$	2293.01
	Dropped terms	
	$s*a$	2287.26
	Terms in the final model	
Story 1 delayed recall	$s + a + e + s*e$	2287.26
	Initially included terms	
	$s + a + e + s*a + s*e$	1994.95
	Dropped terms	
	$s*a$	1992.63
Story 2 immediate recall	$s*e$	1991.45
	s	1987.31
	Terms in the final model	
	$a + e$	1987.31
	Initially included terms	
Story 2 delayed recall	$s + a + e + s*a + s*e$	1723.35
	Dropped terms	
	$s*a$	1717.62
	$s*e$	1715.1
	s	1711.42
Story 1 + 2 immediate recall	Terms in the final model	
	$a + e$	1711.42
	Initially included terms	
	$s + a + e + s*a + s*e$	1839.69
	Dropped terms	
	$s*a$	1833.84
	$s*e$	1831.38
	s	1827.67
	Terms in the final model	
	$a + e$	1827.67
	Initially included terms	
	$s + a + e + s*a$	843.32
	Dropped terms	
	$s*a$	839.4
	s	834.61
	a	832.91
	Terms in the final model	
	e	832.91

age = a, sex = s, education = e.

6.21.3 Best model fit of the RBMT

The table shows the terms of the best models for the RBMT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Story 1 immediate recall	$s + a + e + s*e$	0
Story 1 delayed recall	$a + e$	1
Story 2 immediate recall	$a + e$	1
Story 2 delayed recall	$a + e$	2
Story 1 + 2 immediate recall	e	0

age = a, sex = s, education = e.

6.21.4 Box-Cox power transformation of the RBMT

The table shows the best Box-Cox power transformation for the RBMT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Story 1 immediate recall	0.23	-0.021	2.625
Story 1 delayed recall	0.54	0.004	2.789
Story 2 immediate recall	0.35	0.002	2.613
Story 2 delayed recall	0.78	-0.119	3.007
Story 1 + 2 immediate recall	0.16	0.102	3.023

6.21.5 Descriptive statistics for the RBMT

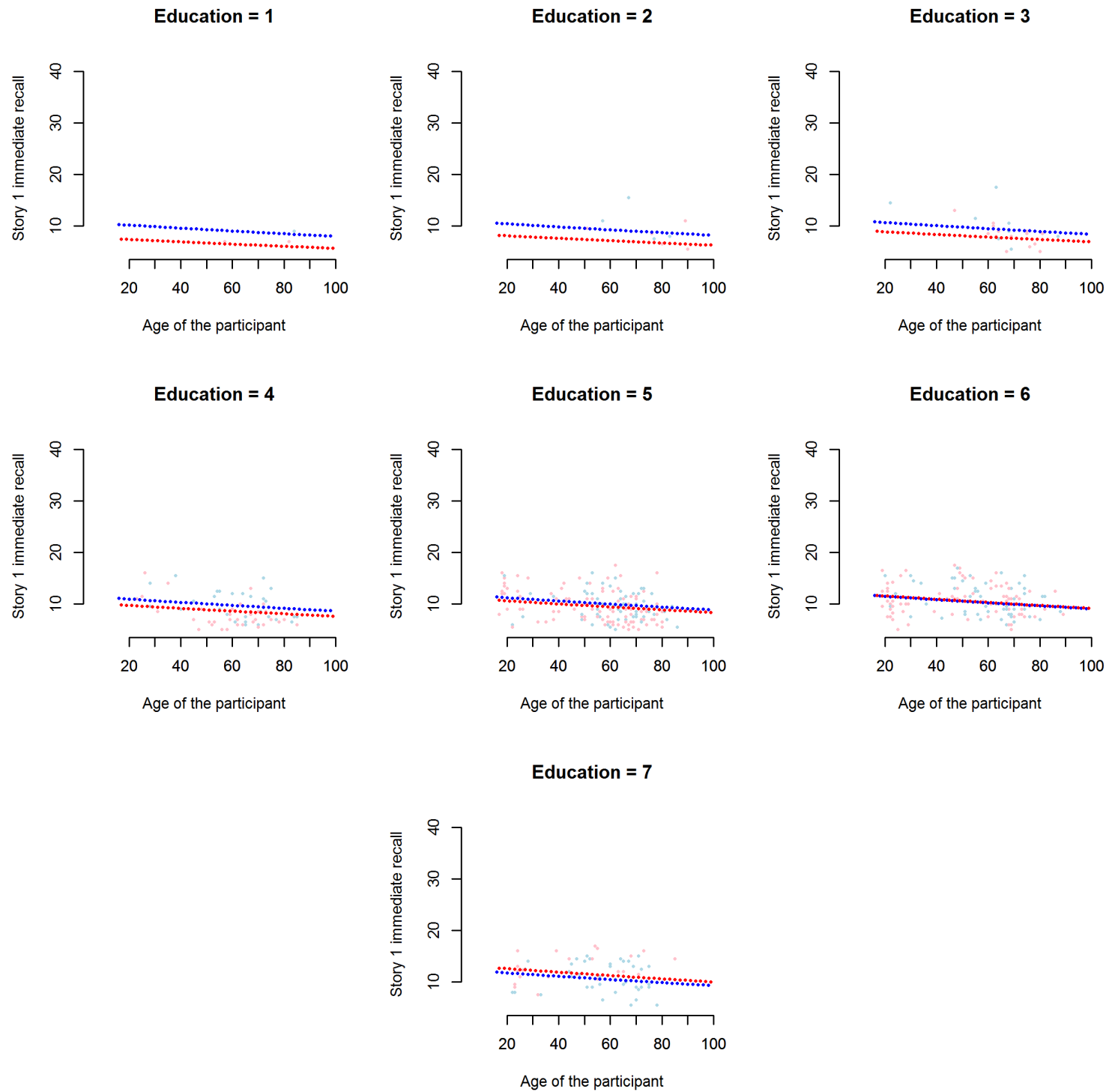
The table gives descriptives after outliers are removed on all RBMT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Story 1 immediate recall	5	10	18	199	19-88	5	10	18	265	17-90
Story 1 delayed recall	2	8	15	174	20-88	2	6	17	222	17-89
Story 2 immediate recall	5	10	18	140	20-88	5	10	19	205	17-90
Story 2 delayed recall	2	9	16	142	20-88	2	8	18	216	17-89
Story 1 + 2 immediate recall	10	22	31	58	23-81	10	18	34	76	19-82

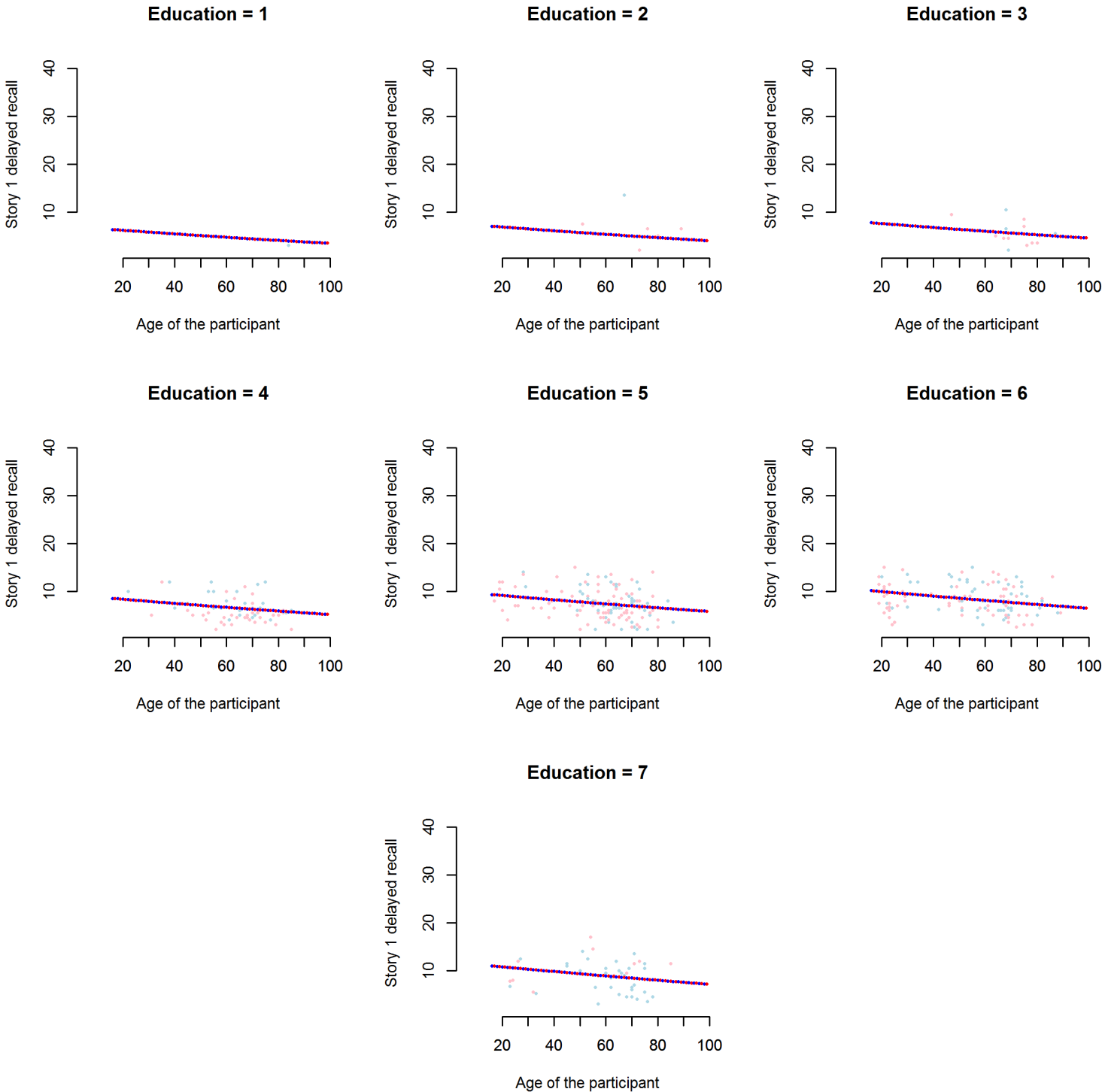
6.21.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

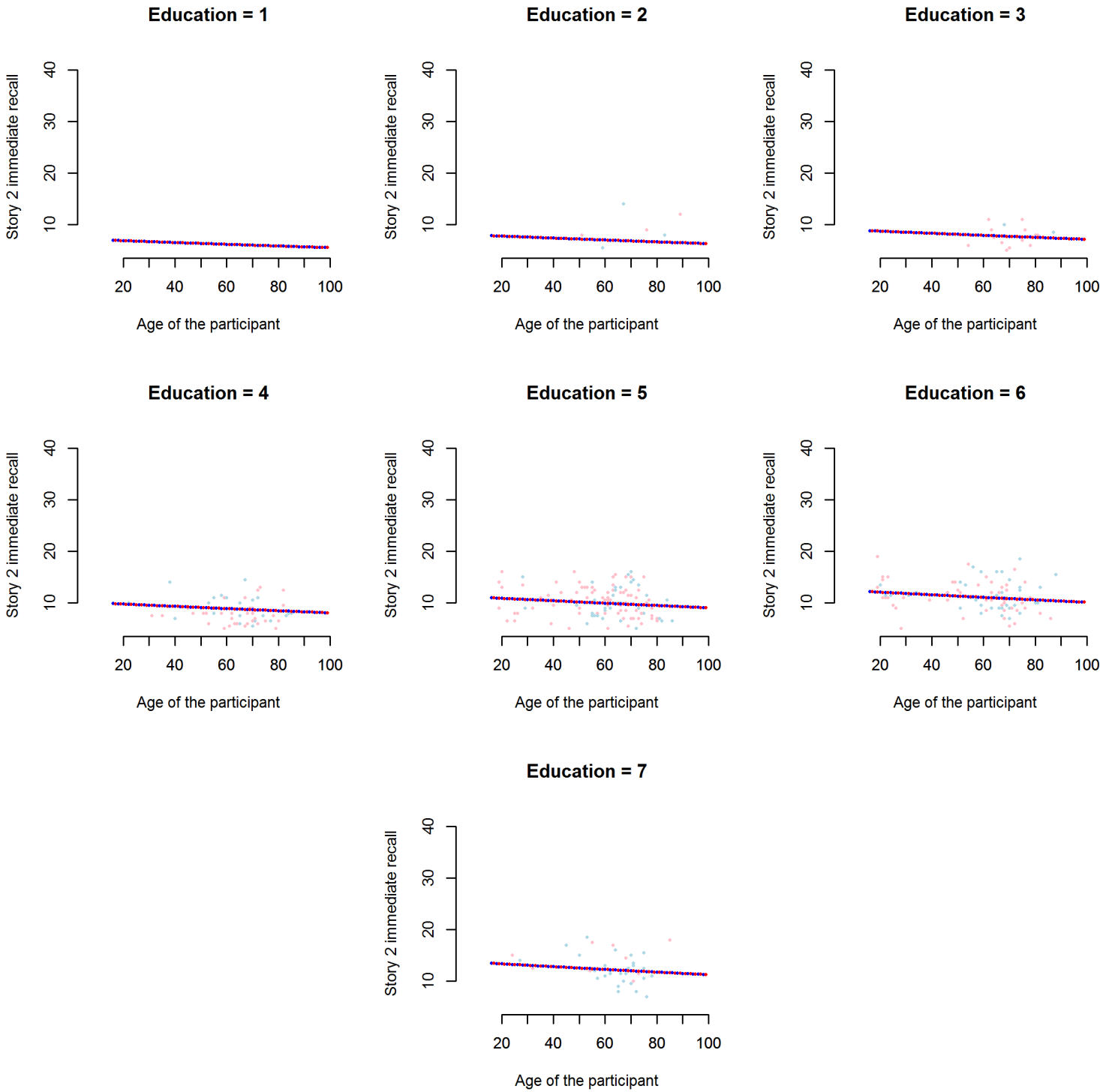
1. RBMT - Prose 1 immediate recall



2. RBMT - Prose 1 delayed recall

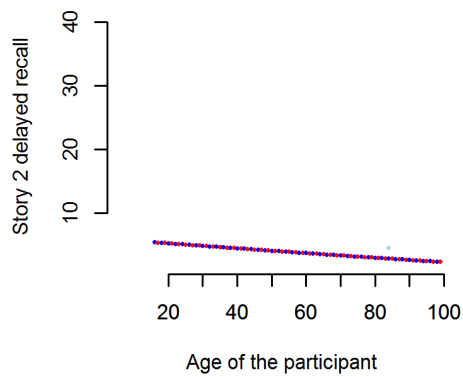


3. RBMT - Prose 2 immediate recall

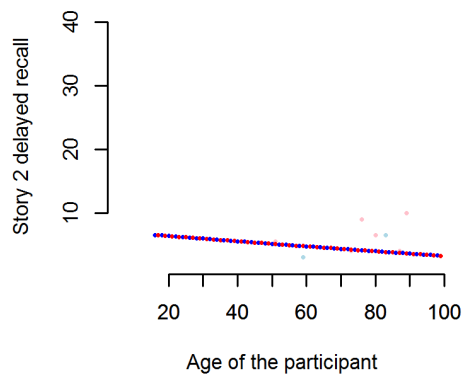


4. RBMT - Prose 2 delayed recall

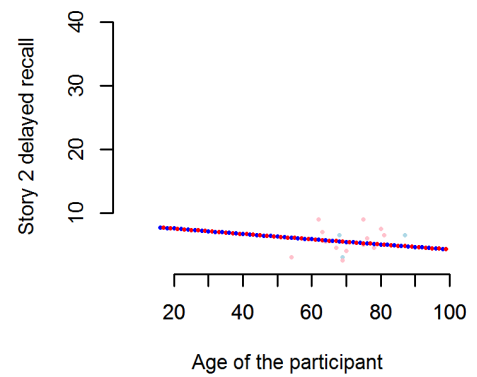
Education = 1



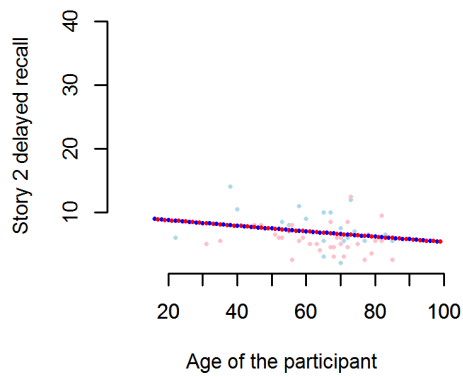
Education = 2



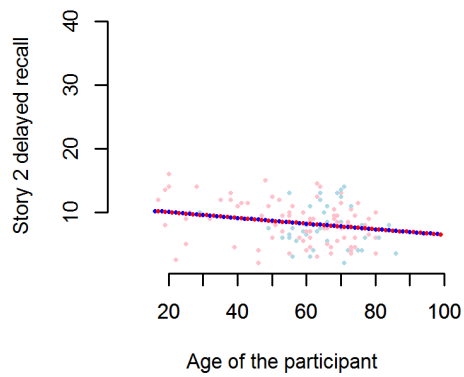
Education = 3



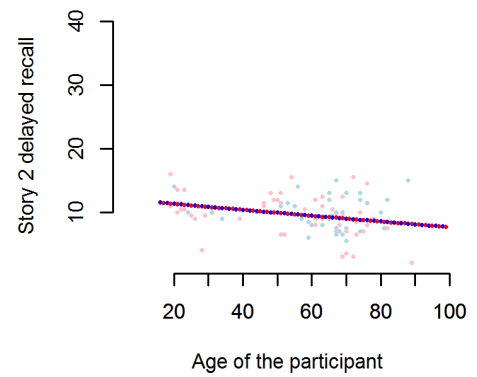
Education = 4



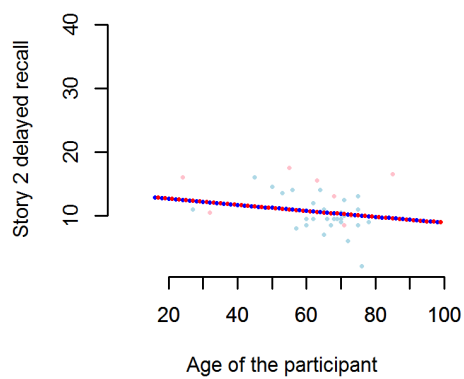
Education = 5



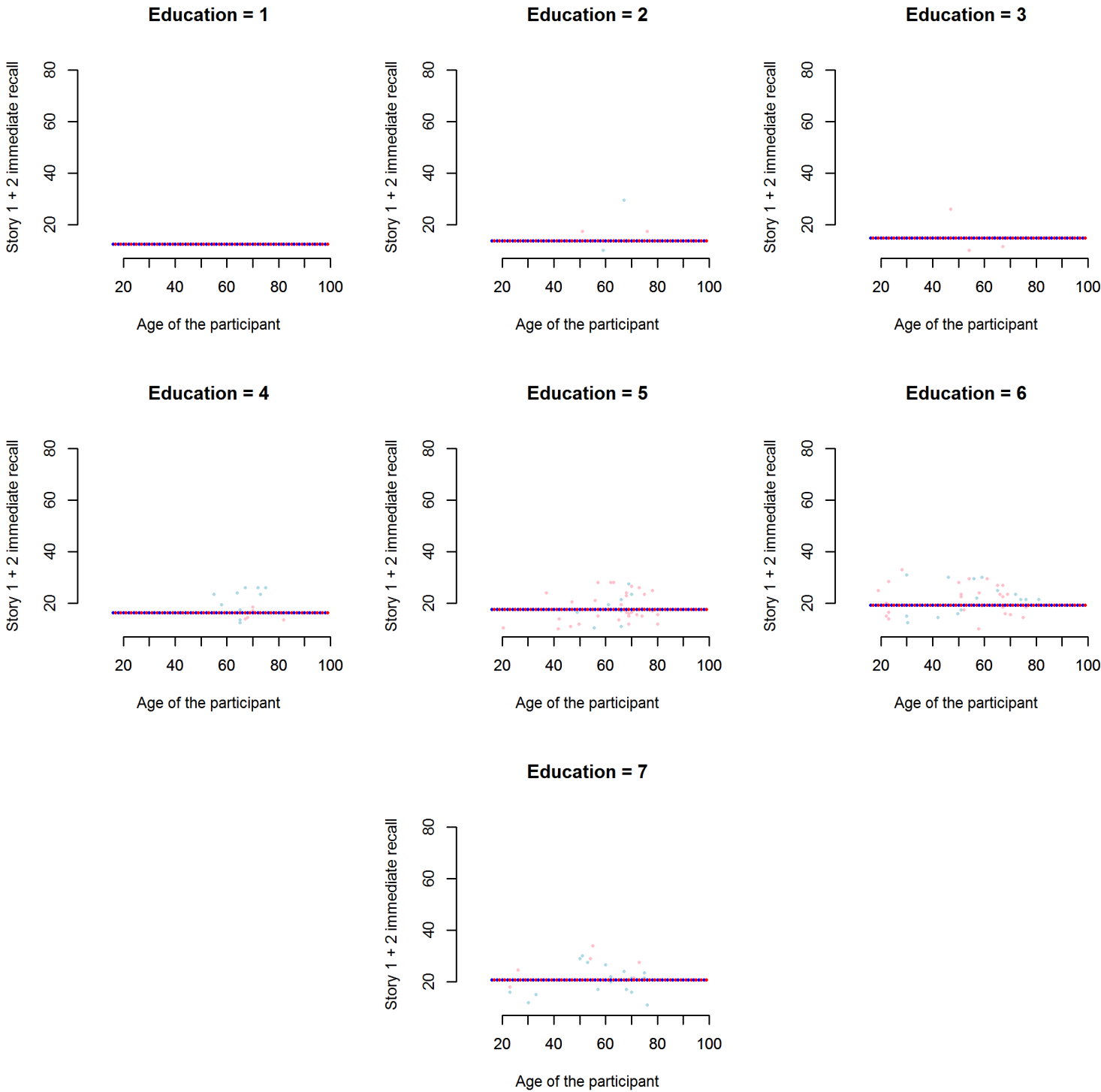
Education = 6



Education = 7

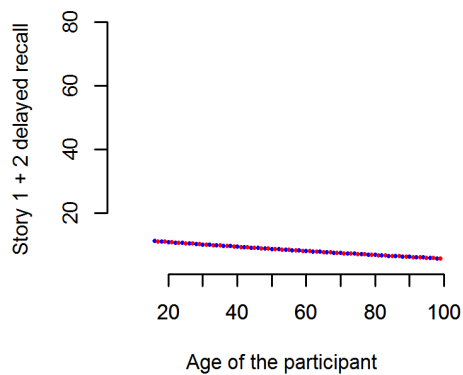


5. RBMT - Prose 1+2 immediate recall

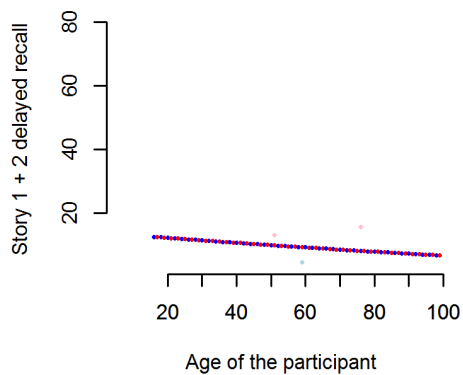


4. RBMT - Prose 1+2 delayed recall

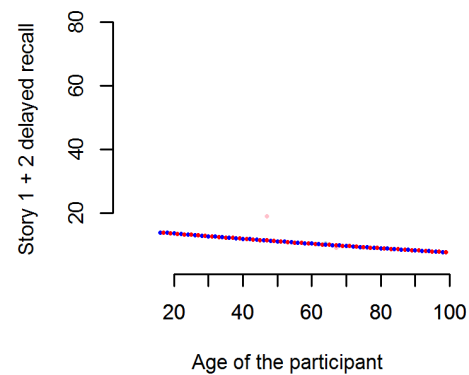
Education = 1



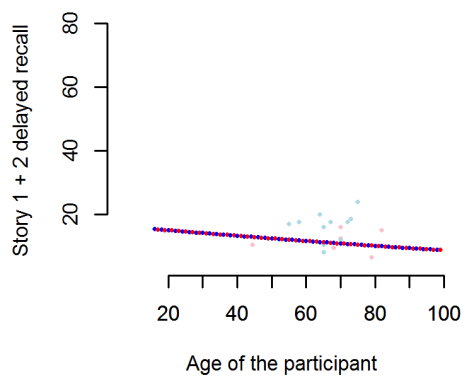
Education = 2



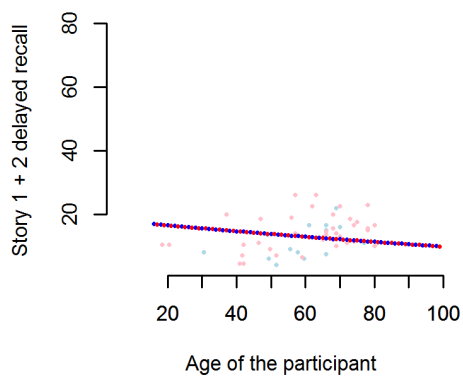
Education = 3



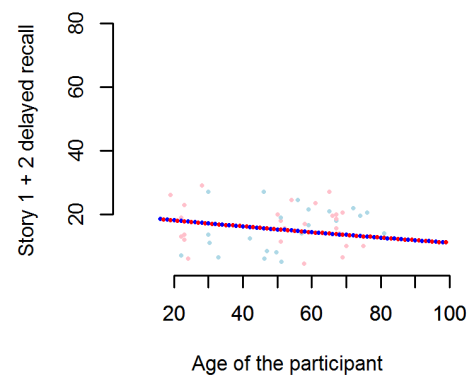
Education = 4



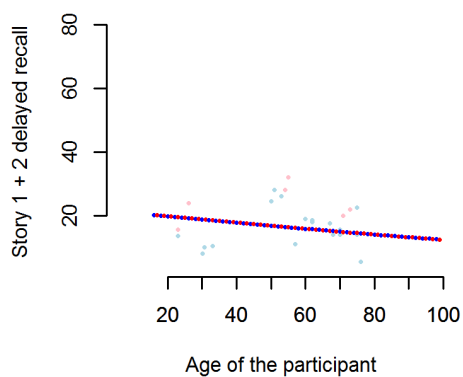
Education = 5



Education = 6



Education = 7



6.22 Rey Complex Figure Task (RCFT)

6.22.1 Extreme Borders of the RCFT

The table shows extreme minimum and maximum scores on all RCFT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Rey-Osterrieth Complex Figure Test Copy	12	36	0 %
Rey-Osterrieth Complex Figure Test Recall	2	36	0 %
Rey-Osterrieth Complex Figure Test Delayed Recall	2	36	0 %
Taylor Complex Figure Test Copy	15	36	0 %
Taylor Complex Figure Test Recall	2	36	0 %
Taylor Complex Figure Test Delayed Recall	2	36	0.003 %

6.22.2 BIC Selection for RCFT

The table shows the selection of the effects of demographic variables for the RCFT.

Variable	Demographic Effects	BIC
Rey-Osterrieth Complex Figure Test Copy	Initially included terms	
	$s + a + e + s*a + s*e$	1935.77
	Dropped terms	
	$s*e$	1929.78
	$s*a$	1923.84
	s	1917.91
	Terms in the final model	
Rey-Osterrieth Complex Figure Test Recall	$a + e$	1917.91
	Initially included terms	
	$s + a + e + s*a + s*e$	1963.27
	Dropped terms	
	$s*a$	1958.34
	$s*e$	1955.26
	Terms in the final model	
Rey-Osterrieth Complex Figure Test Delayed Recall	$s + a + e$	1955.26
	Initially included terms	
	$s + a + e + s*a + s*e$	2058.07
	Dropped terms	
	$s*a$	2053.36
	$s*e$	2049.55
	Terms in the final model	
Taylor Complex Figure Test Copy	$s + a + e$	2049.55
	Initially included terms	
	$s + a + e + s*a + s*e$	1483.53
	Dropped terms	
	$s*a$	1479.78
	$s*e$	1476.41
	s	1471.64
Taylor Complex Figure Test Recall	a	1469.87
	Terms in the final model	
	e	1469.87
	Initially included terms	
	$s + a + e + s*e$	554.9
	Dropped terms	
	$s*e$	549.96
Taylor Complex Figure Test Delayed Recall	s	544.95
	e	544.43
	Terms in the final model	
	a	544.43
	Initially included terms	
	$s + a + e + s*a + s*e$	1978.3
	Dropped terms	
	$s*a$	1973.58
	$s*e$	1968.63
	s	1965.43
	Terms in the final model	
	$a + e$	1965.43

age = a, sex = s, education = e.

6.22.3 Best model fit of the RCFT

The table shows the terms of the best models for the RCFT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this

section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Rey-Osterrieth Complex Figure Test Copy	a + e	12
Rey-Osterrieth Complex Figure Test Recall	s + a + e	1
Rey-Osterrieth Complex Figure Test Delayed Recall	s + a + e	0
Taylor Complex Figure Test Copy	e	9
Taylor Complex Figure Test Recall	a	1
Taylor Complex Figure Test Delayed Recall	a + e	0

age = a, sex = s, education = e.

6.22.4 Box-Cox power transformation of the RCFT

The table shows the best Box-Cox power transformation for the RCFT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Rey-Osterrieth Complex Figure Test Copy	6.76	-0.138	2.399
Rey-Osterrieth Complex Figure Test Recall	1.35	-0.117	2.766
Rey-Osterrieth Complex Figure Test Delayed Recall	1.26	-0.151	2.883
Taylor Complex Figure Test Copy	7.87	-0.121	2.139
Taylor Complex Figure Test Recall	1.863	0.001	2.256
Taylor Complex Figure Test Delayed Recall	1.06	-0.032	2.815

6.22.5 Descriptive statistics for the RCFT

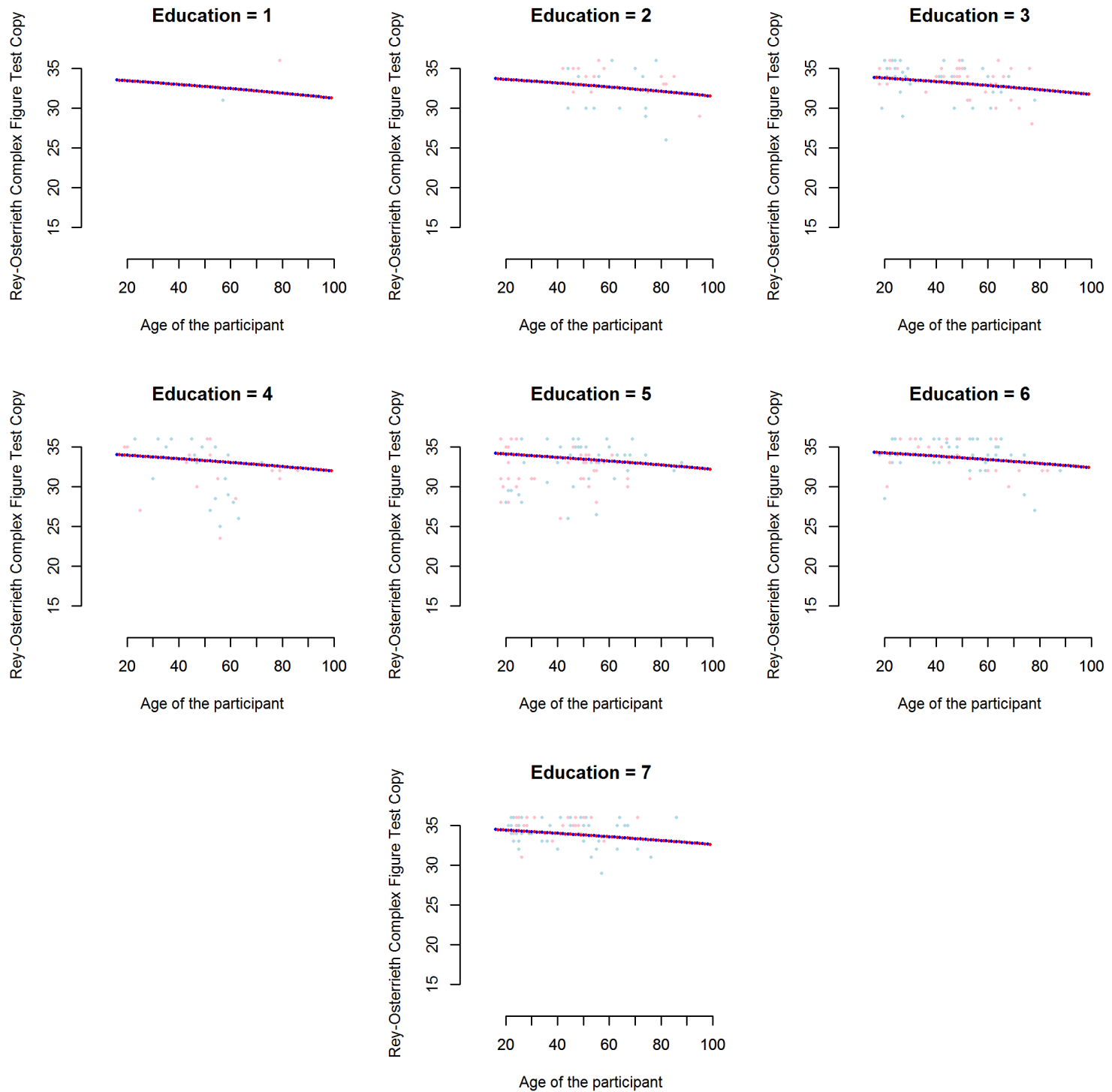
The table gives descriptives after outliers are removed on all RCFT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Rey-Osterrieth CFT Copy	25	34	36	215	18-88	24	34	36	173	17-95
Rey-Osterrieth CFT Recall	6	25	36	156	18-86	4	22	34	148	17-82
Rey-Osterrieth CFT Delayed Recall	6	24	35	163	18-86	4	20	35	156	17-82
Taylor CFT Copy	27	34	36	151	18-84	27	34	36	143	18-87
Taylor CFT Recall	8	26	35	76	18-83	4	27	34	74	18-83
Taylor CFT Delayed Recall	3	22	36	155	18-84	2	20	35	146	18-87

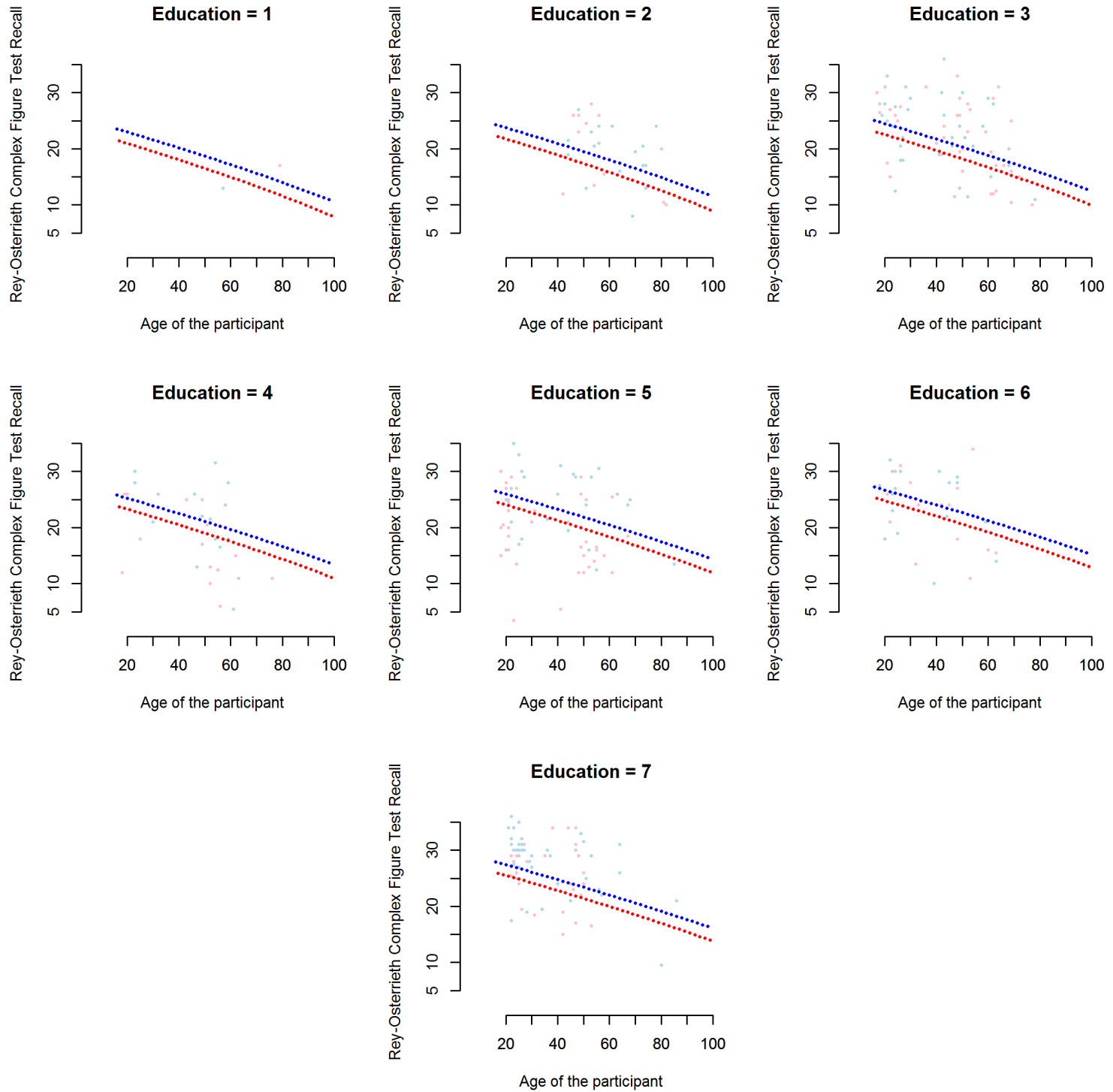
6.22.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. RCFT - Rey Figure - Copy

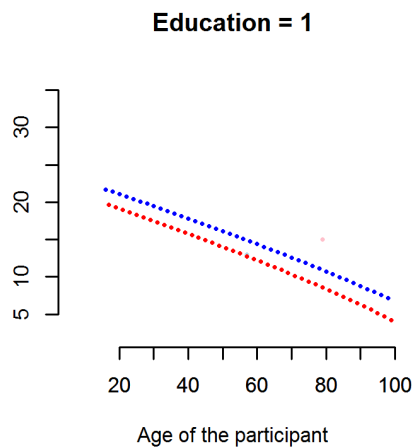


2. RCFT - Rey Figure - Recall

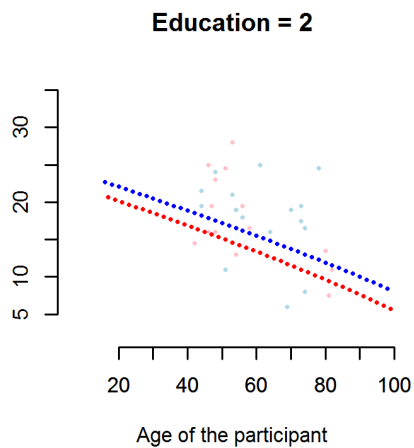


3. RCFT - Rey Figure - Delayed Recall

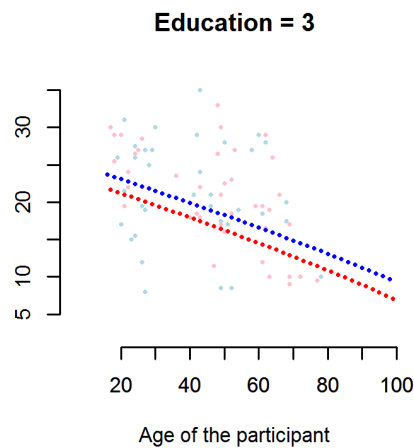
Rey-Osterrieth Complex Figure Test Delayed Recall



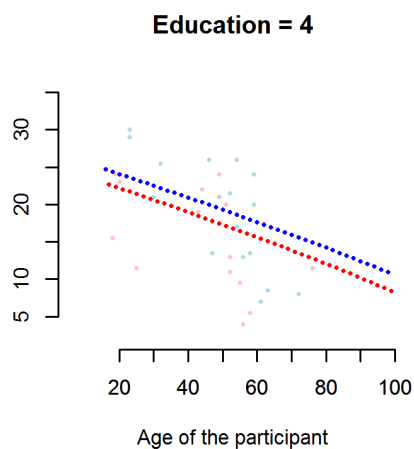
Rey-Osterrieth Complex Figure Test Delayed Recall



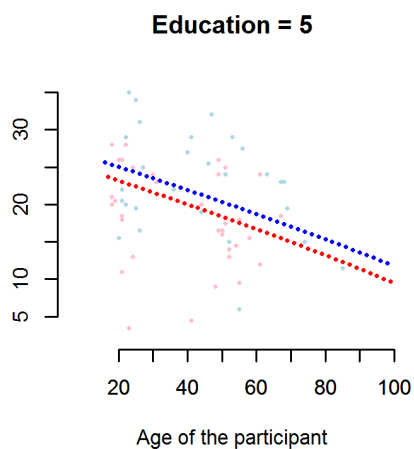
Rey-Osterrieth Complex Figure Test Delayed Recall



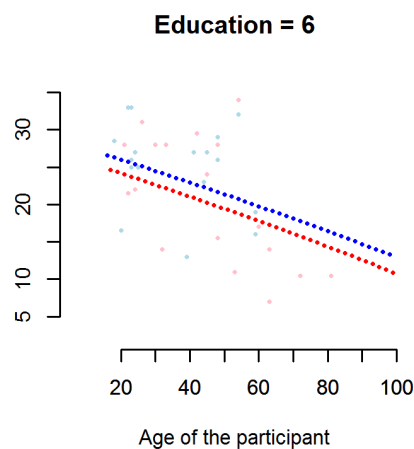
Rey-Osterrieth Complex Figure Test Delayed Recall



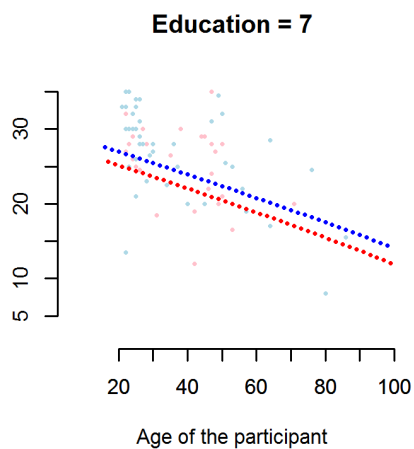
Rey-Osterrieth Complex Figure Test Delayed Recall



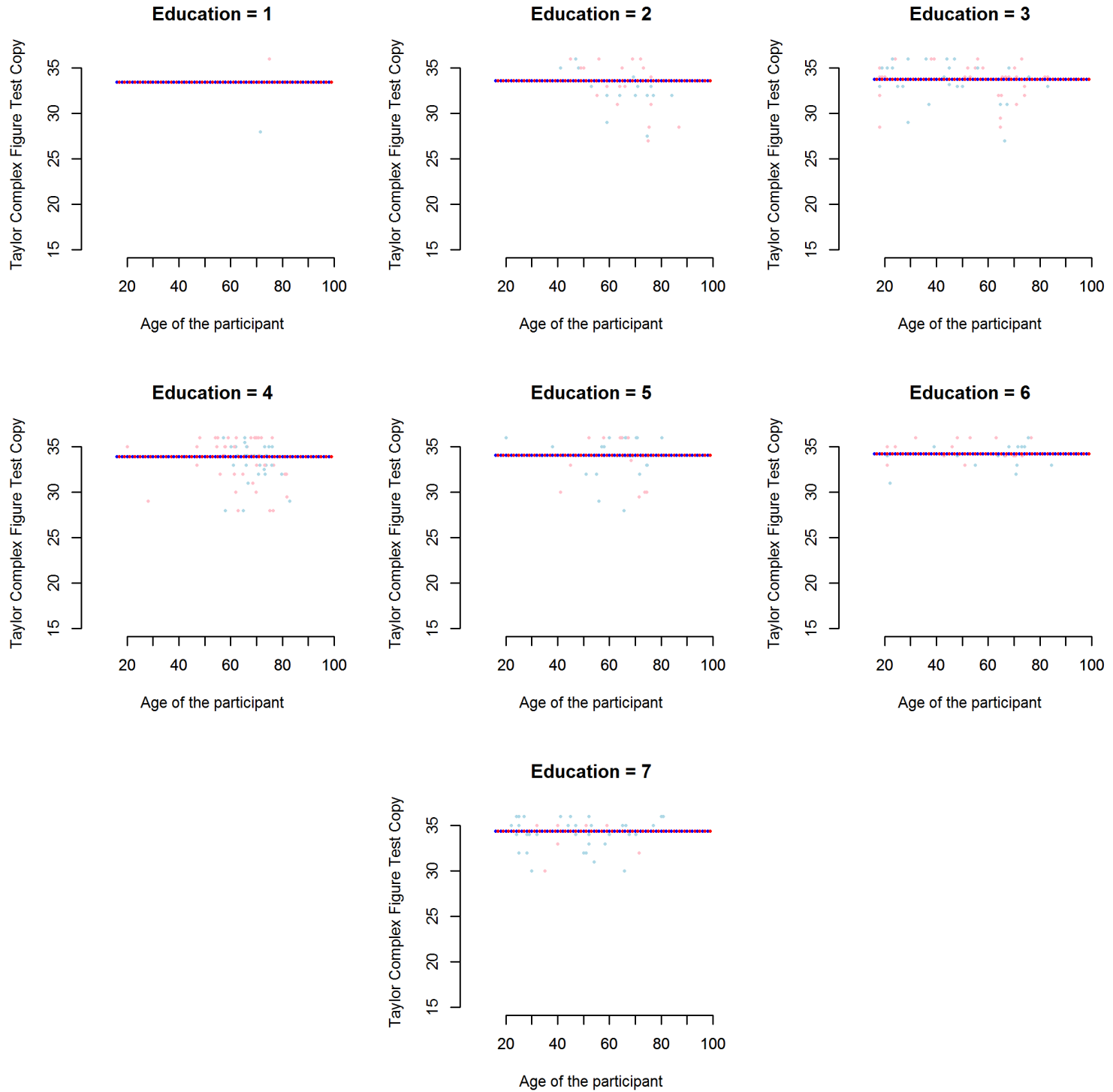
Rey-Osterrieth Complex Figure Test Delayed Recall



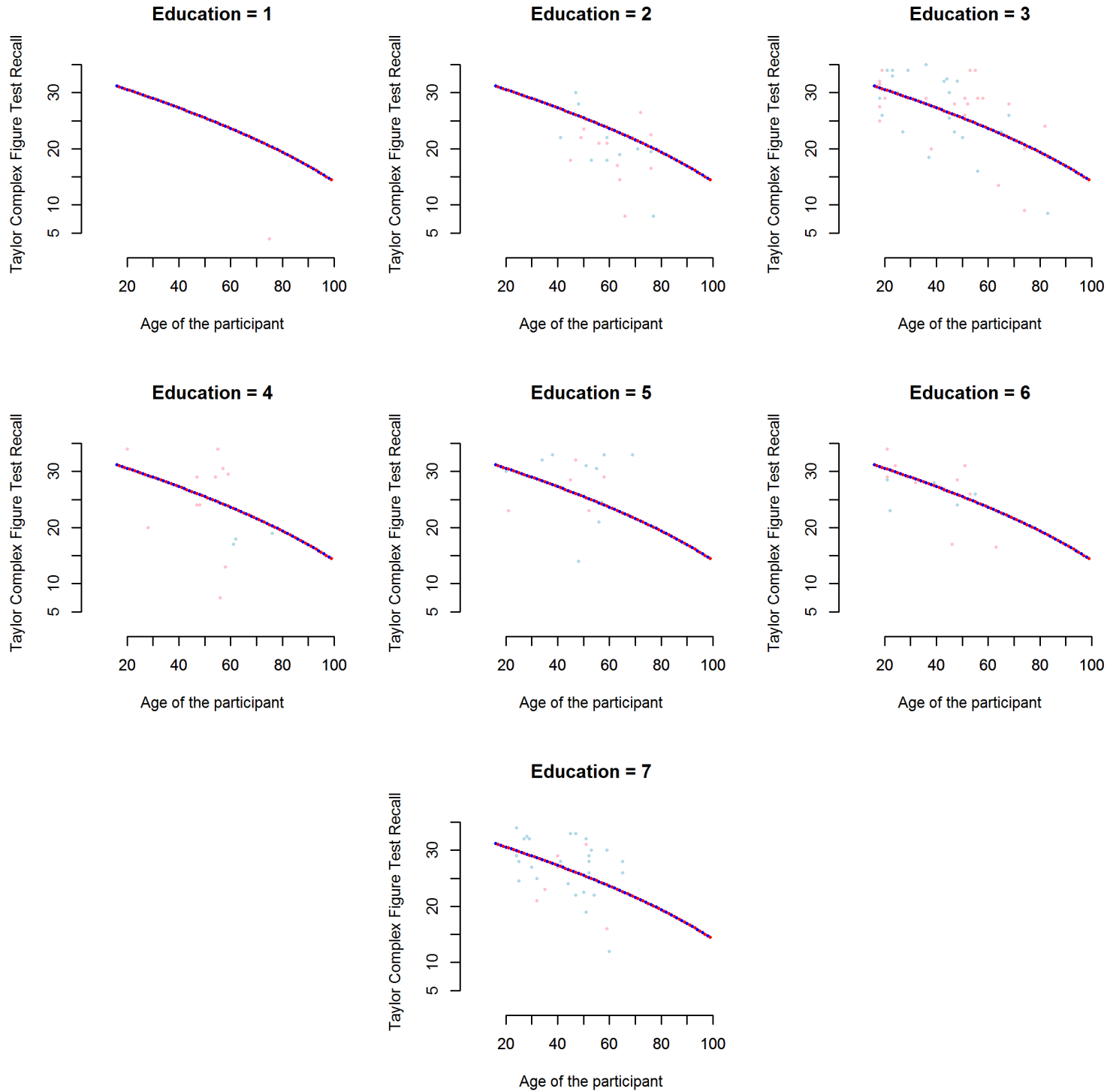
Rey-Osterrieth Complex Figure Test Delayed Recall



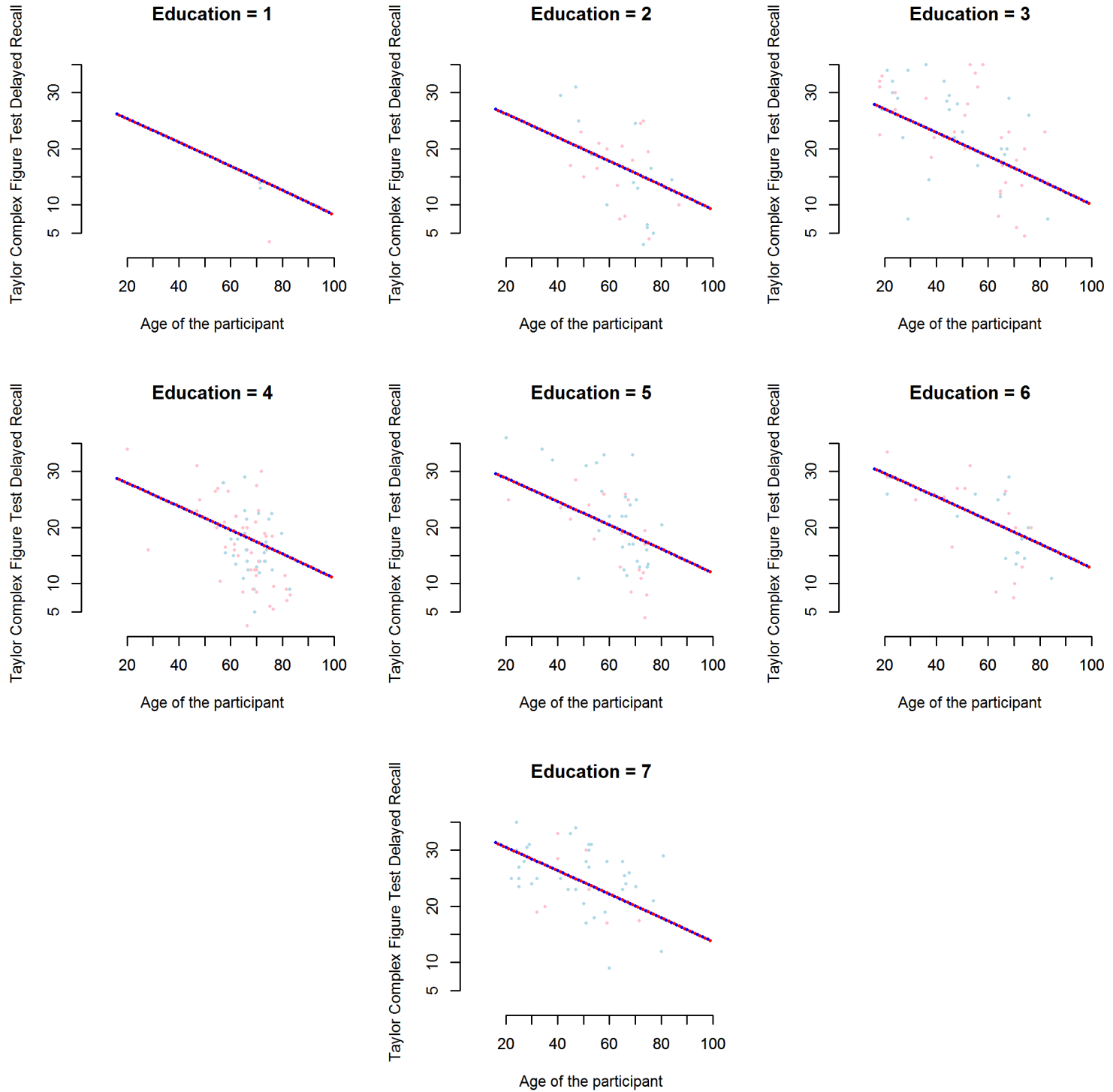
4. RCFT - Taylor Figure - Copy



5. RCFT - Taylor Figure - Recall



6. RCFT - Taylor Figure - Delayed Recall



6.23 Semantic Fluency

6.23.1 Extreme Borders of the SF

The table shows extreme minimum and maximum scores on all SF variables. The last column shows the number of cases removed based on these criteria.

6.23.2 Extreme Borders of the SF

The table shows extreme minimum and maximum scores on all SF variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Animals	8	60	0.024 %
Occupations	5	50	0.002 %

6.23.3 BIC Selection for SF

The table shows the selection of the effects of demographic variables for the SF.

Variable	Demographic Effects	BIC
Animals	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	36361.42
	Dropped terms	
	$s*a*e$	36358.7
	$s*a$	36350.03
Occupations	Terms in the final model	
	$s + a + e + s*e + a*e$	36350.03
	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	11058.42
	Dropped terms	
	$s*a*e$	11052.69
	$a*e$	11045.28
	$s*a$	11043.93
	$s*e$	11040.6
	s	11033.34
	Terms in the final model	
	$a + e$	11033.34

age = a, sex = s, education = e.

6.23.4 Best model fit of the SF

The table shows the terms of the best models for the SF variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Animals	$s + a + e + s*e + a*e$	29
Occupations	$a + e$	5

age = a, sex = s, education = e.

6.23.5 Box-Cox power transformation of the SF

The table shows the best Box-Cox power transformation for the SF variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Animals	0.46	0.036	2.823
Occupations	0.51	-0.013	2.948

6.23.6 Descriptive statistics for the SF

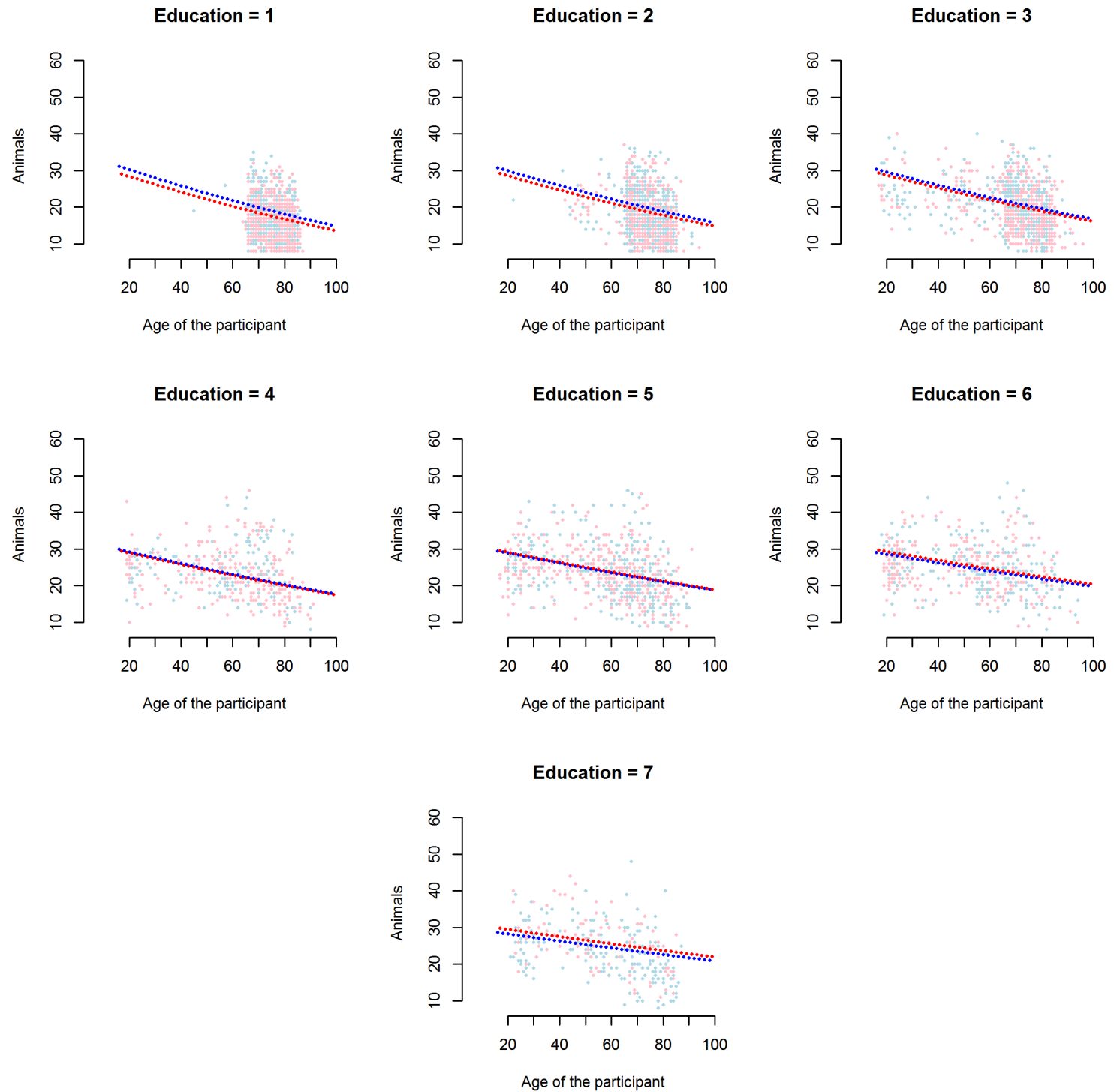
The table gives descriptives after outliers are removed on all SF variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Animals	8	20	48	2324	18-94	8	18	46	3460	17-96
Occupations	6	18	35	764	18-94	5	17	34	1091	17-95

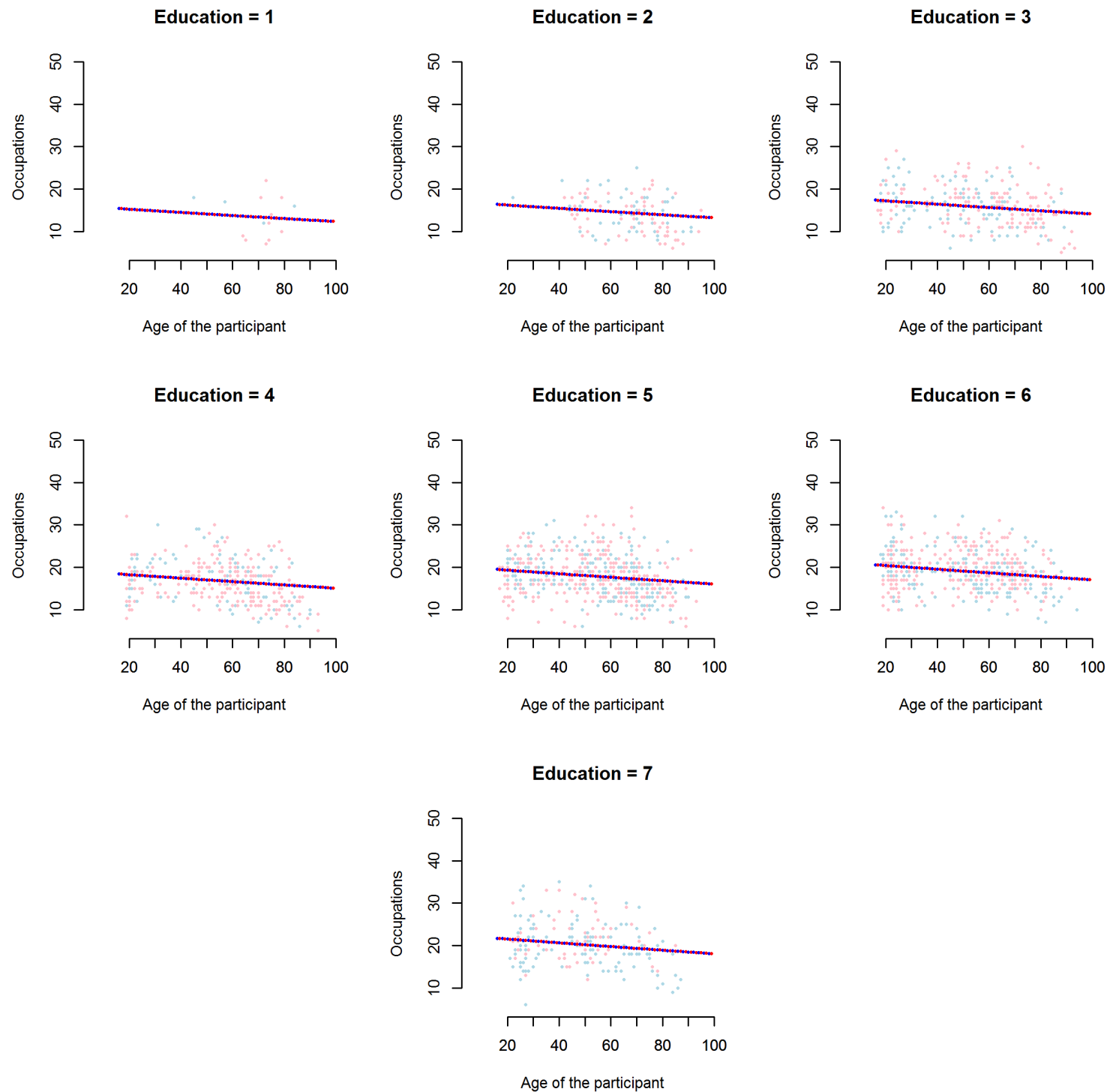
6.23.7 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. Semantic Fluency - Animals in 1 minute



2. Semantic Fluency - Occupations in 1 minute



6.24 Selective Reminding Test (SRT)

6.24.1 Extreme Borders of the SRT

The table shows extreme minimum and maximum scores on all SRT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
SRT Total Recall	45	150	0.005 %
SRT Long Term Retrieval	2	150	0 %
SRT Long Term Storage	2	150	0 %
SRT Consistent Long Term Retrieval	0	150	0 %
SRT Delayed Recall	1	12	0.001 %

6.24.2 BIC Selection for SRT

The table shows the selection of the effects of demographic variables for the SRT.

Variable	Demographic Effects	BIC
SRT Total Recall	Initially included terms	
	$s + a + e + s^*a + s^*e + a^*e + s^*a^*e$	27960.27
	Dropped terms	
	s^*a^*e	27952.18
	s^*e	27944.1
	a^*e	27936.53
	s^*a	27933.94
	Terms in the final model	
	$s + a + e$	27933.94
SRT Long Term Retrieval	Initially included terms	
	$s + a + e + s^*a + s^*e + a^*e + s^*a^*e$	30751.66
	Dropped terms	
	s^*a^*e	30743.8
	s^*e	30735.72
	a^*e	30727.92
	s^*a	30727.54
	Terms in the final model	
	$s + a + e$	30727.54
SRT Long Term Stora	Initially included terms	
	$s + a + e + s^*a + s^*e + a^*e + s^*a^*e$	30201.43
	Dropped terms	
	s^*a^*e	30194.38
	s^*e	30186.53
	a^*e	30180.65
	s^*a	30178.54
	Terms in the final model	
	$s + a + e$	30178.54
SRT Consistent Long Term Retrieval	Initially included terms	
	$s + a + e + s^*a + s^*e + a^*e + s^*a^*e$	32614.31
	Dropped terms	
	s^*a^*e	32606.21
	s^*e	32598.46
	a^*e	32593.09
	s^*a	32588.53
	Terms in the final model	
	$s + a + e$	32588.53
SRT Delayed Recall	Initially included terms	
	$s + a + e + s^*a + s^*e + a^*e + s^*a^*e$	14184.41
	Dropped terms	
	s^*a^*e	14176.33
	s^*e	14170.7
	a^*e	14166.84
	Terms in the final model	
	$s + a + e + s^*a$	14166.84

age = a, sex = s, education = e.

6.24.3 Best model fit of the SRT

The table shows the terms of the best models for the SRT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
SRT Total Recall	s + a + e	12
SRT Long Term Retrieval	s + a + e	12
SRT Long Term Storage	s + a + e	39
SRT Consistent Long Term Retrieval	s + a + e	0
SRT Delayed Recall	s + a + e + s*a	73

age = a, sex = s, education = e.

6.24.4 Box-Cox power transformation of the SRT

The table shows the best Box-Cox power transformation for the SRT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
SRT Total Recall	2.76	0	2.618
SRT Long Term Retrieval	1.86	-0.107	2.603
SRT Long Term Storage	2.58	-0.132	2.538
SRT Consistent Long Term Retrieval	0.81	-0.232	2.654
SRT Delayed Recall	3.51	-0.281	2.296

6.24.5 Descriptive statistics for the SRT

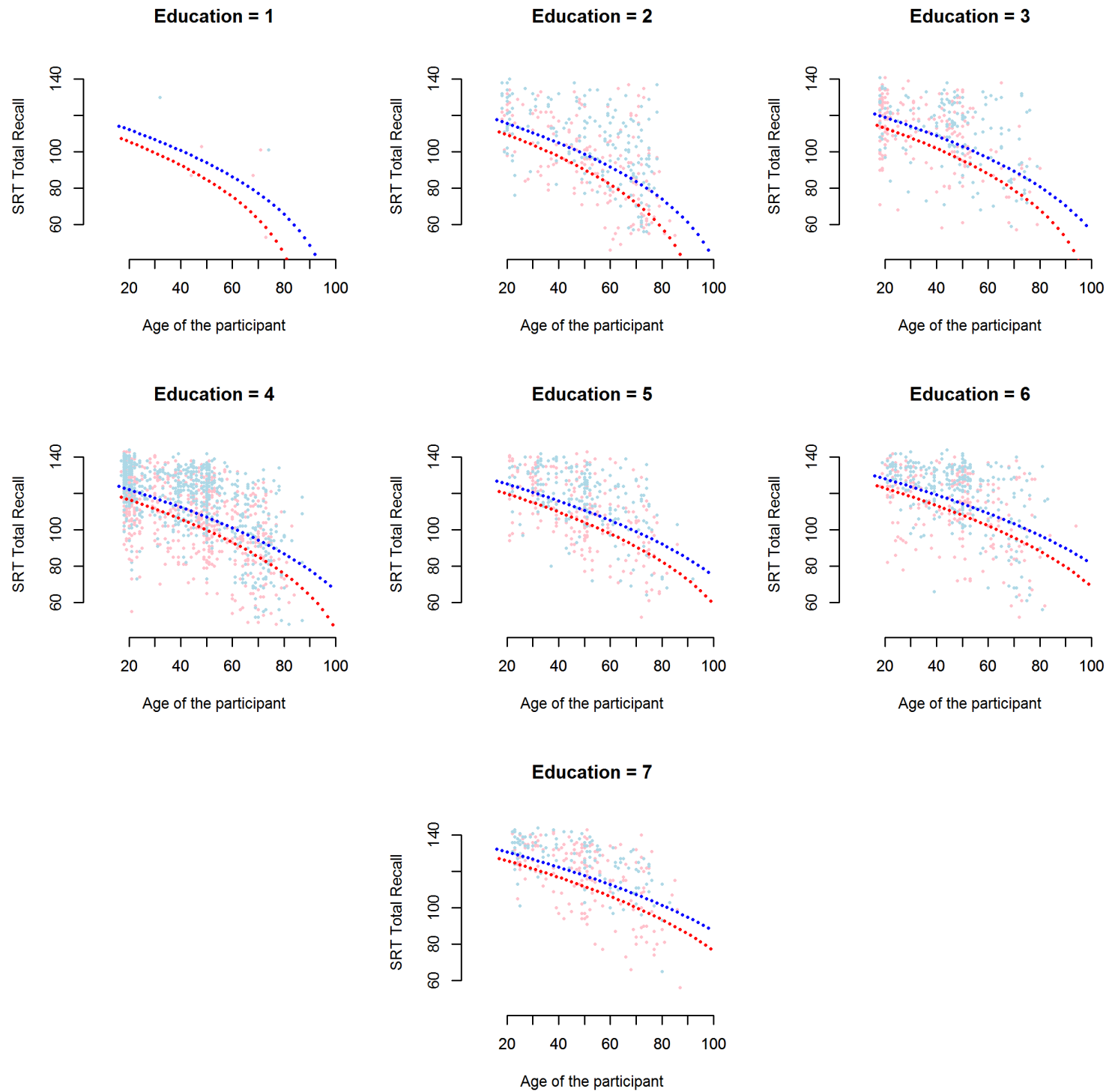
The table gives descriptives after outliers are removed on all SRT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

	Male					Female				
Variable name	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
SRT Total Recall	48	121	144	1652	17-92	46	114	143	1655	17-94
SRT Long Term Retrieval	2	113	144	1657	17-92	2	103	143	1665	17-94
SRT Long Term Storage	21	119	144	1649	17-92	22	112	143	1646	17-94
SRT Consistent Long Term Retrieval	0	96	144	1664	17-92	0	78	143	1671	17-94
SRT Delayed Recall	4	11	12	1627	17-87	2	11	12	1629	17-94

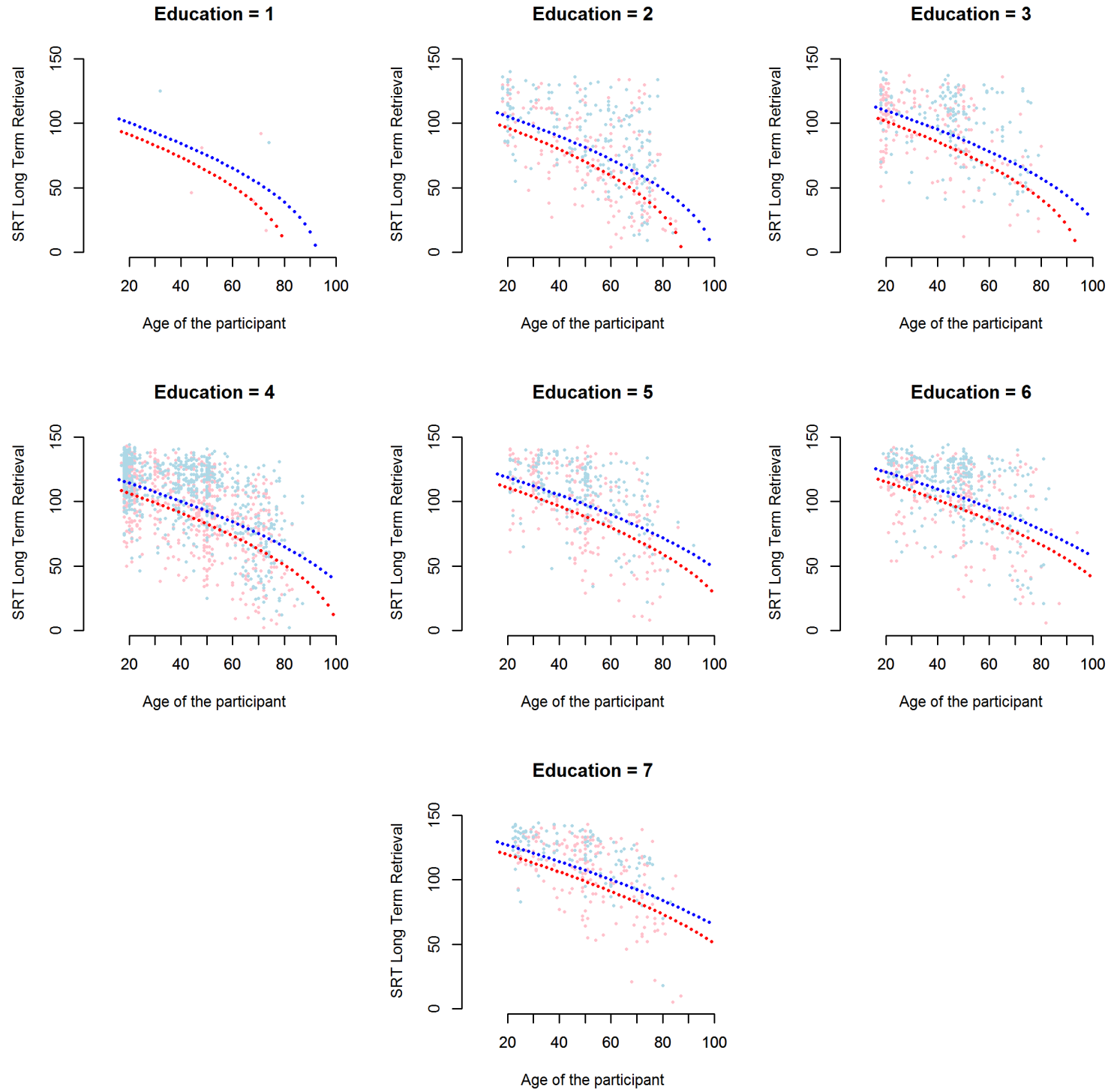
6.24.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

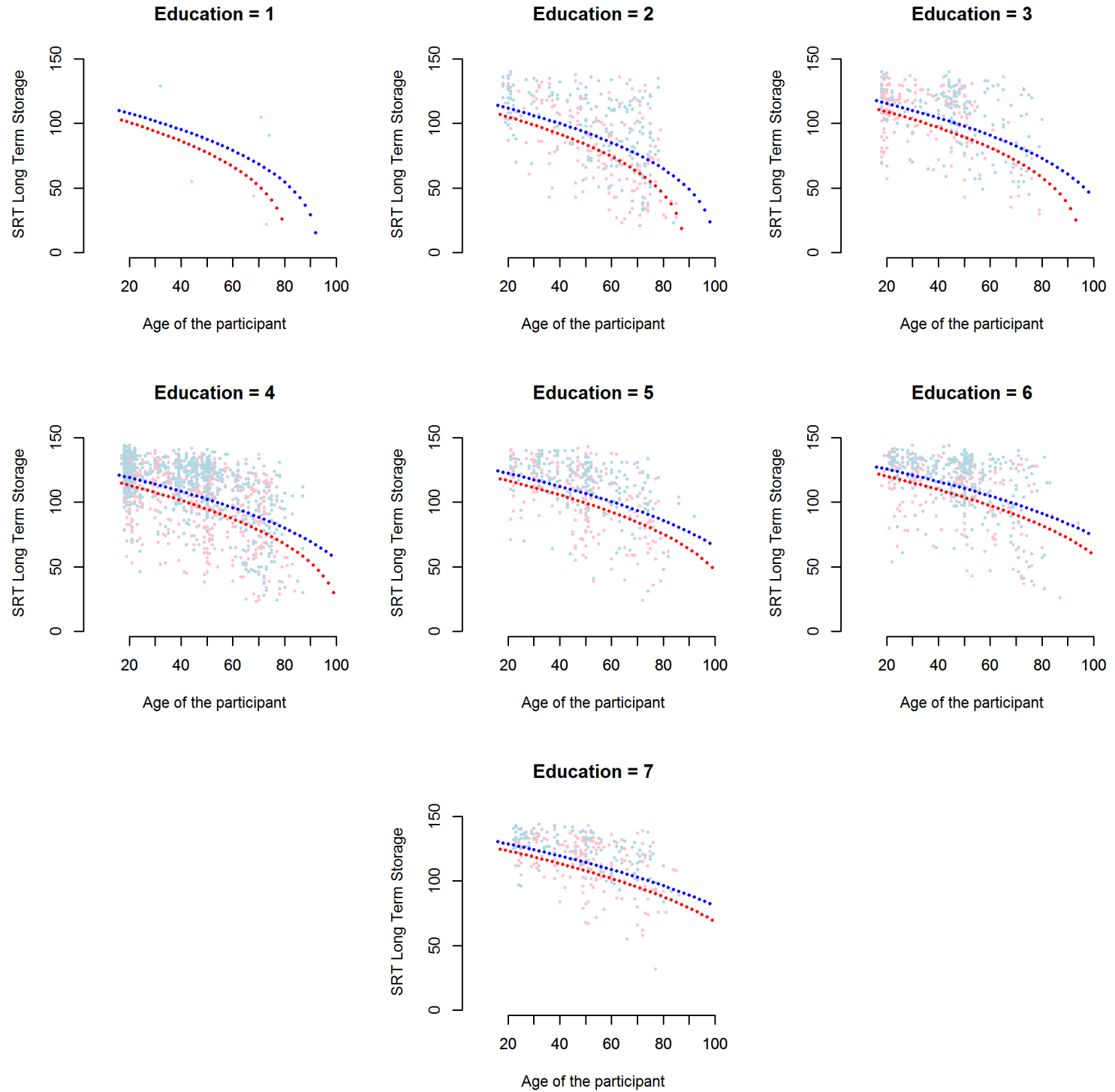
1. SRT - Total Recall



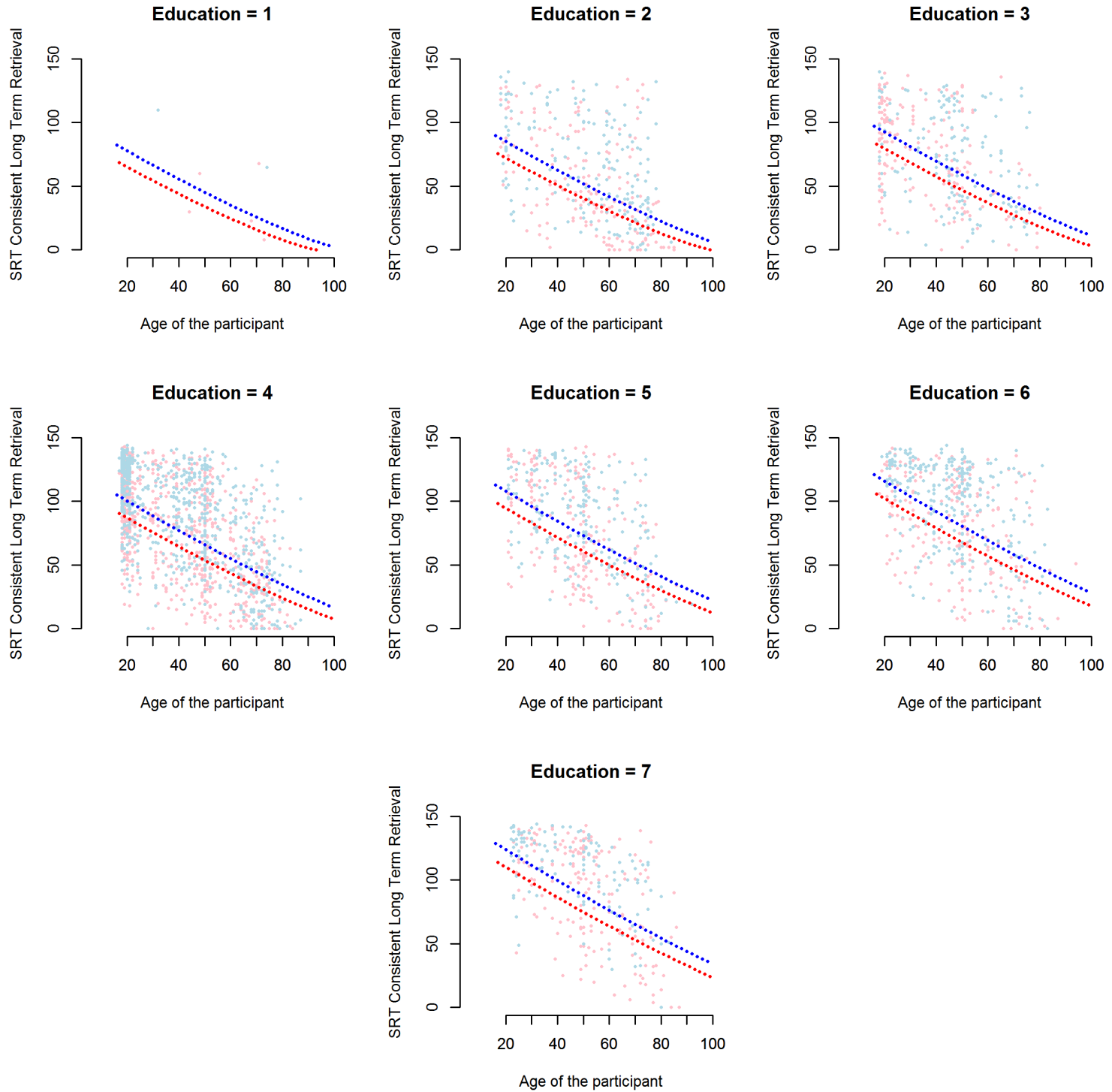
2. SRT - Long Term Retrieval



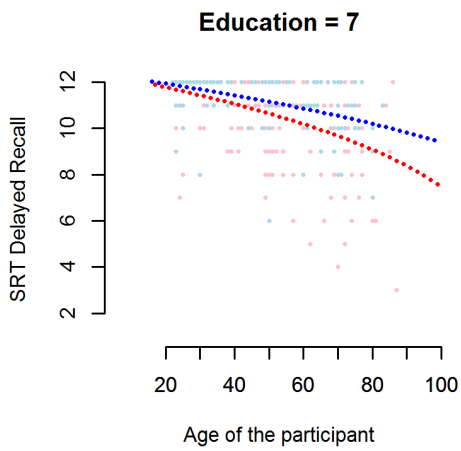
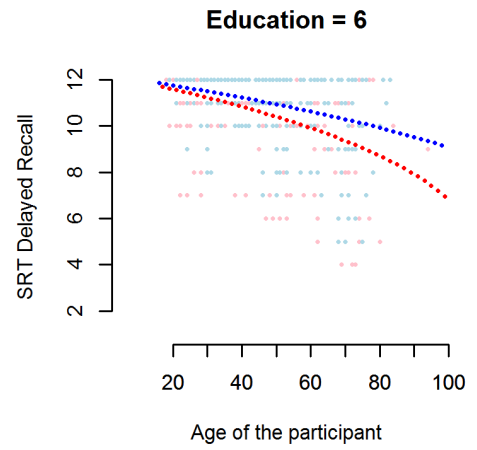
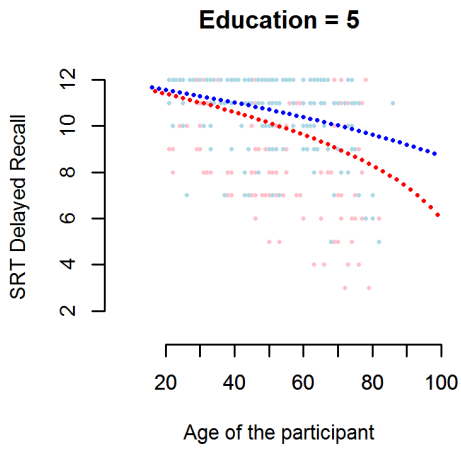
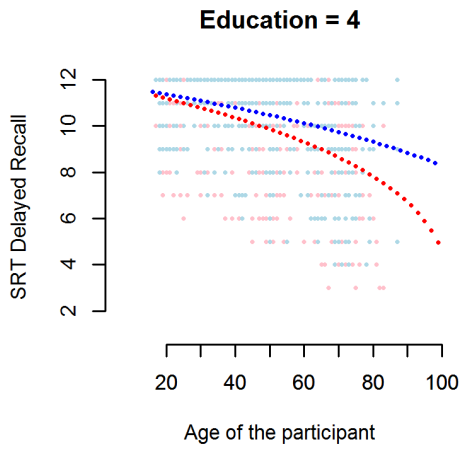
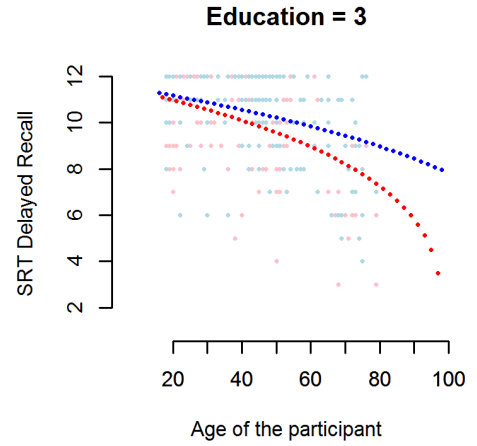
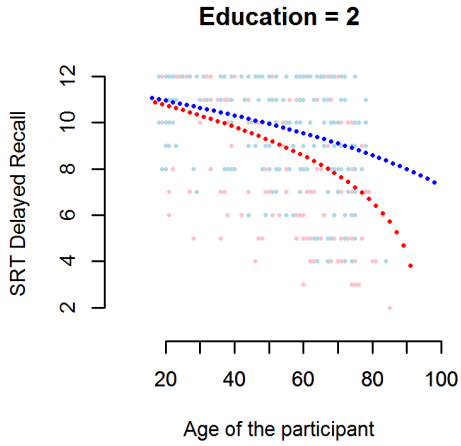
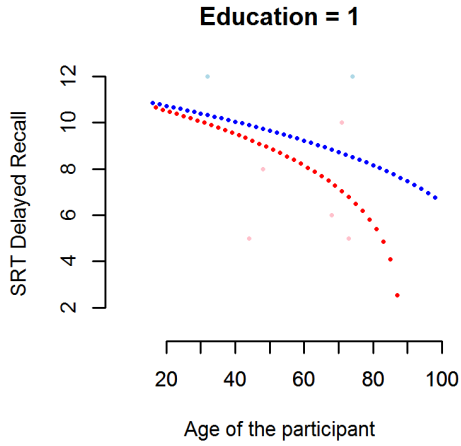
3. SRT - Long Term Storage



4. SRT - Consistent Long Term Retrieval



5. SRT -Delayed Recall



6.25 Stroop Color Word Test (Stroop)

6.25.1 Extreme Borders of the Stroop

The table shows extreme minimum and maximum scores on all Stroop variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
Stroop Card I	30	100	0.008 %
Stroop Card II	30	200	0.002 %
Stroop Card III	30	500	0.001 %

6.25.2 BIC Selection for Stroop

The table shows the selection of the effects of demographic variables for the Stroop.

Variable	Demographic Effects	BIC
Stroop Card I	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	10546.13
	Dropped terms	
	$s*a*e$	10542.47
	$a*e$	10535.46
	$s*a$	10529.64
	$s*e$	10528.04
	Terms in the final model	
	$s + a + e$	10528.04
Stroop Card II	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	14472.39
	Dropped terms	
	$s*a*e$	14465.56
	$s*e$	14458.37
	Terms in the final model	
	$s + a + e + s*a + a*e$	14458.37
Stroop Card III	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	18284.73
	Dropped terms	
	$s*a*e$	18277.96
	$s*e$	18270.46
	Terms in the final model	
	$s + a + e + s*a + a*e$	18270.46

age = a, sex = s, education = e.

6.25.3 Best model fit of the Stroop

The table shows the terms of the best models for the Stroop variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
Stroop Card I	$s + a + e$	26
Stroop Card II	$s + a + e + s*a + a*e$	28
Stroop Card III	$s + a + e + s*a + a*e$	45

age = a, sex = s, education = e.

6.25.4 Box-Cox power transformation of the Stroop

The table shows the best Box-Cox power transformation for the Stroop variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
Stroop Card I	-0.58	0.089	2.822
Stroop Card II	-0.18	-0.002	3.063
Stroop Card III	-0.25	-0.064	3.178

6.25.5 Descriptive statistics for the Stroop

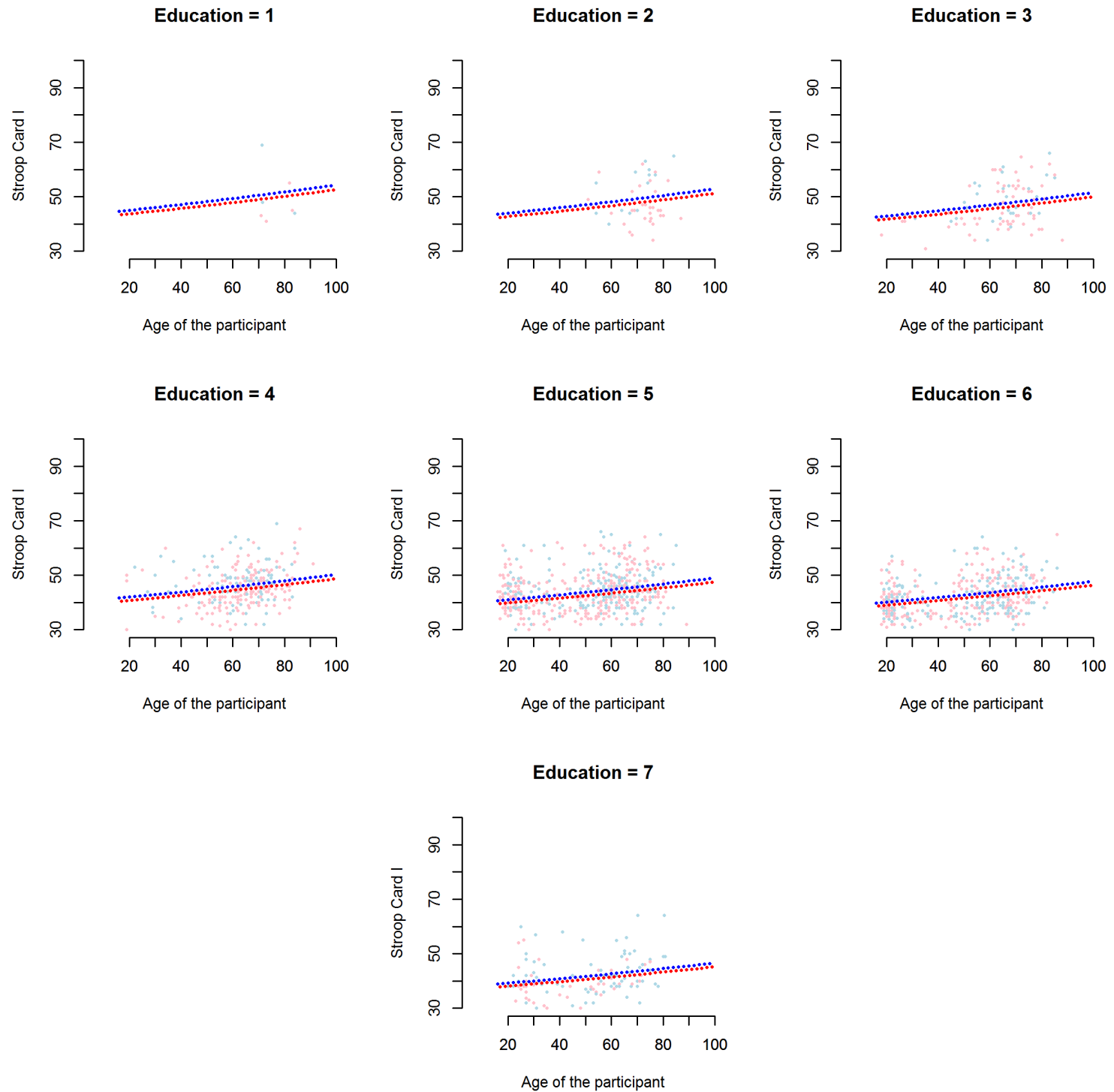
The table gives descriptives after outliers are removed on all Stroop variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
Stroop Card I	30	44	69	606	19-86	30	43	67	905	16-91
Stroop Card II	31	57	93	804	18-90	34	55	92	1090	16-91
Stroop Card III	42	93	215	798	18-86	41	90	204	1080	16-89

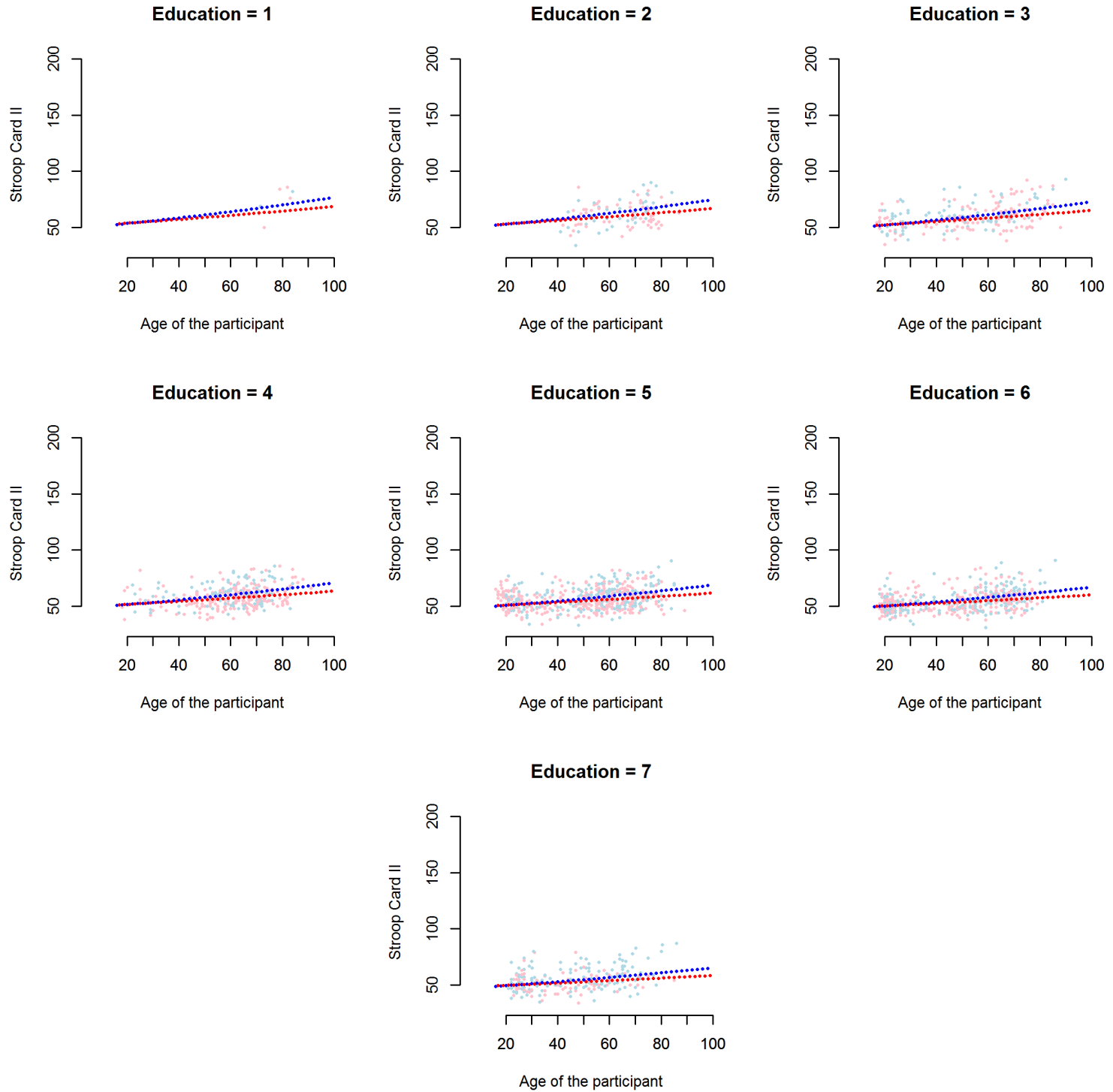
6.25.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

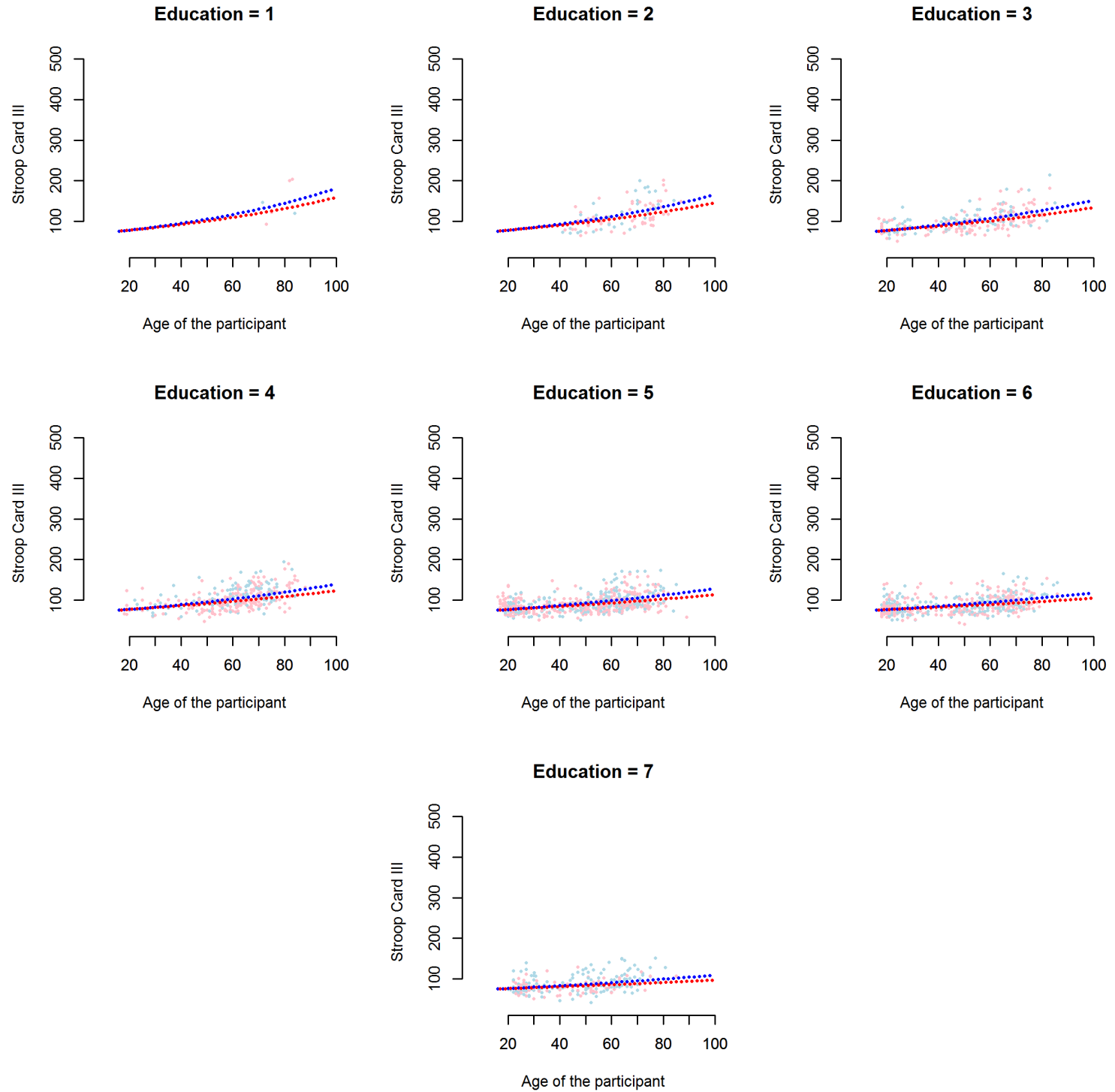
1. Stroop Card I in seconds



2. Stroop Card II in seconds



2. Stroop Card III in seconds



6.26 Trail Making Test (TMT)

6.26.1 Extreme Borders of the TMT

The table shows extreme minimum and maximum scores on all TMT variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
TMTa	10	150	0.006 %
TMTb	10	500	0.002 %

6.26.2 BIC Selection for TMT

The table shows the selection of the effects of demographic variables for the TMT.

Variable	Demographic Effects	BIC
TMTa	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	26420.45
	Dropped terms	
	$s*a*e$	26420.05
	$s*a$	26412.05
	$s*e$	26404.24
	s	26397.93
	Terms in the final model	
	$a + e + a*e$	26397.93
TMTb	Initially included terms	
	$s + a + e + s*a + s*e + a*e + s*a*e$	33090.42
	Dropped terms	
	$s*a*e$	33087.3
	$s*e$	33079.41
	$s*a$	33077.41
	Terms in the final model	
	$s + a + e + a*e$	33077.41

age = a, sex = s, education = e.

6.26.3 Best model fit of the TMT

The table shows the terms of the best models for the TMT variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
TMTa	a + e + a*e	71
TMTb	s + a + e + a*e	110

age = a, sex = s, education = e.

6.26.4 Box-Cox power transformation of the TMT

The table shows the best Box-Cox power transformation for the TMT variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
TMTa	-0.03	-0.08	2.696
TMTb	-0.11	-0.029	2.803

6.26.5 Descriptive statistics for the TMT

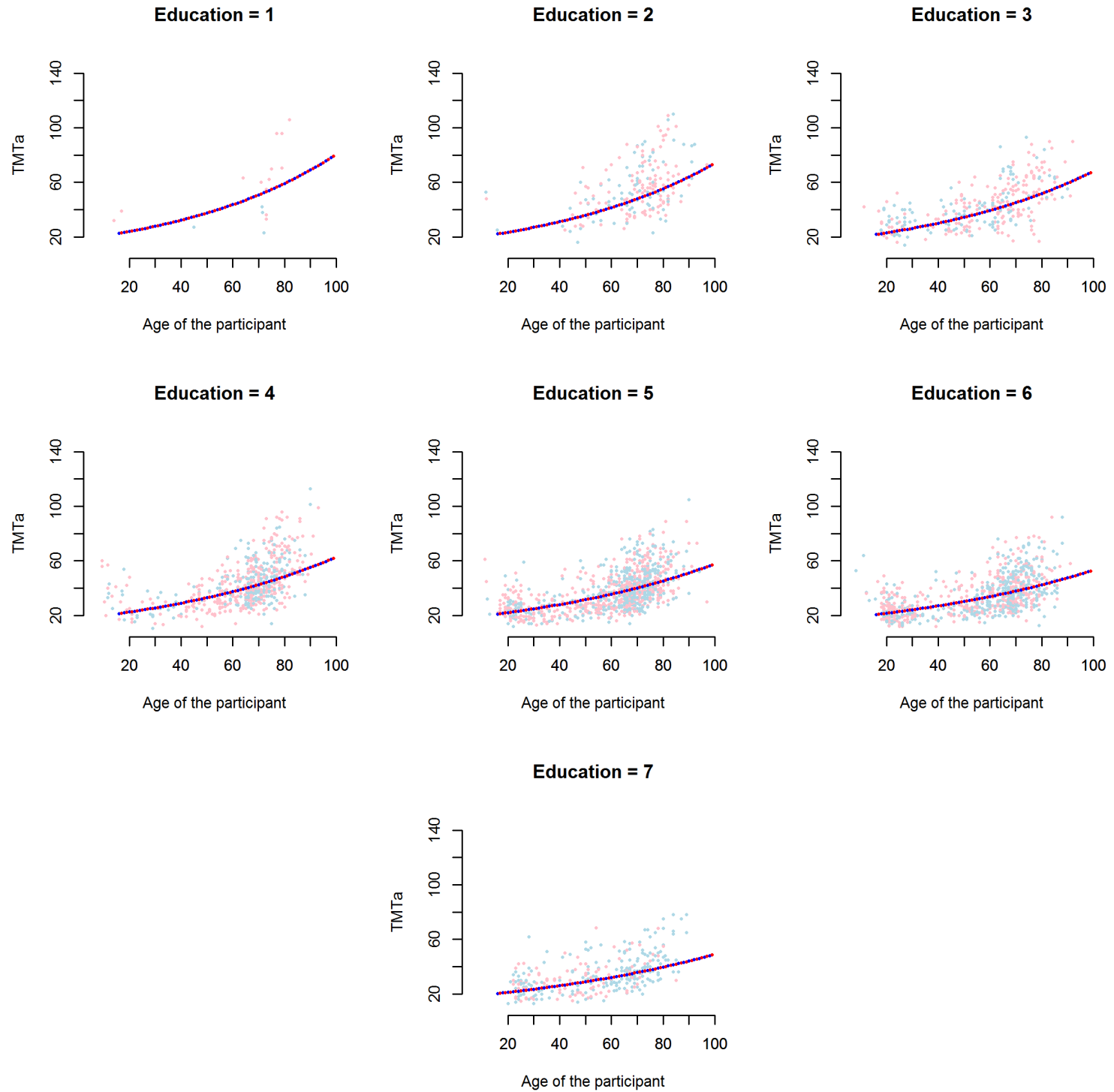
The table gives descriptives after outliers are removed on all TMT variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
TMTa	10	36	113	1476	8-94	12	36	109	1664	9-97
TMTb	21	81	378	1439	8-94	22	78	300	1633	9-97

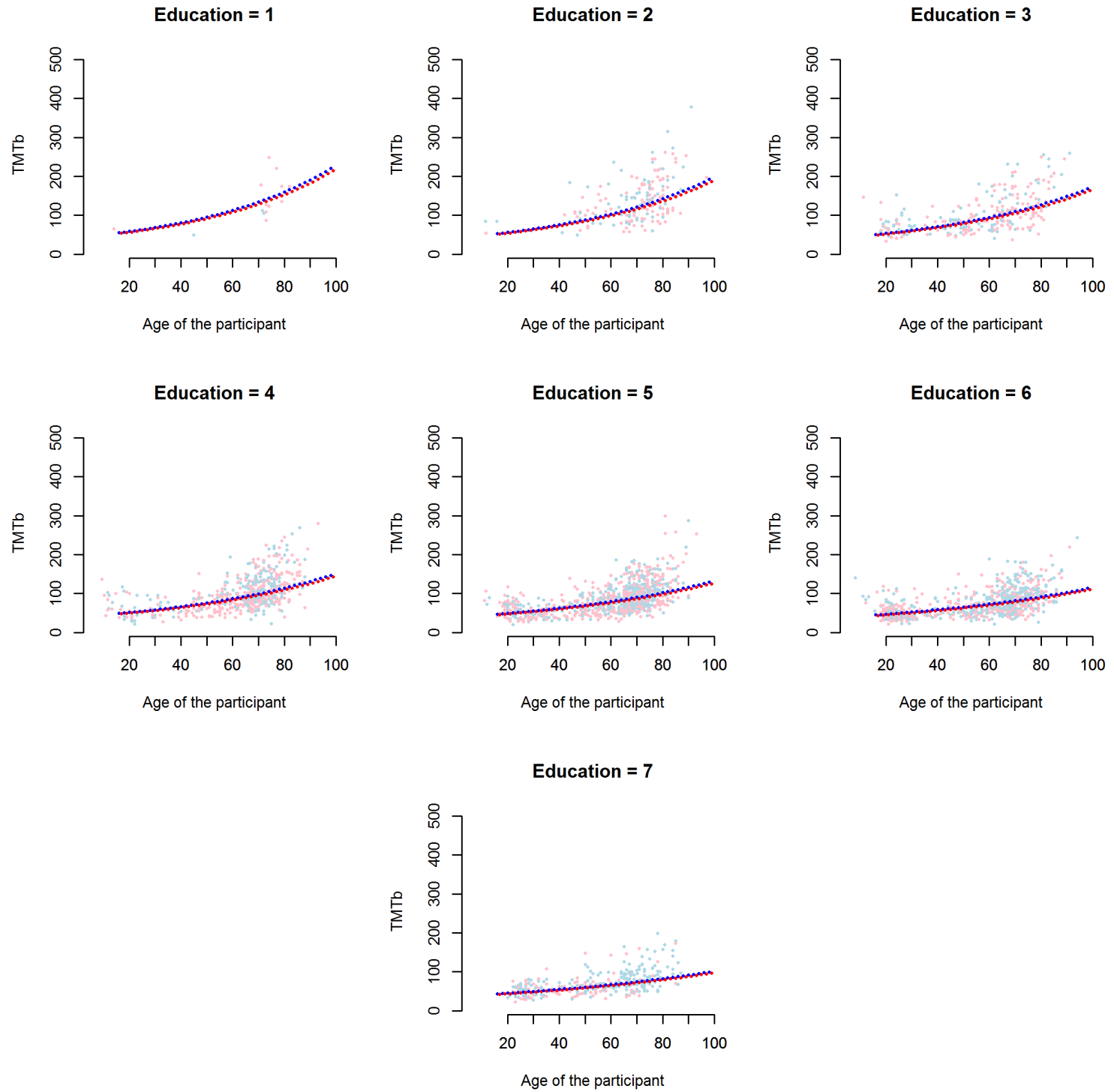
6.26.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. TMTa in seconds



2. TMTb in seconds



6.27 Tower Of London (TOL)

6.27.1 Extreme Borders of the TOL

The table shows extreme minimum and maximum scores on all TOL variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
TOL total move score	0	70	0 %

6.27.2 BIC Selection for TOL

The table shows the selection of the effects of demographic variables for the TOL.

Variable	Demographic Effects	BIC
TOL total move score	Initially included terms	
	s + a	309.18
	Dropped terms	
	s	305.29
	a	304.93
	Terms in the final model	
	None	304.93

age = a, sex = s, education = e.

6.27.3 Best model fit of the TOL

The table shows the terms of the best models for the TOL variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
TOL total move score		1

age = a, sex = s, education = e.

6.27.4 Box-Cox power transformation of the TOL

The table shows the best Box-Cox power transformation for the TOL variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
TOL total move score	0.43	-0.642	2.899

6.27.5 Descriptive statistics for the TOL

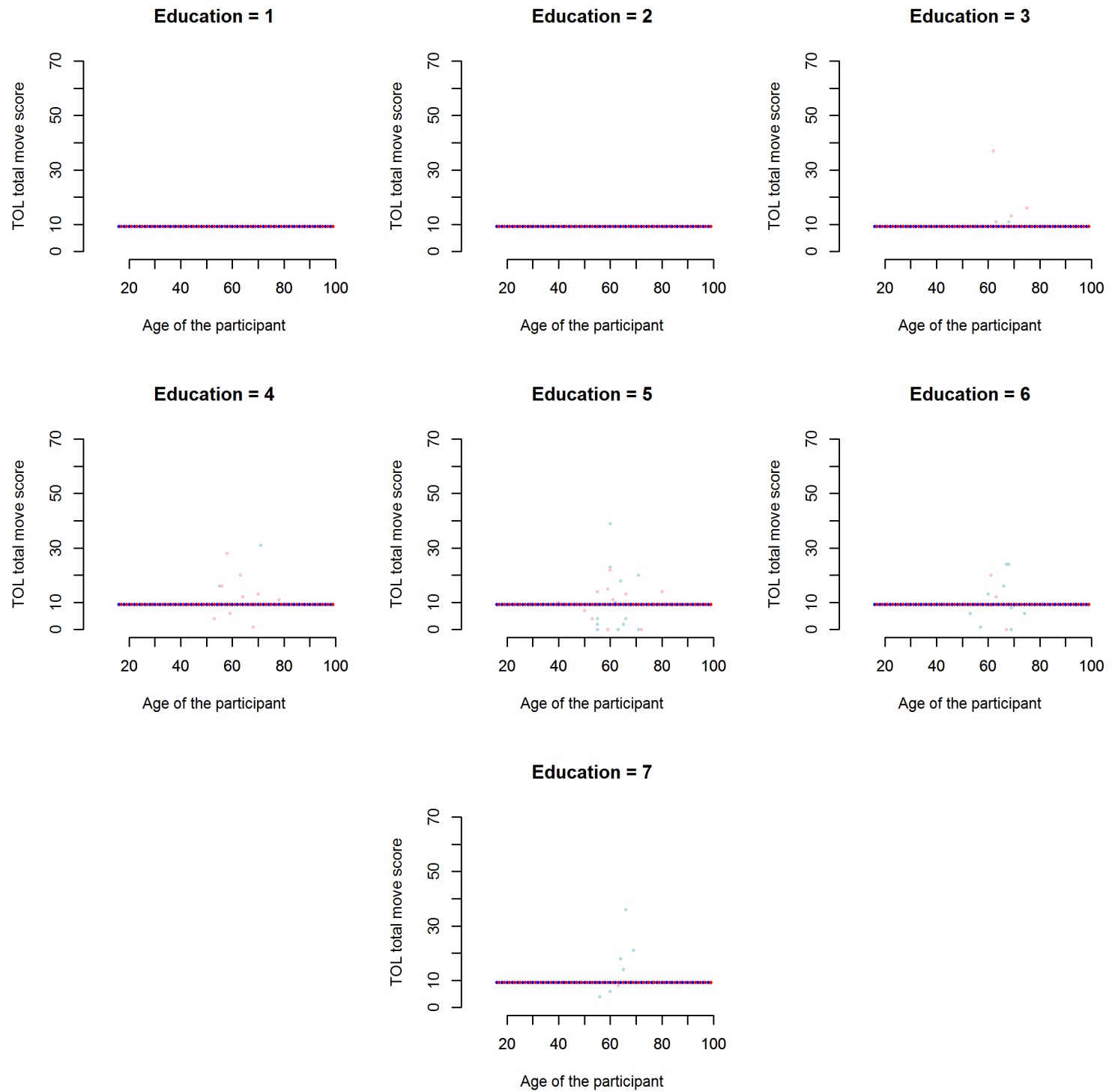
The table gives descriptives after outliers are removed on all TOL variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
TOL total move score	0	11	39	33	53-74	0	12	37	29	40-80

6.27.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. TOL - Total Move Score



6.28 Wechsler Adult Intelligence Scales - NL

6.28.1 Extreme Borders of the WAIS-NL

The table shows extreme minimum and maximum scores on all WAIS-NL variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
WAIS NL Arithmetic	2	16	0 %
WAIS NL Block Design	1	26	0 %
WAIS NL Coding	11	115	0 %
WAIS NL Information	1	22	0 %
WAIS NL Picture Completion	0	20	0 %
WAIS NL Similarities	0	26	0 %

6.28.2 BIC Selection for WAIS-NL

The table shows the selection of the effects of demographic variables for the WAIS-NL.

Variable	Demographic Effects	BIC
WAIS NL Arithmetic	Initially included terms	
	None	34.28
	Terms in the final model	
	None	34.28
WAIS NL Block Design	Initially included terms	
	None	64.39
	Terms in the final model	
	None	64.39
WAIS NL Coding	Initially included terms	
	s + a + e + s*e	1843.78
	Dropped terms	
	s*e	1843.25
	s	1839.26
	Terms in the final model	
WAIS NL Information	a + e	1839.26
	Initially included terms	
	None	39.61
	Terms in the final model	
WAIS NL Picture Completion	None	39.61
	Initially included terms	
	None	44.3
	Terms in the final model	
WAIS NL Similarities	None	44.3
	Initially included terms	
	None	42.47
	Terms in the final model	
	None	42.47

age = a, sex = s, education = e.

6.28.3 Best model fit of the WAIS-NL

The table shows the terms of the best models for the WAIS-NL variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
WAIS NL Arithmetic	a + e	0
WAIS NL Block Design		2
WAIS NL Coding		0
WAIS NL Information		0
WAIS NL Picture Completion		0
WAIS NL Similarities		0

age = a, sex = s, education = e.

6.28.4 Box-Cox power transformation of the WAIS-NL

The table shows the best Box-Cox power transformation for the WAIS-NL variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
WAIS NL Arithmetic	1.458	-0.144	1.803
WAIS NL Block Design	7.795	-0.388	1.551
WAIS NL Coding	0.56	0.25	2.675
WAIS NL Information	-1.503	0.118	1.711
WAIS NL Picture Completion	1.872	-0.244	2.012
WAIS NL Similarities	-0.179	0.009	1.976

6.28.5 Descriptive statistics for the WAIS-NL

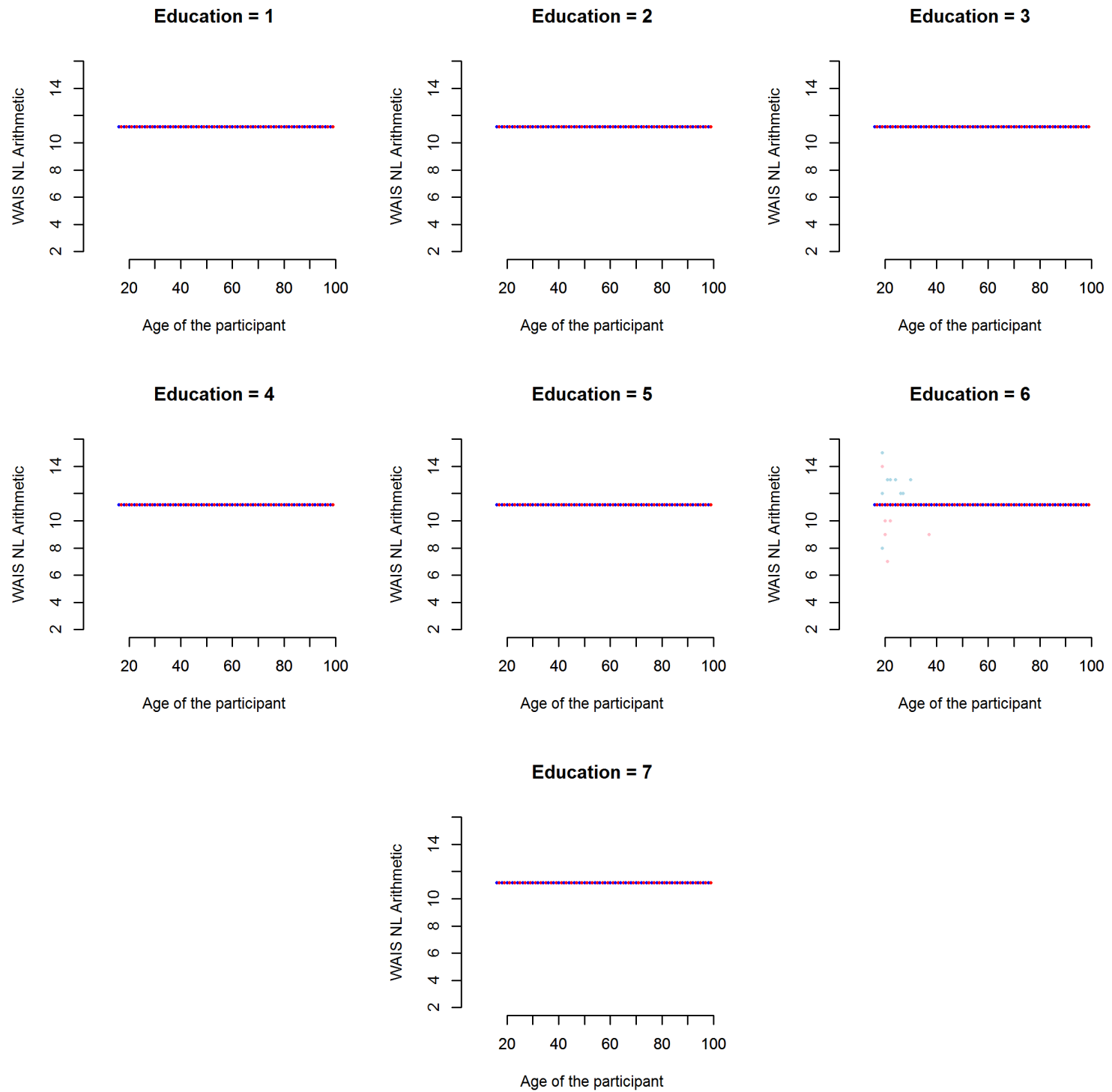
The table gives descriptives after outliers are removed on all WAIS-NL variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
WAIS NL Arithmetic	8	13	15	10	19-30	7	9	14	8	19-37
WAIS NL Block Design	20	26	26	9	19-30	20	24	26	7	19-22
WAIS NL Coding	31	58	82	70	19-70	37	61	90	178	19-69
WAIS NL Information	12	18	20	10	19-30	12	14	16	8	19-37
WAIS NL Picture Completion	8	14	16	10	19-30	5	10	16	8	19-37
WAIS NL Similarities	15	18	25	10	19-30	15	20	24	8	19-37

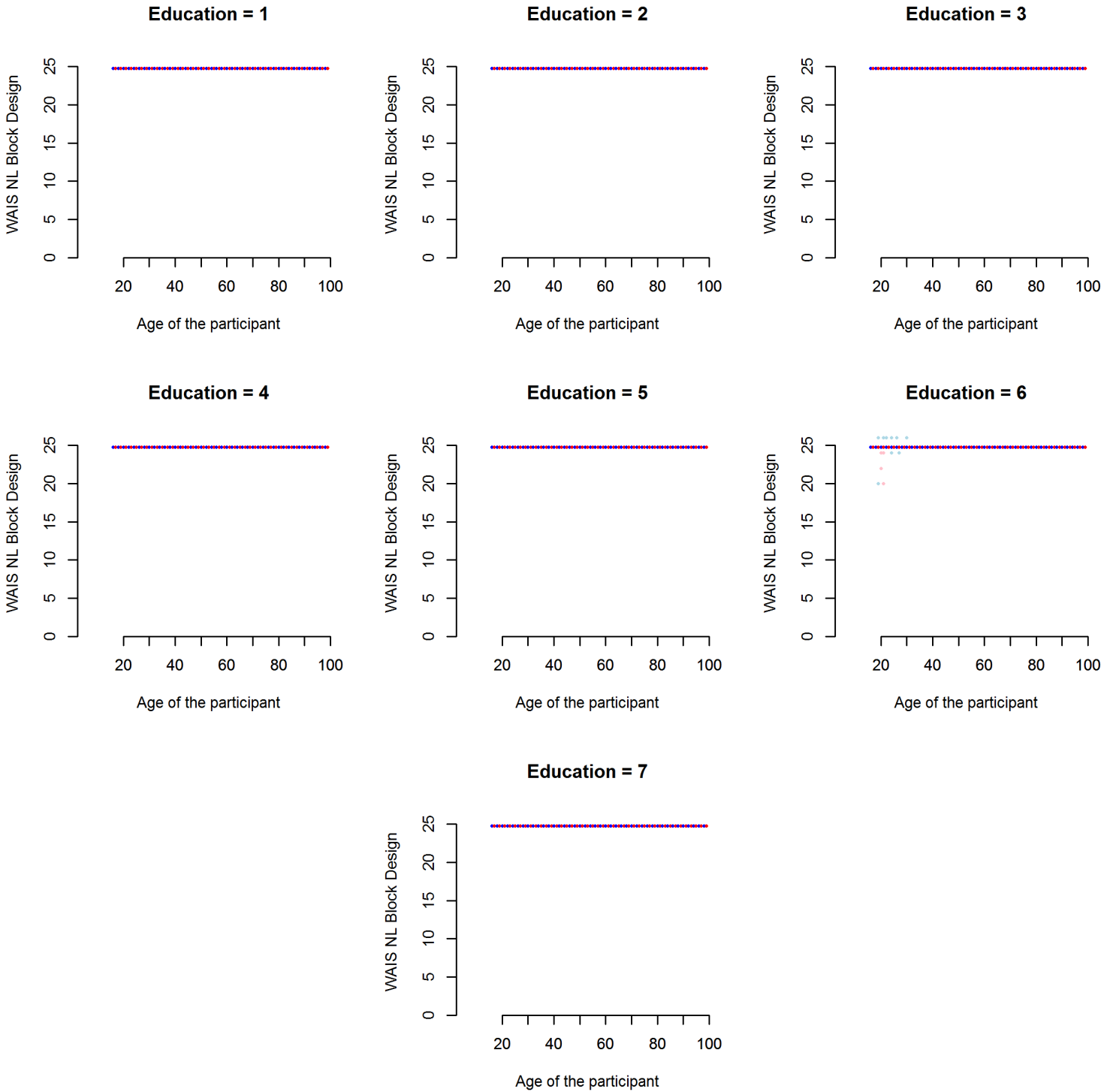
6.28.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. WAIS - NL - Arithmetic

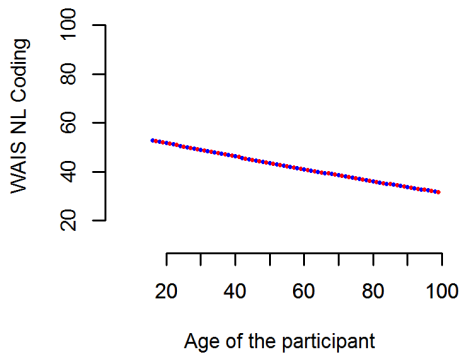


2. WAIS - NL - Block Design

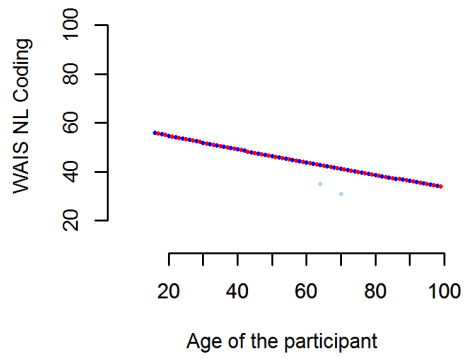


3. WAIS - NL - Coding

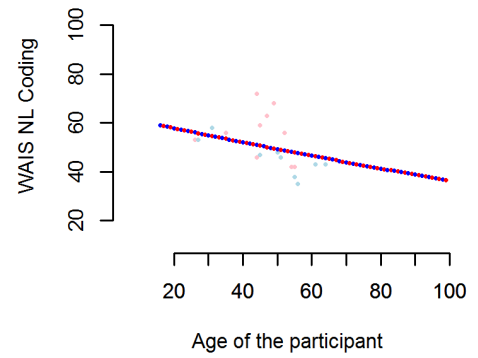
Education = 1



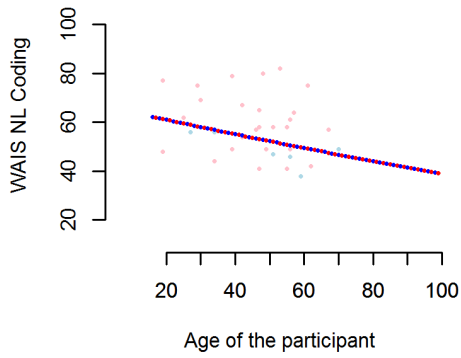
Education = 2



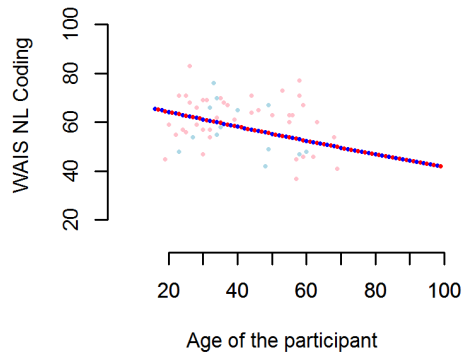
Education = 3



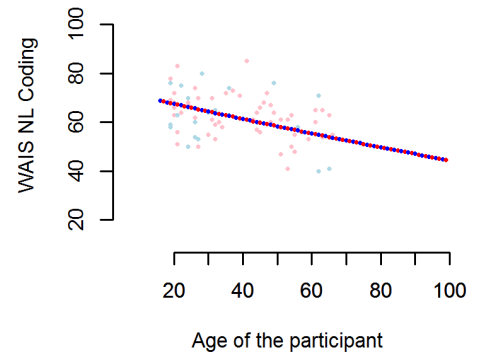
Education = 4



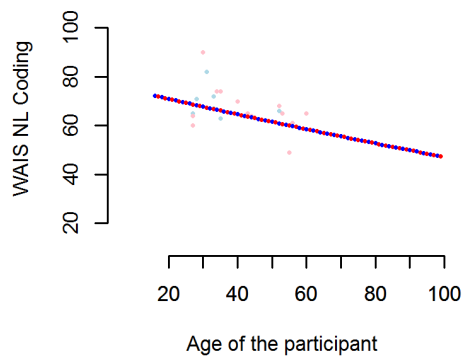
Education = 5



Education = 6

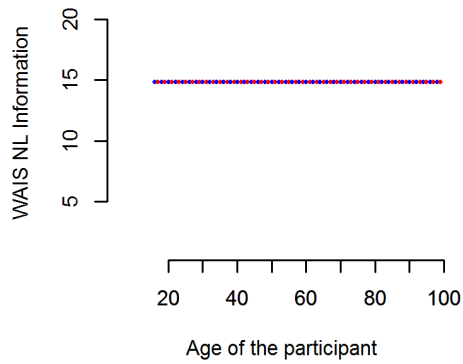


Education = 7

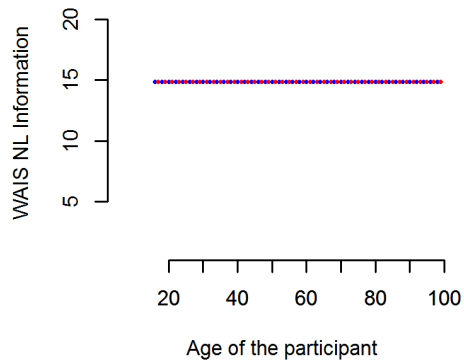


4. WAIS - NL - Information

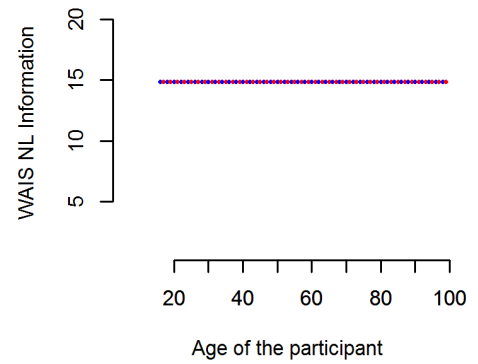
Education = 1



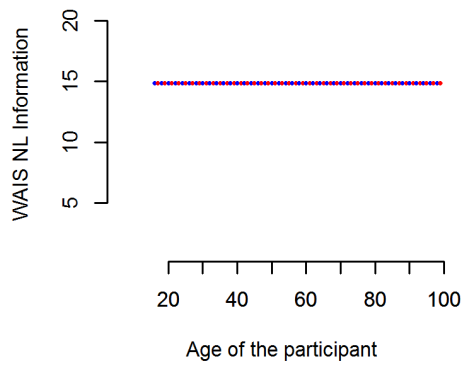
Education = 2



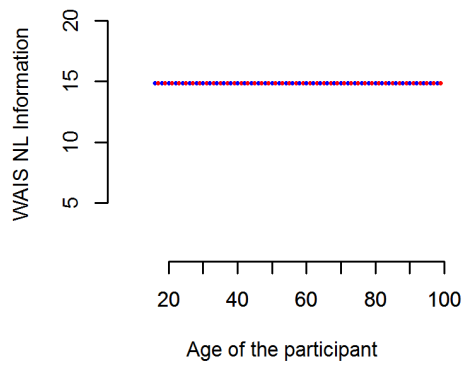
Education = 3



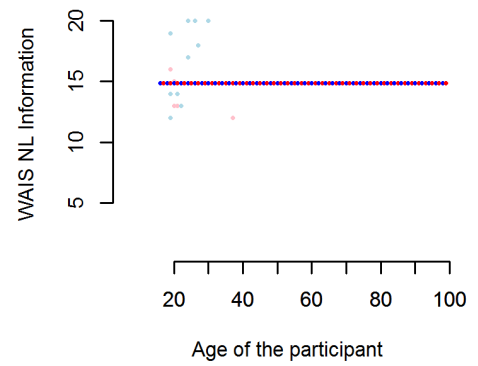
Education = 4



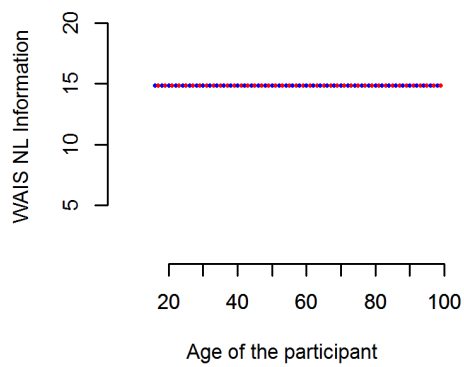
Education = 5



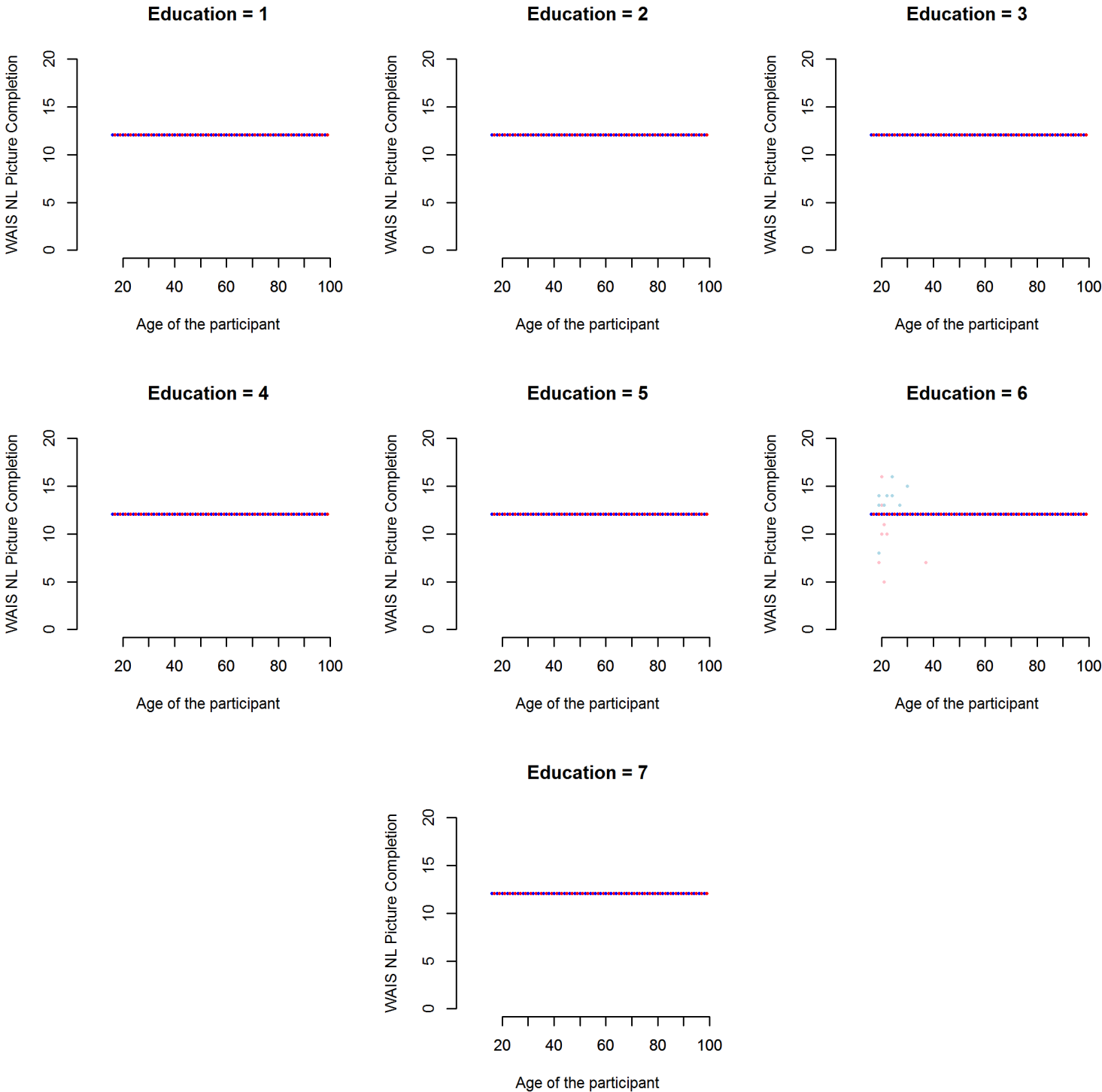
Education = 6



Education = 7

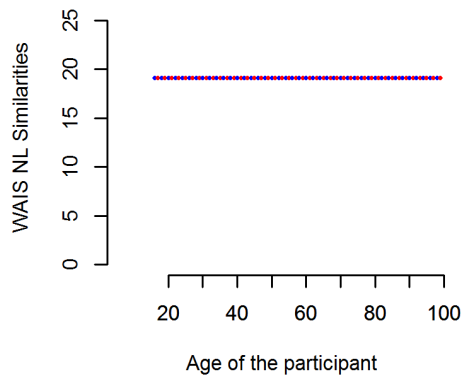


5. WAIS - NL - Picture Completion

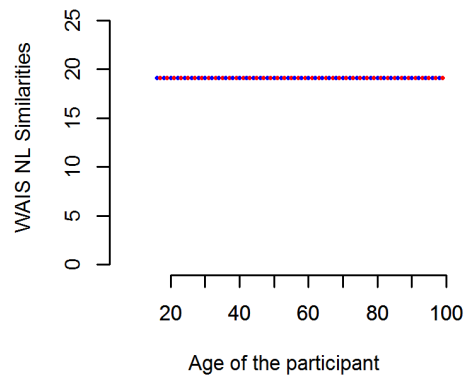


6. WAIS - NL - Similarities

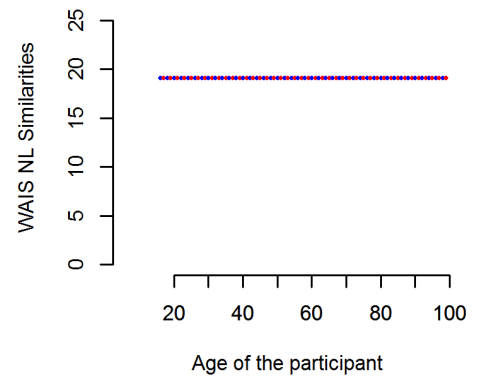
Education = 1



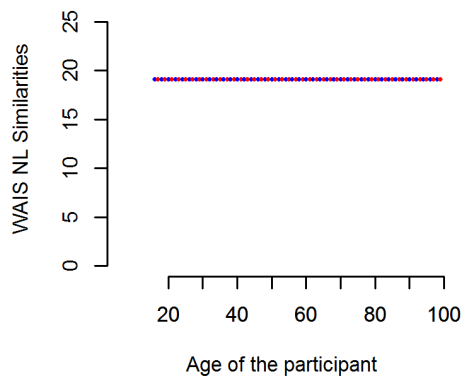
Education = 2



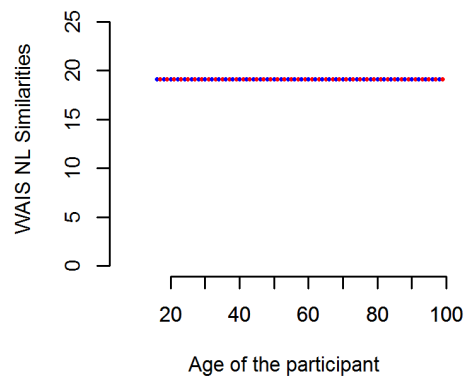
Education = 3



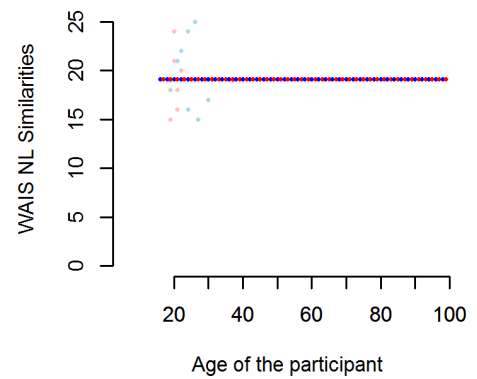
Education = 4



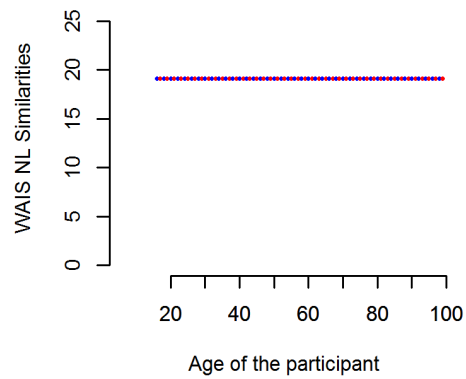
Education = 5



Education = 6



Education = 7



6.29 Wechsler Adult Intelligence Scale -R

6.29.1 Extreme Borders of the WAIS-R

The table shows extreme minimum and maximum scores on all WAIS-R variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
WAIS R Coding	1	93	0 %
WAIS R Digitspan	0	28	0 %

6.29.2 BIC Selection for WAIS-R

The table shows the selection of the effects of demographic variables for the WAIS-R.

Variable	Demographic Effects	BIC
WAIS R Coding	Initially included terms	
	s + a	320.62
	Dropped terms	
	s	318.08
	Terms in the final model	
WAIS R Digitspan	a	318.08
	Initially included terms	
	s + a + e + s*e	604.82
	Dropped terms	
	s*e	601.84
	s	596.9
	Terms in the final model	
	a + e	596.9

age = a, sex = s, education = e.

6.29.3 Best model fit of the WAIS-R

The table shows the terms of the best models for the WAIS-R variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
WAIS R Coding	a	0
WAIS R Digitspan	a + e	0

age = a, sex = s, education = e.

6.29.4 Box-Cox power transformation of the WAIS-R

The table shows the best Box-Cox power transformation for the WAIS-R variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
WAIS R Coding	0.801	0.106	2.822
WAIS R Digitspan	0.672	-0.105	2.73

6.29.5 Descriptive statistics for the WAIS-R

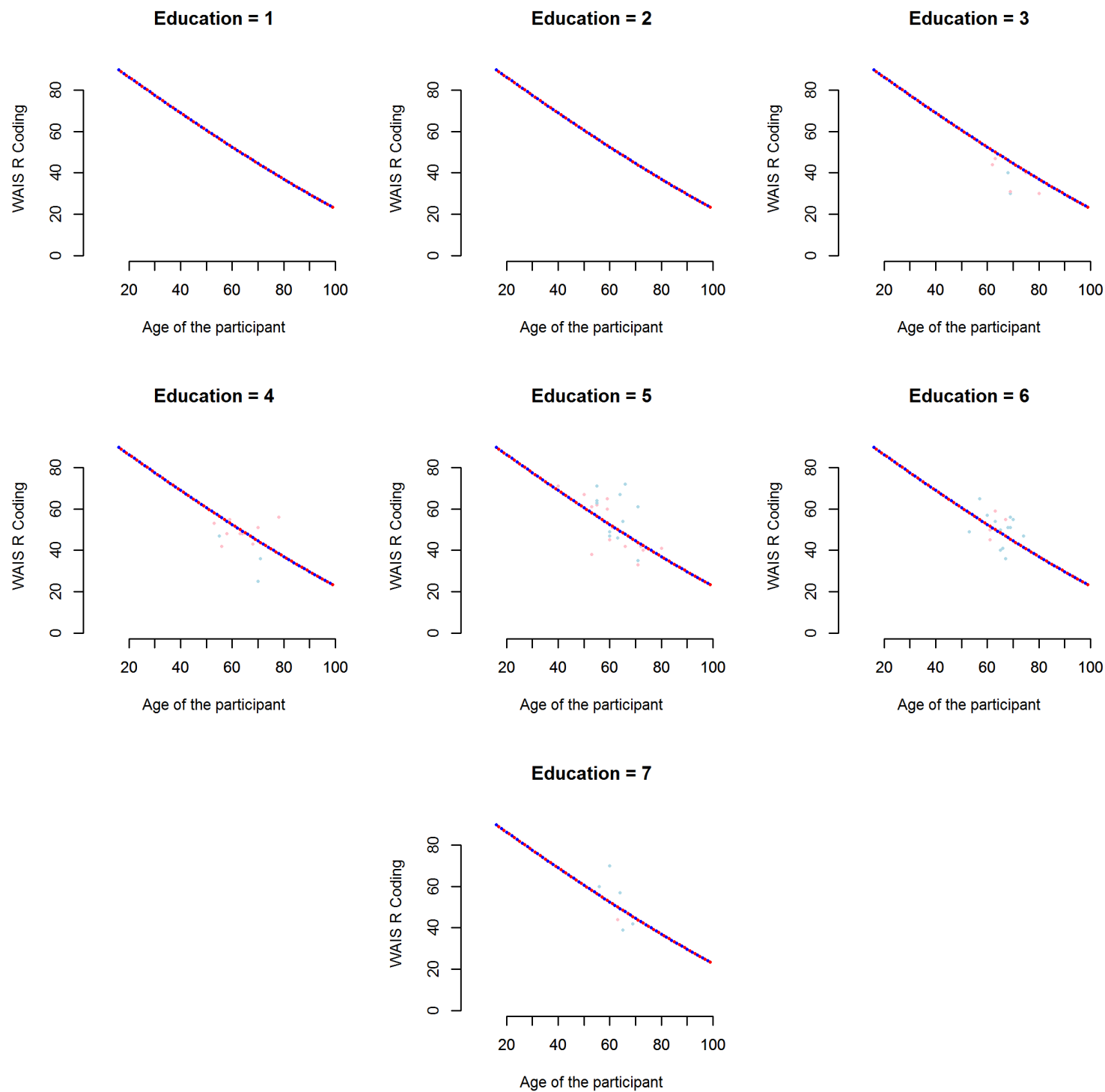
The table gives descriptives after outliers are removed on all WAIS-R variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
WAIS R Coding	25	51	72	37	53-74	30	48	71	33	40-80
WAIS R Digitspan	6	14	22	131	18-80	5	13	21	117	17-77

6.29.6 Plots with raw data points and back-transformed predicted data points

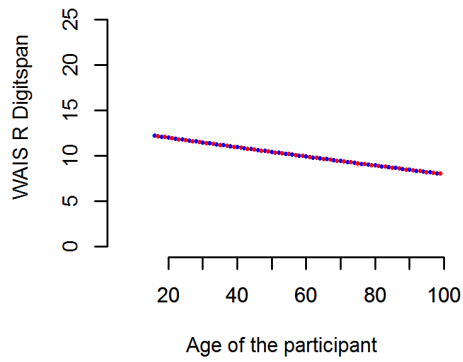
These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. WAIS - R - Coding

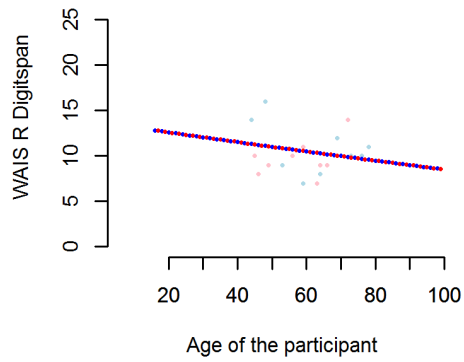


2. WAIS - R - Digitspan

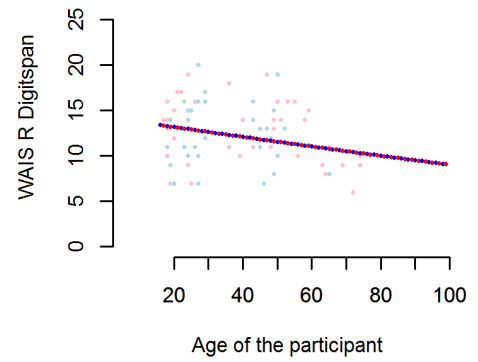
Education = 1



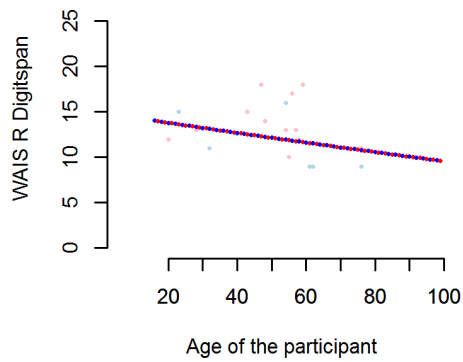
Education = 2



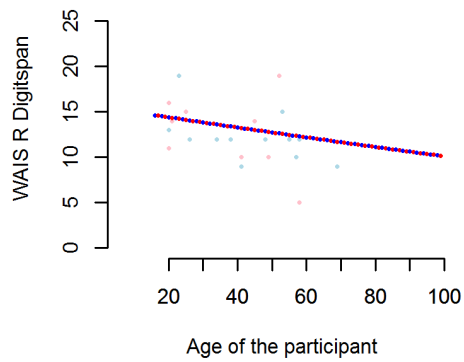
Education = 3



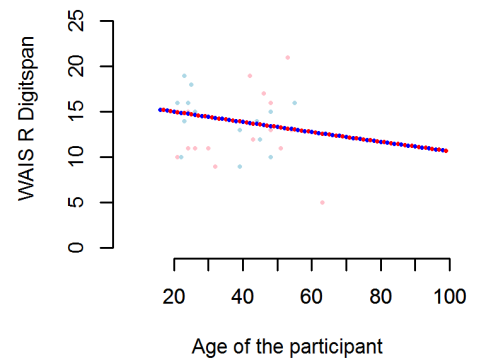
Education = 4



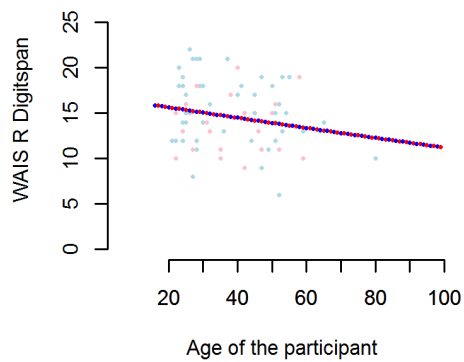
Education = 5



Education = 6



Education = 7



6.30 Wechsler Adult Intelligence Scale - III

6.30.1 Extreme Borders of the WAIS-III

The table shows extreme minimum and maximum scores on all WAIS-III variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
WAIS III Arithmetic	0	22	0 %
WAIS III BlockDesign	2	68	0 %
WAIS III Coding	10	133	0.001 %
WAIS III Comprehension	4	33	0 %
WAIS III Digitspan	4	30	0 %
WAIS III Information	2	28	0.001 %
WAIS III Matrix Reasoning	2	26	0 %
WAIS III Object Assembly	1	52	0 %
WAIS III Picture Arrangement	1	22	0 %
WAIS III Picture Completion	4	25	0 %
WAIS III Similarities	4	33	0 %
WAIS III Symbol Search	4	60	0 %
WAIS III Vocabulary	7	66	0 %
WAIS III Letter Number Sequencing	3	21	0.005 %

6.30.2 BIC Selection for WAIS-III

The table shows the selection of the effects of demographic variables for the WAIS-III.

Variable	Demographic Effects	BIC
WAIS III Arithmetic	Initially included terms	
	$s + a + e + s*e$	8570.94
	Dropped terms	
	$s*e$	8564.17
	a	8558.51
WAIS III BlockDesign	Terms in the final model	
	$s + e$	8558.51
	Initially included terms	
	$s + e + s*e$	13288.54
	Dropped terms	
WAIS III Coding	$s*e$	13281.84
	Terms in the final model	
	$s + e$	13281.84
	Initially included terms	
	$s + a + e + s*a + s*e$	13668.07
WAIS III Comprehension	Dropped terms	
	$s*a$	13661.44
	$s*e$	13654.67
	Terms in the final model	
	$s + a + e$	13654.67
WAIS III Digitspan	Initially included terms	
	s	486.66
	Dropped terms	
	s	482.79
	Terms in the final model	
WAIS III Information	None	482.79
	Initially included terms	
	$s + a$	979.5
	Dropped terms	
	s	975.1
WAIS III Matrix Reasoning	Terms in the final model	
	a	975.1
	Initially included terms	
	$s + e + s*e$	8724.16
	Dropped terms	
WAIS III Object Assembly	$s*e$	8716.85
	Terms in the final model	
	$s + e$	8716.85
	Initially included terms	
	s	938.32
WAIS III Picture Arrangement	Dropped terms	
	s	934.01
	Terms in the final model	
	None	934.01
	Initially included terms	
WAIS III Picture Completion	s	260.04
	Dropped terms	
	s	256.71
	Terms in the final model	
	None	256.71
WAIS III Picture Completion	Initially included terms	
	s	722.15
	Dropped terms	
	s	719.79
	Terms in the final model	
WAIS III Picture Completion	None	719.79
	Initially included terms	
	s	574.87
	Dropped terms	
	s	570.92
WAIS III Picture Completion	Terms in the final model	
	None	570.92

6.30.3 Best model fit of the WAIS-III

The table shows the terms of the best models for the WAIS-III variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
WAIS III Arithmetic	s + e	0
WAIS III BlockDesign	s + e	0
WAIS III Coding	s + a + e	4
WAIS III Comprehension		0
WAIS III Digitspan	a	1
WAIS III Information	s + e	1
WAIS III Matrix Reasoning		0
WAIS III Object Assembly		0
WAIS III Picture Arrangement		0
WAIS III Picture Completion		6
WAIS III Similarities	e	3
WAIS III Symbol Search		0
WAIS III Vocabulary	e	0
WAIS III Letter Number Sequencing	e	4

age = a, sex = s, education = e.

6.30.4 Box-Cox power transformation of the WAIS-III

The table shows the best Box-Cox power transformation for the WAIS-III variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
WAIS III Arithmetic	1.32	-0.094	2.504
WAIS III BlockDesign	1.42	-0.219	2.22
WAIS III Coding	1.05	-0.072	2.874
WAIS III Comprehension	1.7	-0.131	2.087
WAIS III Digitspan	0.5	0.06	2.944
WAIS III Information	1.11	0.053	2.865
WAIS III Matrix Reasoning	2.14	-0.355	2.521
WAIS III Object Assembly	2	-0.287	1.84
WAIS III Picture Arrangement	1	-0.038	2.615
WAIS III Picture Completion	3.04	0.08	2.891
WAIS III Similarities	1.92	-0.167	2.648
WAIS III Symbol Search	0.92	-0.019	2.703
WAIS III Vocabulary	1.63	0.119	2.835
WAIS III Letter Number Sequencing	0.86	-0.041	3.101

6.30.5 Descriptive statistics for the WAIS-III

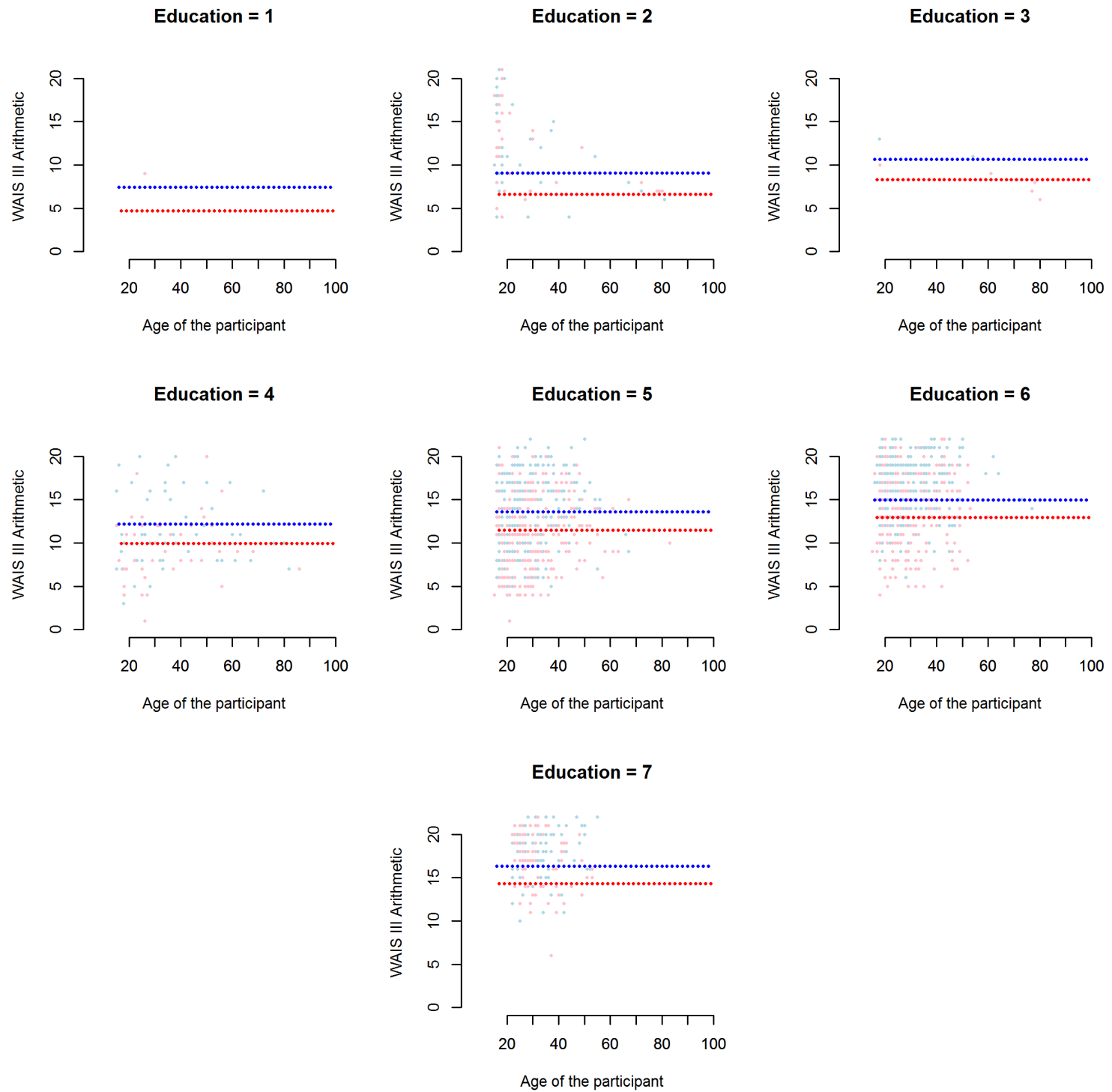
The table gives descriptives after outliers are removed on all WAIS-III variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
WAIS III Arithmetic	3	16	22	715	15-82	1	13	22	809	15-86
WAIS III BlockDesign	4	49	68	755	15-67	2	47	68	868	15-67
WAIS III Coding	23	77	116	801	15-92	20	83	133	877	15-90
WAIS III Comprehension	15	24	31	34	20-67	12	24	32	47	18-67
WAIS III Digitspan	8	14	26	55	17-91	8	15	24	130	17-91
WAIS III Information	4	19	28	695	15-67	4	16	28	798	15-67
WAIS III Matrix Reasoning	6	19	26	53	20-67	5	19	26	101	18-67
WAIS III Object Assembly	19	38	47	14	22-59	18	39	47	20	18-61
WAIS III Picture Arrangement	4	14	22	38	17-67	2	12	21	87	17-67
WAIS III Picture Completion	17	21	25	32	20-67	16	21	25	83	17-67
WAIS III Similarities	9	24	33	100	20-74	10	25	33	174	17-80
WAIS III Symbol Search	12	34	52	38	17-67	15	33	54	47	18-67
WAIS III Vocabulary	14	46	63	94	17-67	17	46	64	117	18-67
WAIS III Letter Number Sequencing	5	10	17	144	20-73	4	10	17	240	18-86

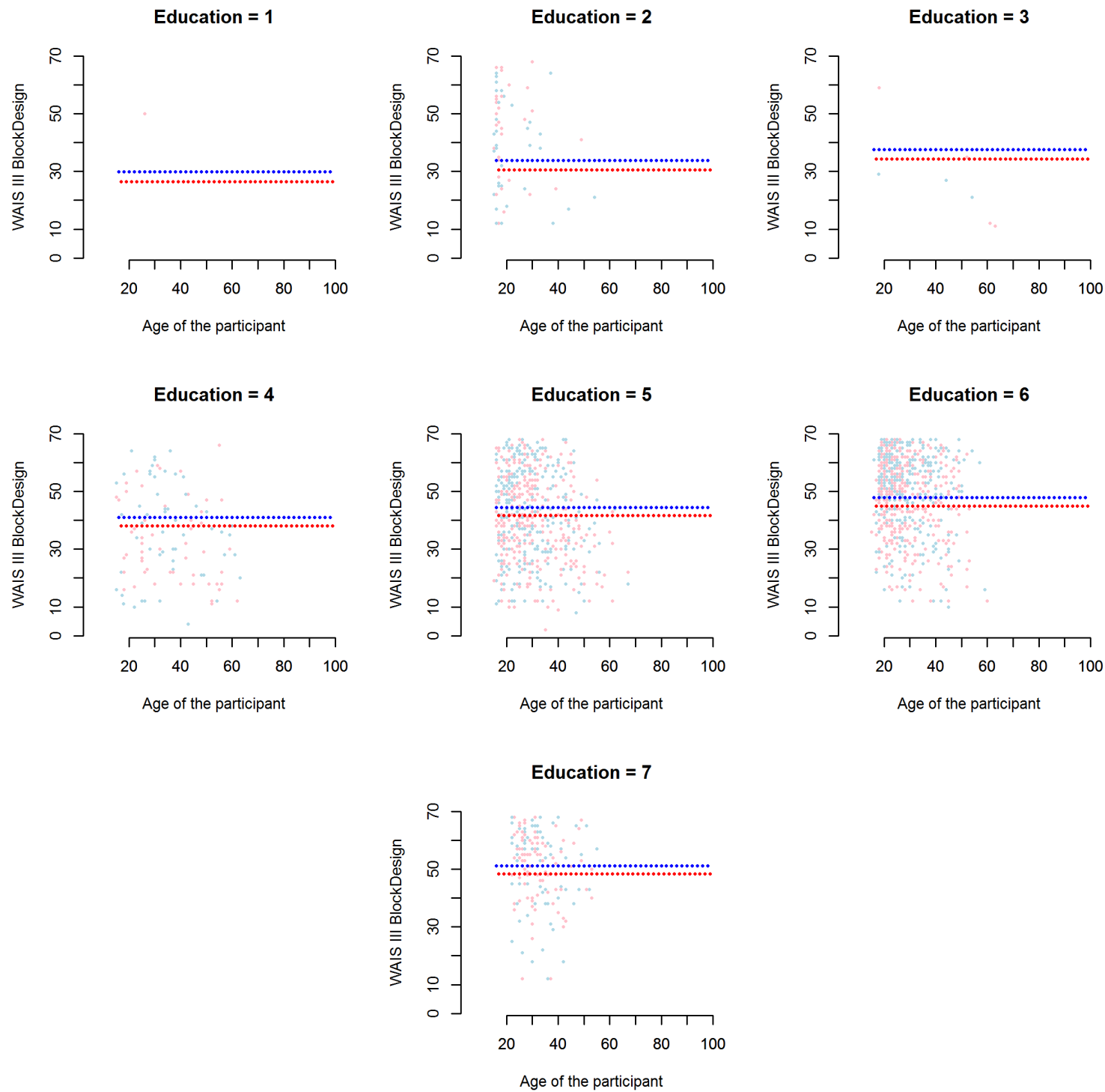
6.30.6 Plots with raw data points and back-transformed predicted data points

These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. WAIS - III - Arithmetic

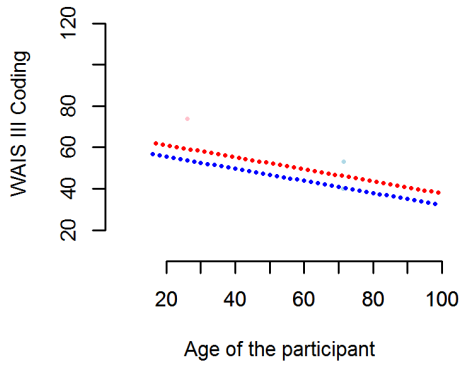


2. WAIS - III - Block design

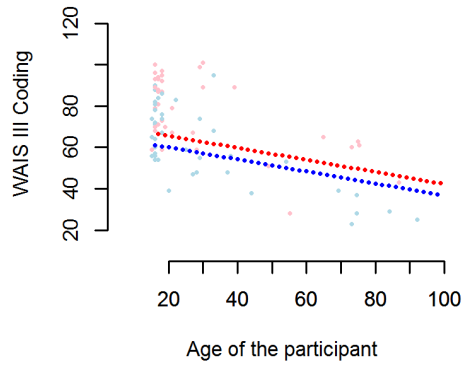


3. WAIS - III - Coding

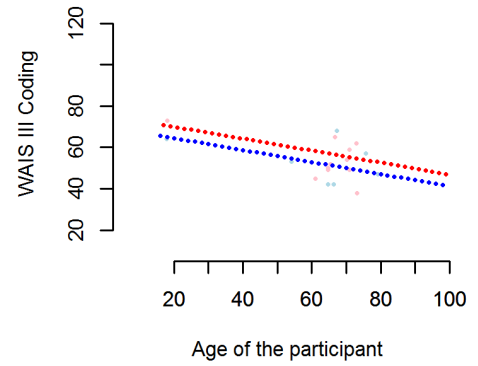
Education = 1



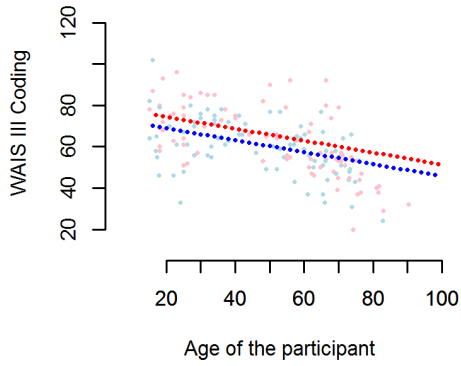
Education = 2



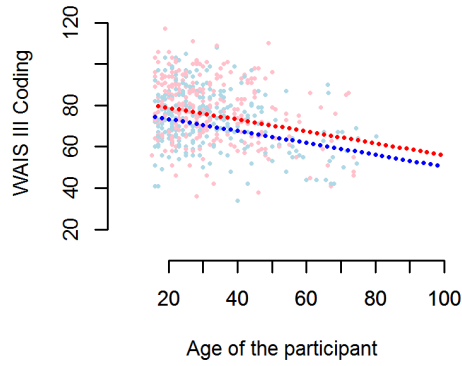
Education = 3



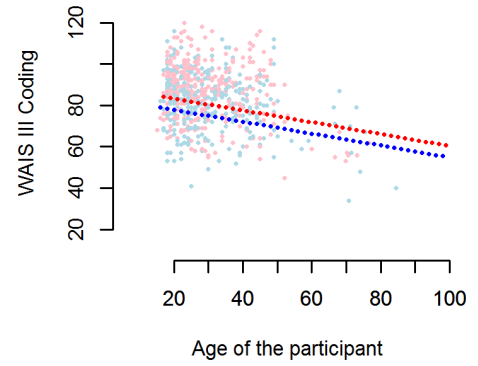
Education = 4



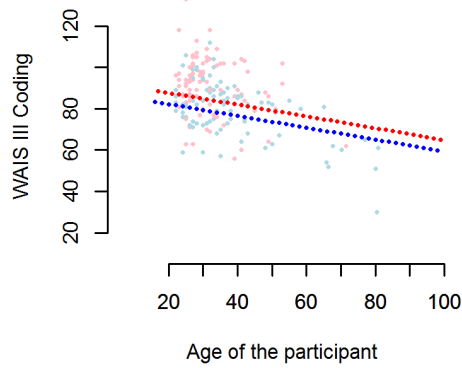
Education = 5



Education = 6

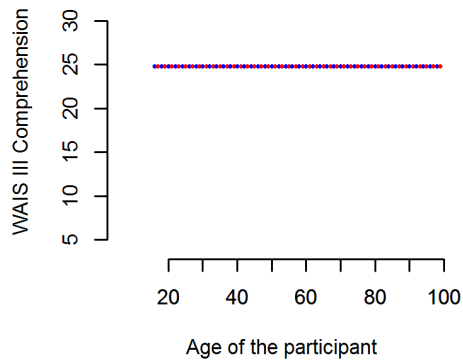


Education = 7

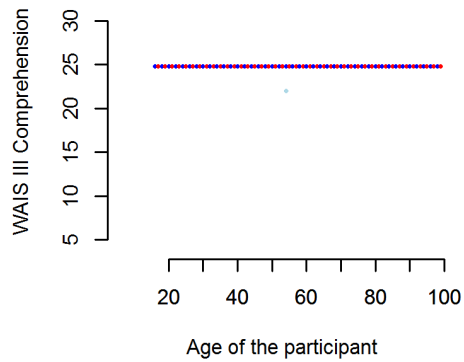


4. WAIS - III - Comprehension

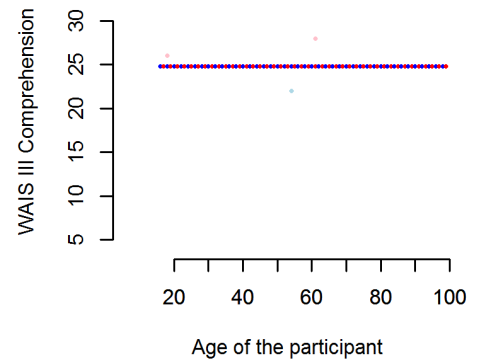
Education = 1



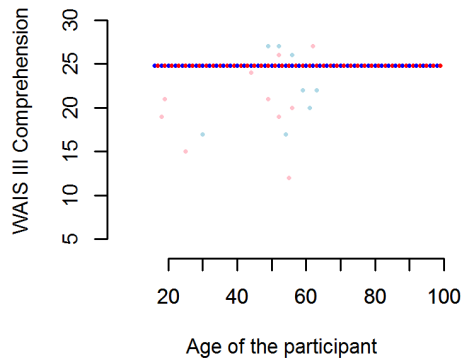
Education = 2



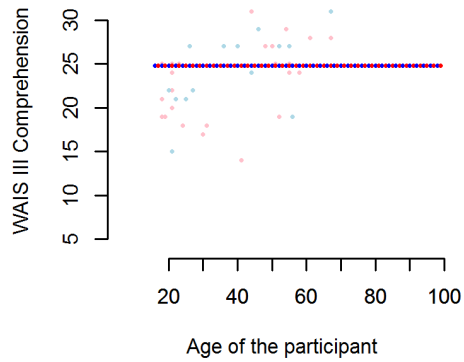
Education = 3



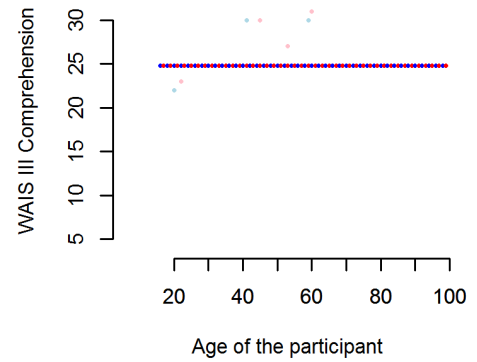
Education = 4



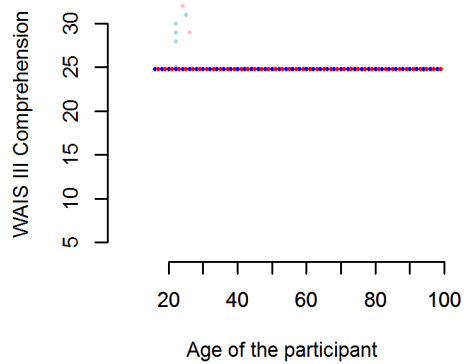
Education = 5



Education = 6

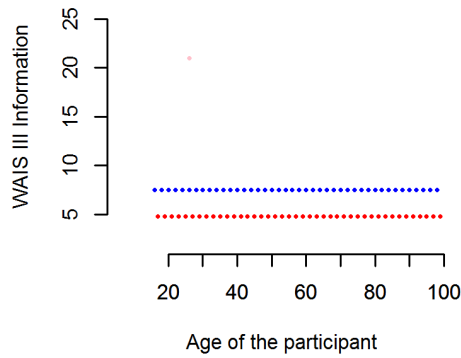


Education = 7

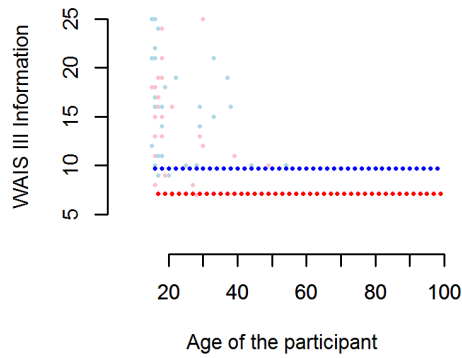


5. WAIS - III - Information

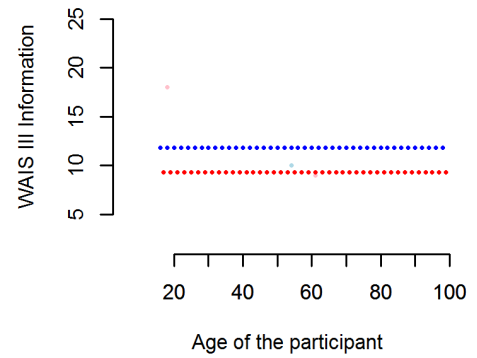
Education = 1



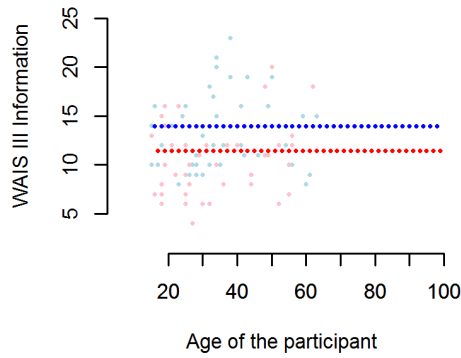
Education = 2



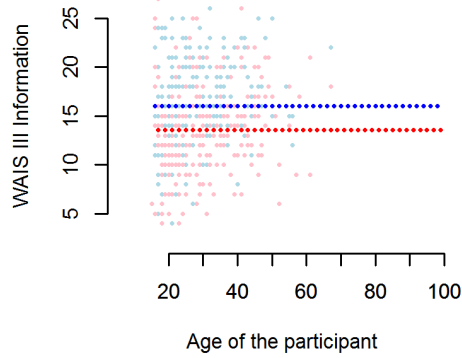
Education = 3



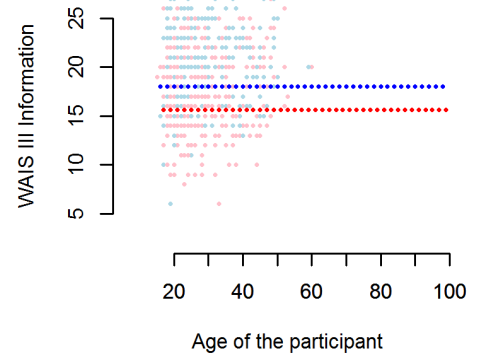
Education = 4



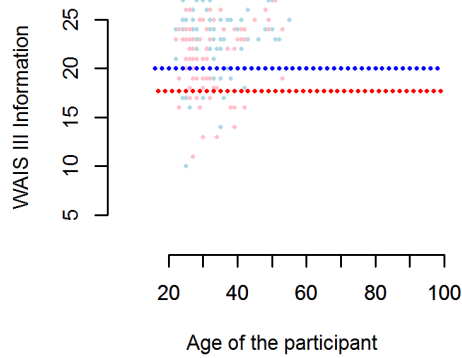
Education = 5



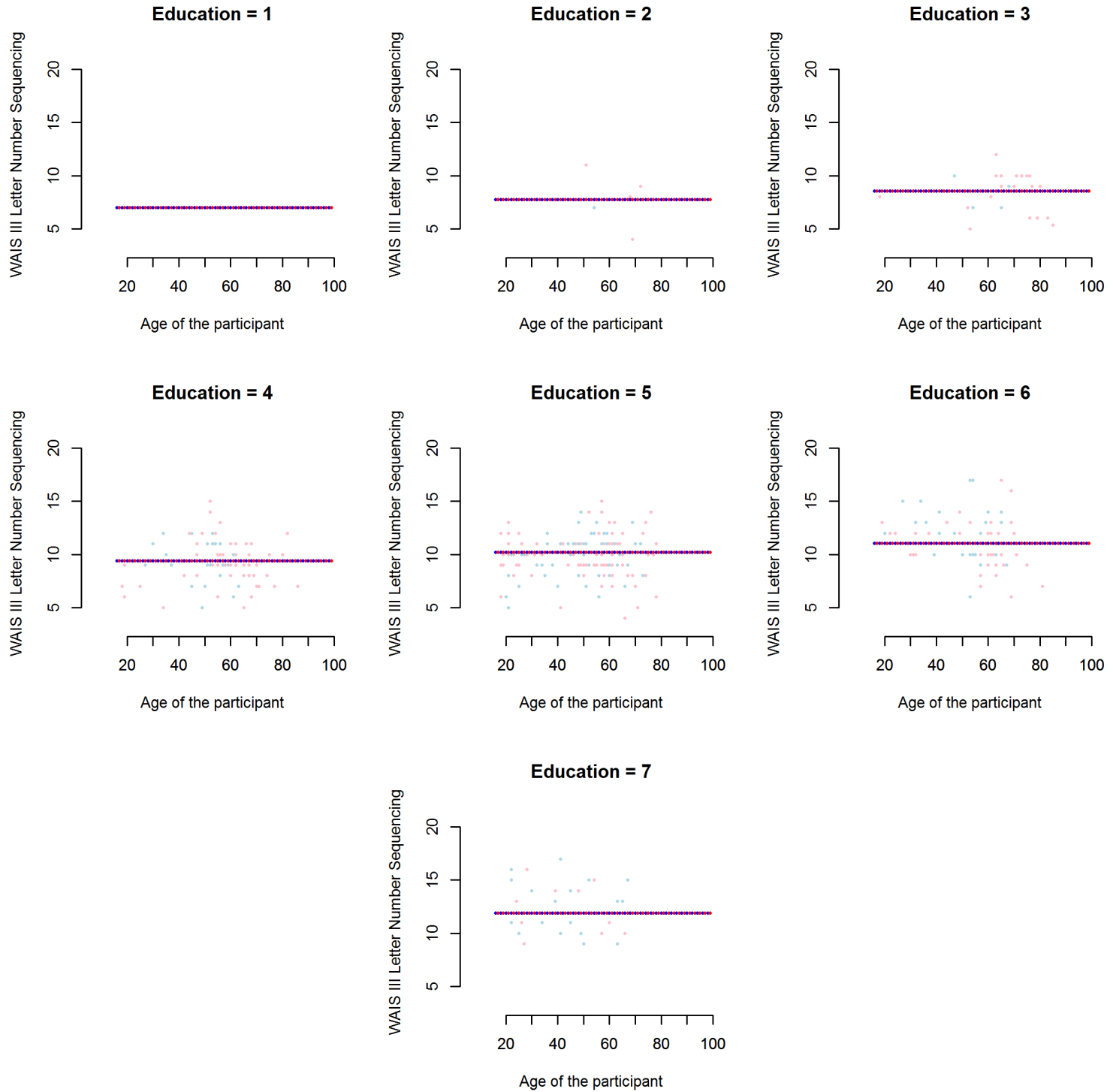
Education = 6



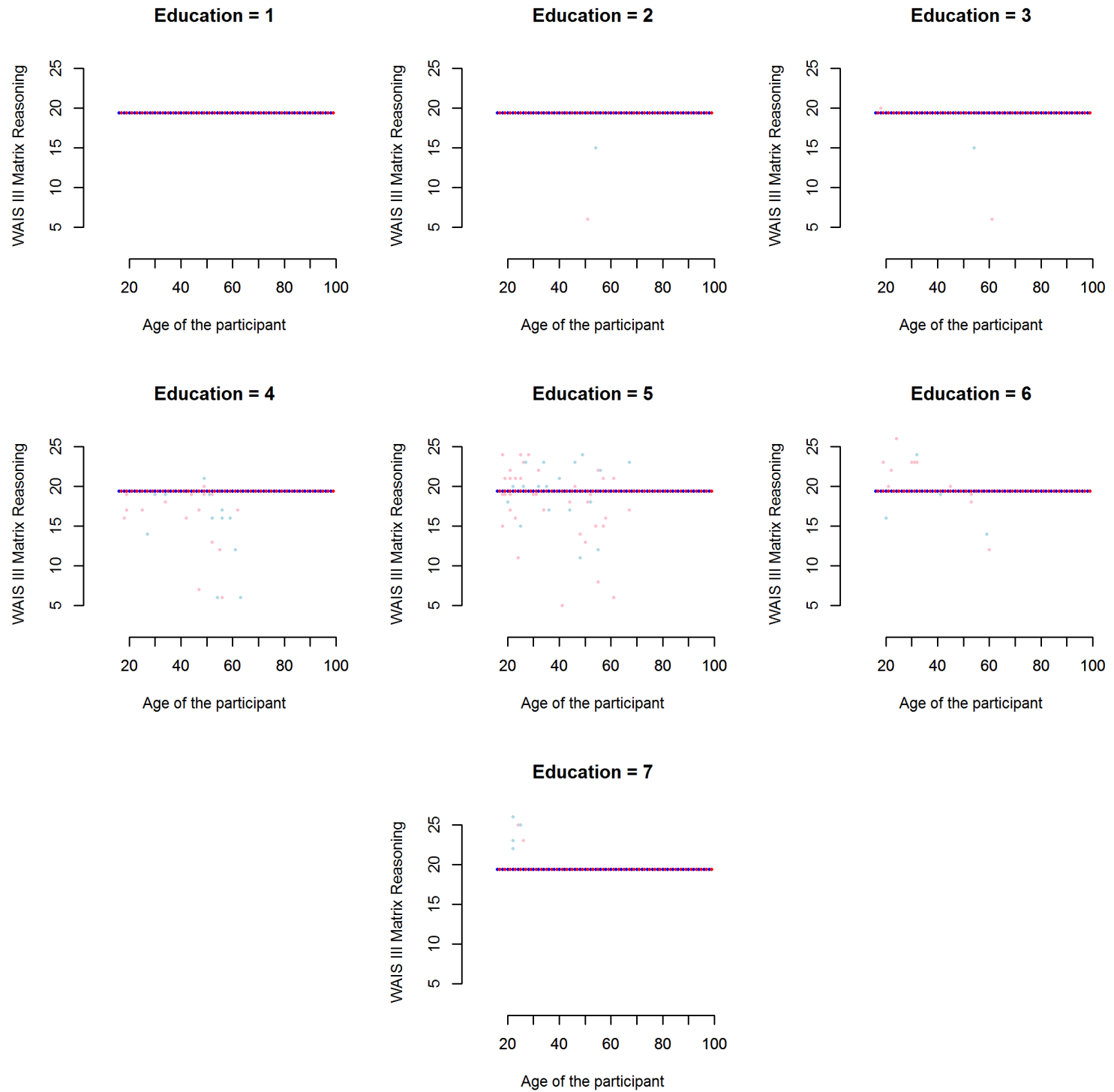
Education = 7



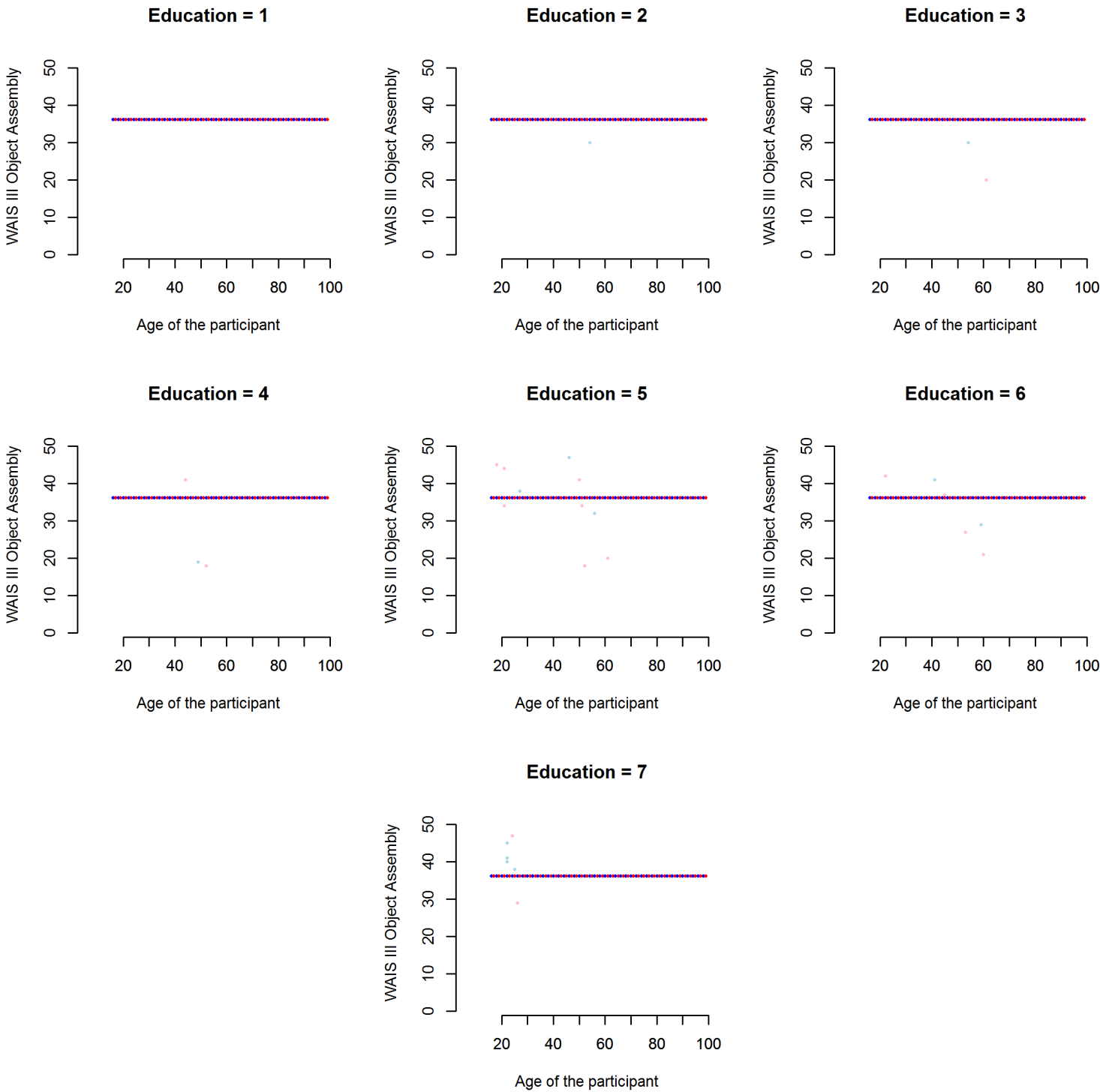
6. WAIS - III - Letter number sequencing



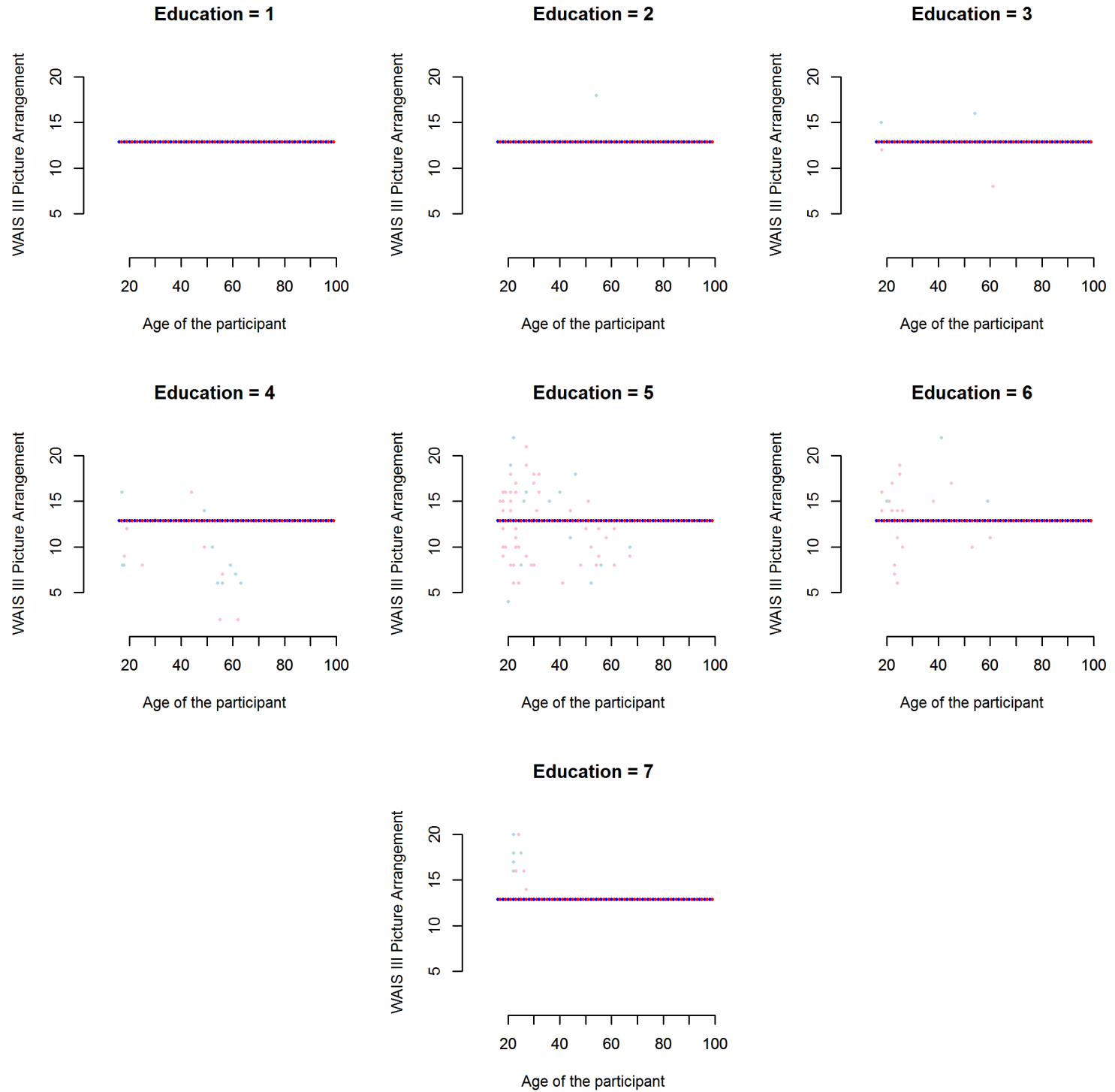
7. WAIS - III - Matrix reasoning



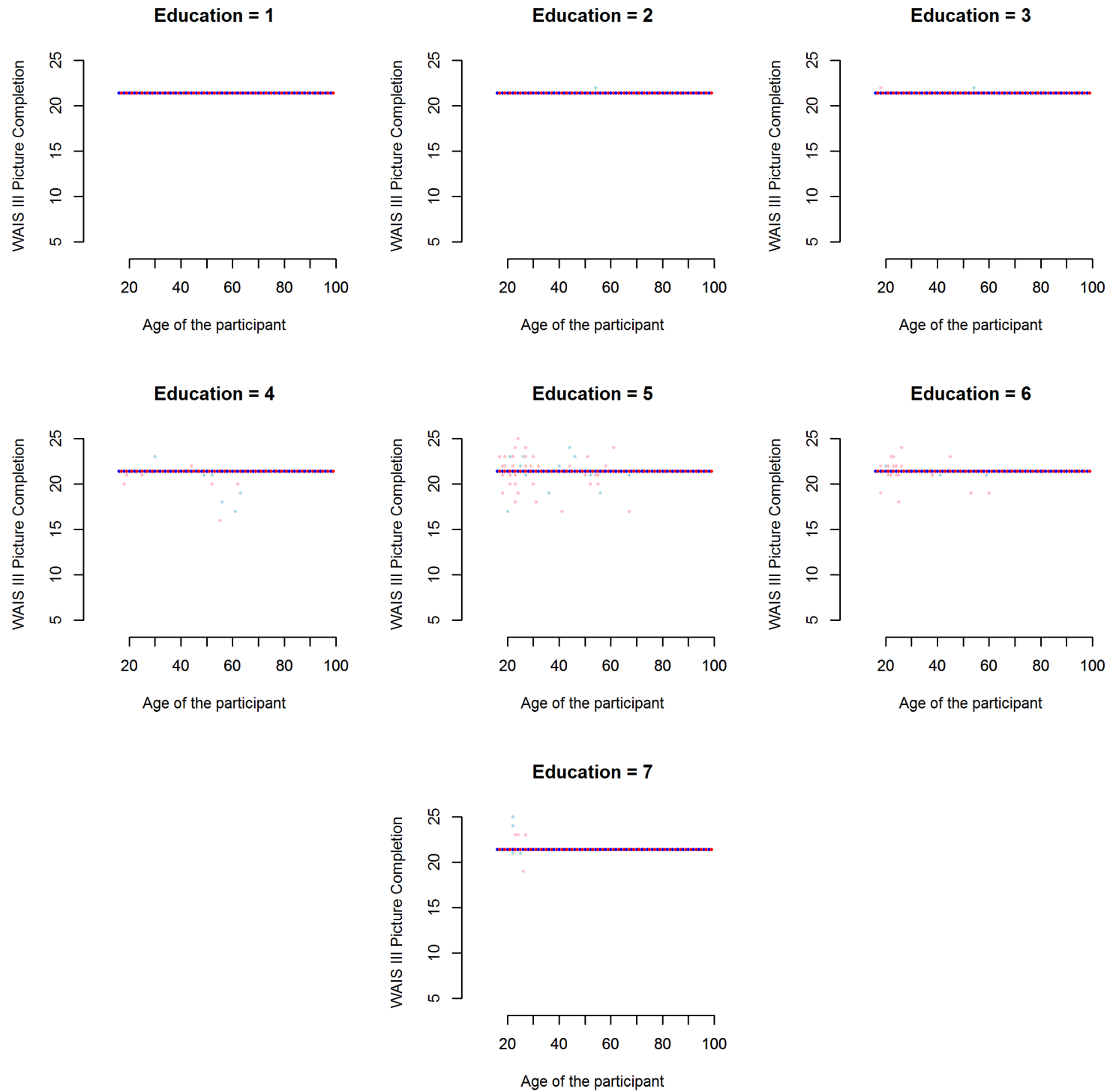
8. WAIS - III - Object assembly



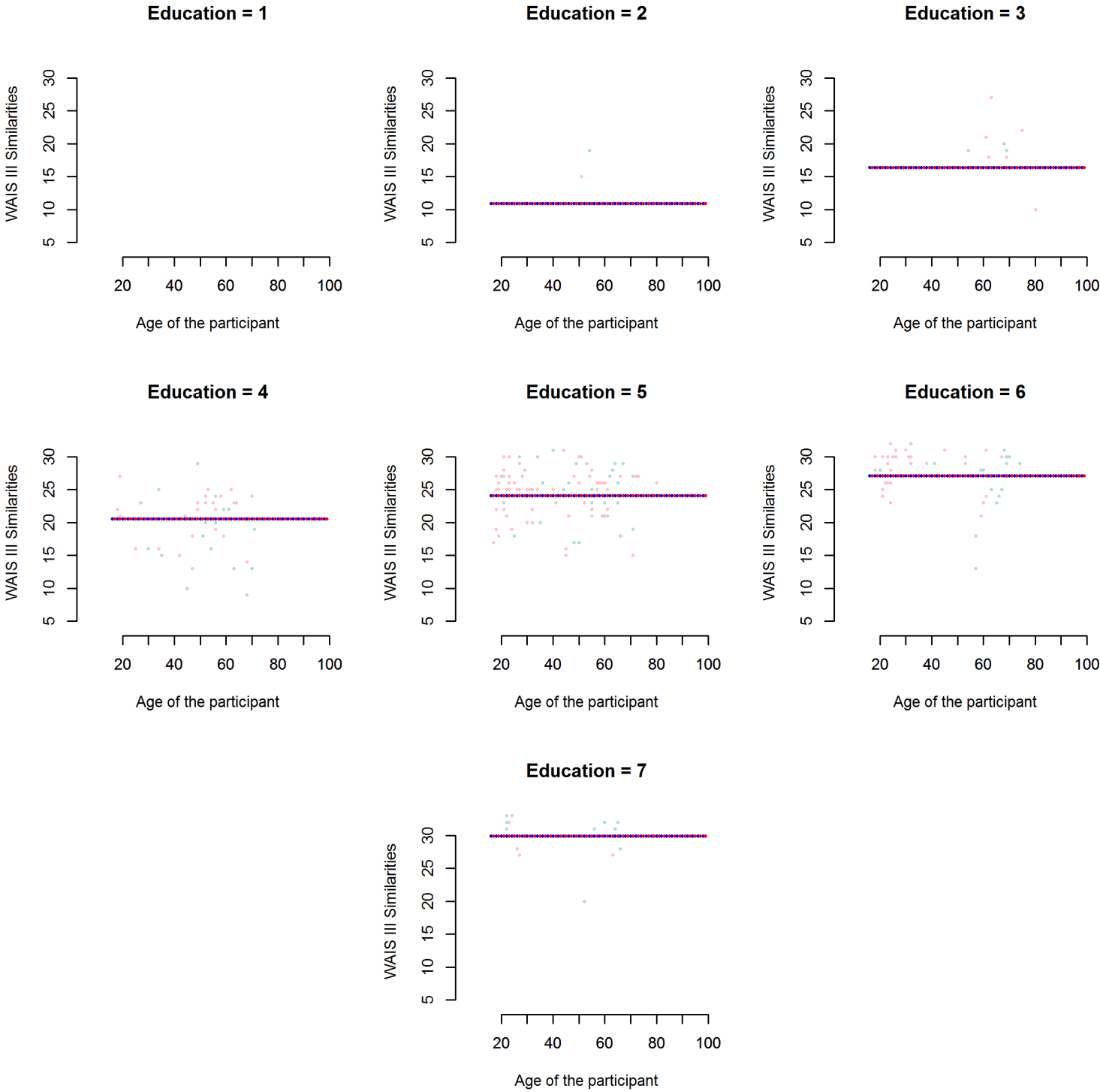
9. WAIS - III - Picture Arrangement



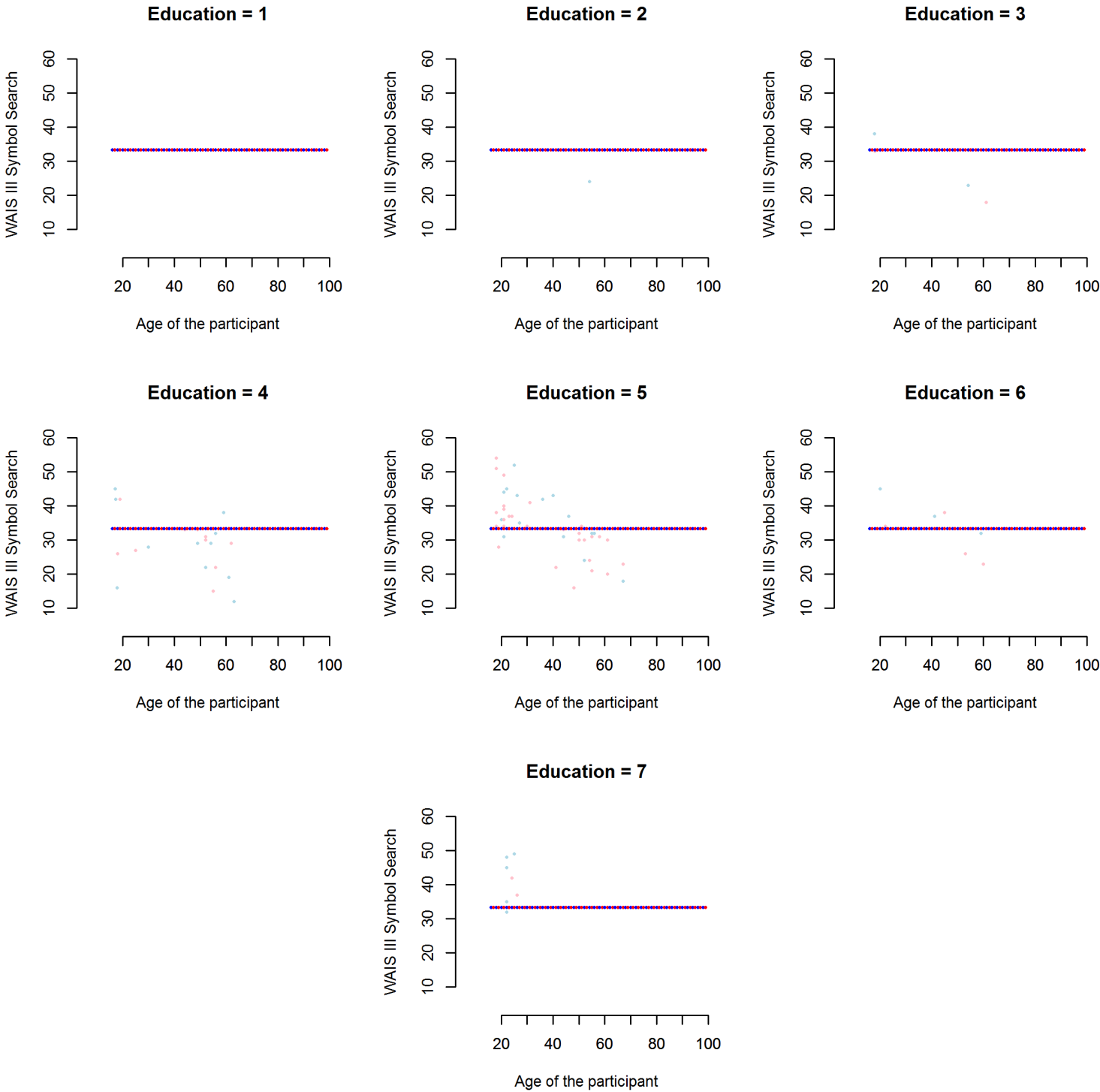
10. WAIS - III - Picture Completion



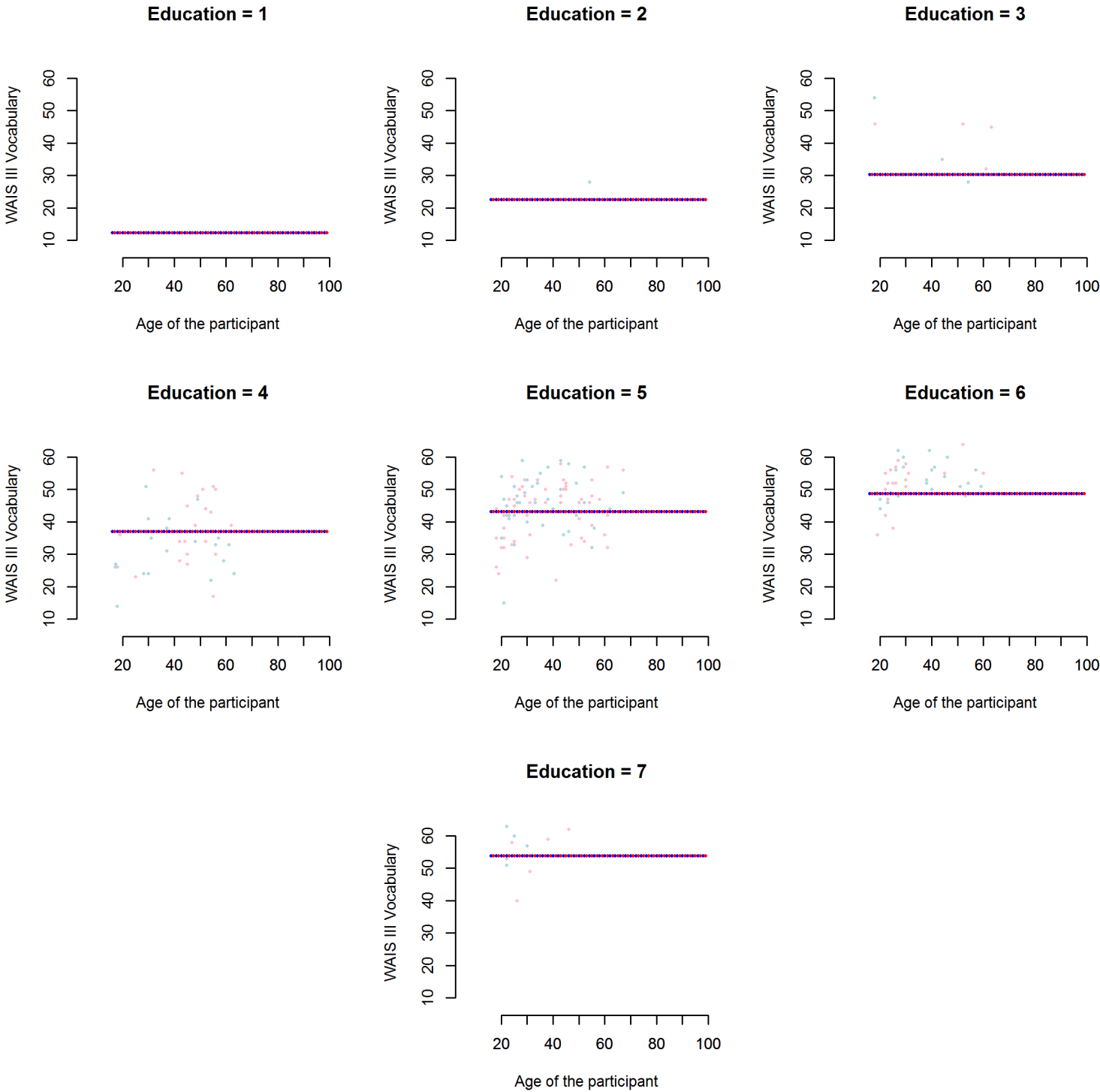
11. WAIS - III - Similarities



12. WAIS - III - Symbol Search

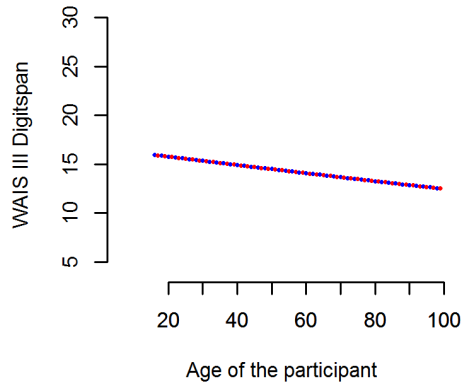


13. WAIS - III - Vocabulary

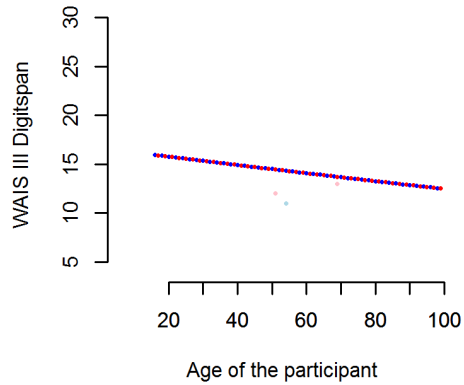


14. WAIS - III - Digitspan

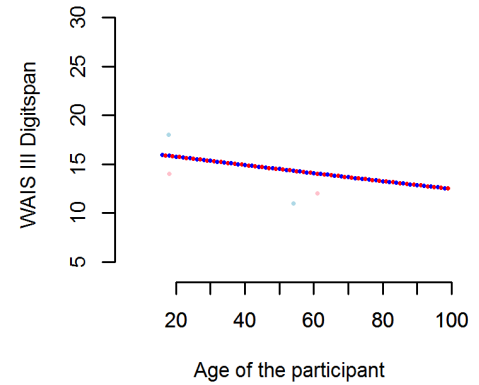
Education = 1



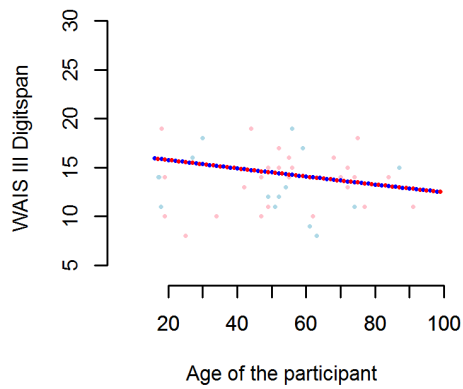
Education = 2



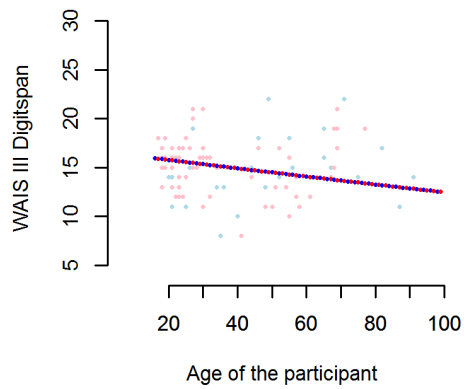
Education = 3



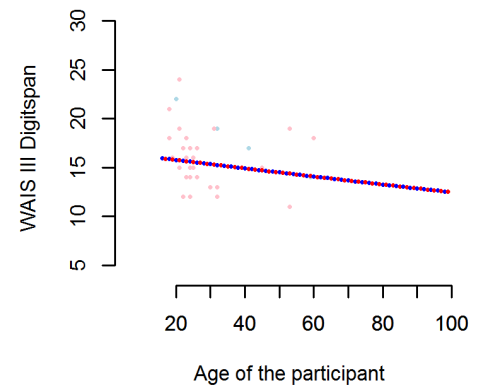
Education = 4



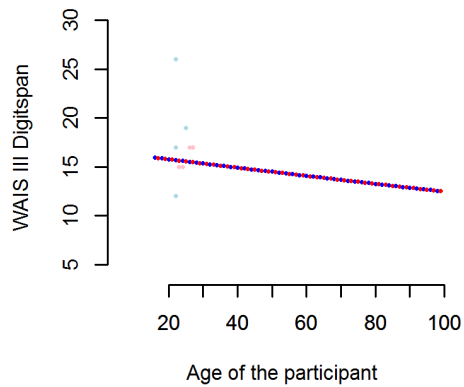
Education = 5



Education = 6



Education = 7



6.31 Wechsler Adult Intelligence Scale - IV

6.31.1 Extreme Borders of the WAIS-IV

The table shows extreme minimum and maximum scores on all WAIS-IV variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
WAIS IV Picture Completion	0	24	0 %
WAIS IV Digitspan	7	48	0 %

6.31.2 BIC Selection for WAIS-IV

The table shows the selection of the effects of demographic variables for the WAIS-IV.

Variable	Demographic Effects	BIC
WAIS IV Picture Completion	Initially included terms	
	s	86.76
	Dropped terms	
	s	84.88
	Terms in the final model	
WAIS IV Digitspan	None	84.88
	Initially included terms	
	None	83.73
	Terms in the final model	
	None	83.73

age = a, sex = s, education = e.

6.31.3 Best model fit of the WAIS-IV

The table shows the terms of the best models for the WAIS-IV variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
WAIS IV Picture Completion		0
WAIS IV Digitspan		2

age = a, sex = s, education = e.

6.31.4 Box-Cox power transformation of the WAIS-IV

The table shows the best Box-Cox power transformation for the WAIS-IV variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
WAIS IV Picture Completion	1.277	-0.004	3.065
WAIS IV Digitspan	1.526	-0.009	3.095

6.31.5 Descriptive statistics for the WAIS-IV

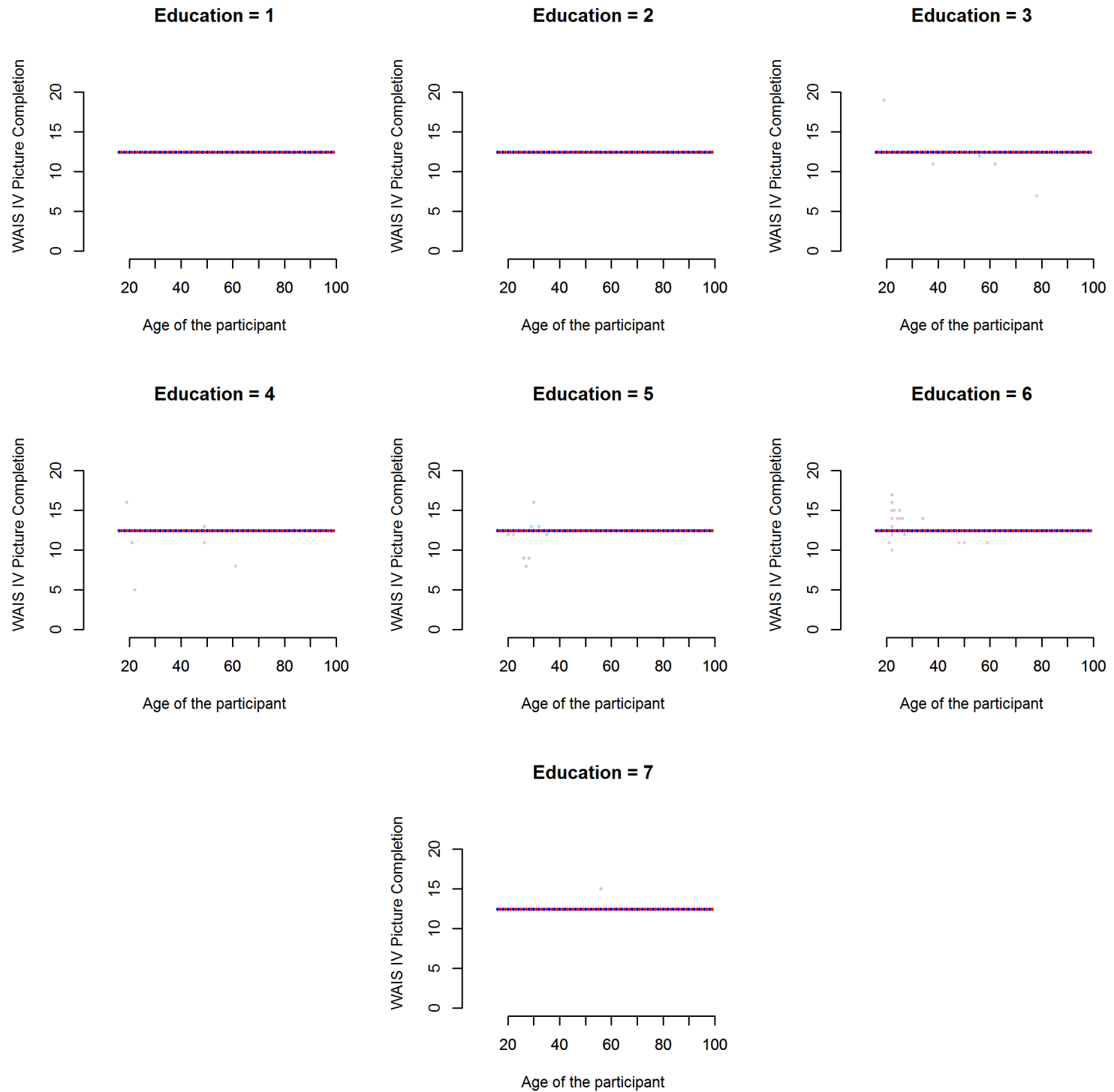
The table gives descriptives after outliers are removed on all WAIS-IV variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
WAIS IV Picture Completion	5	13	19	24	19-62	7	11	15	15	21-78
WAIS IV Digitspan	17	24	28	8	65-91	17	26	33	15	68-91

6.31.6 Plots with raw data points and back-transformed predicted data points

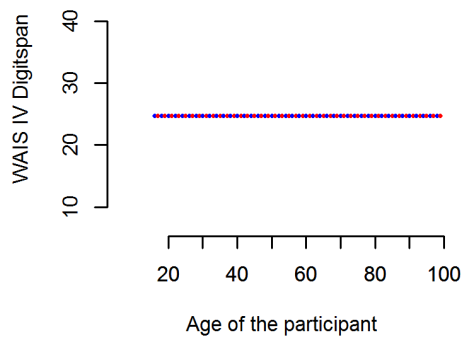
These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. WAIS - IV - Picture Completion

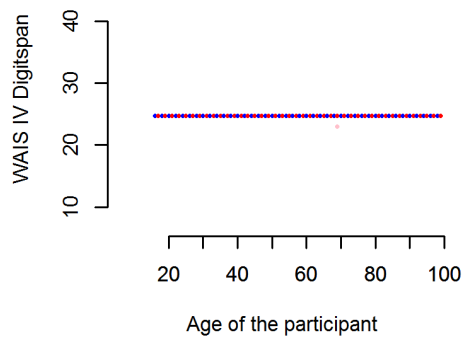


2. WAIS - IV - DigitSpan

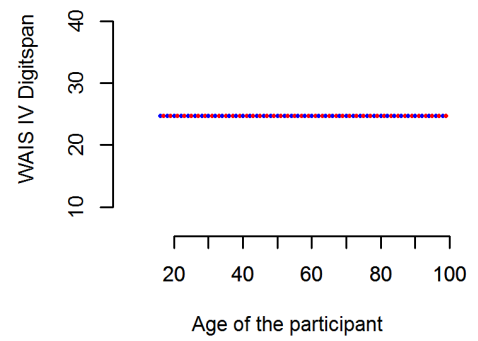
Education = 1



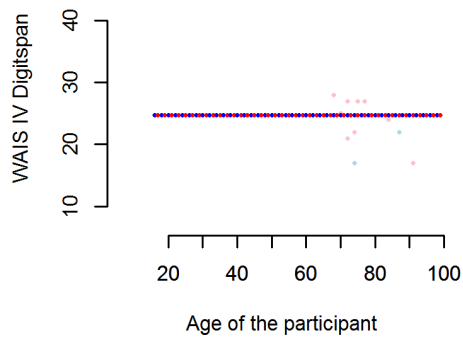
Education = 2



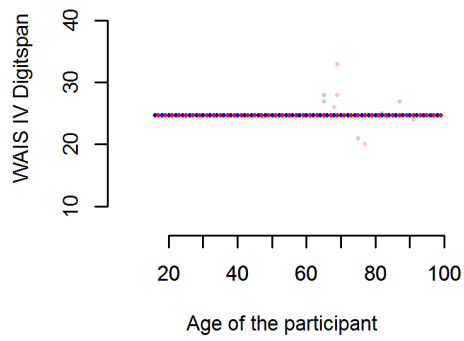
Education = 3



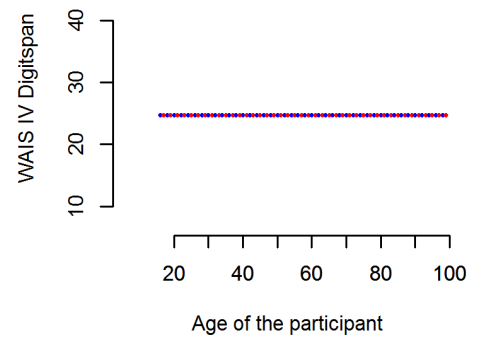
Education = 4



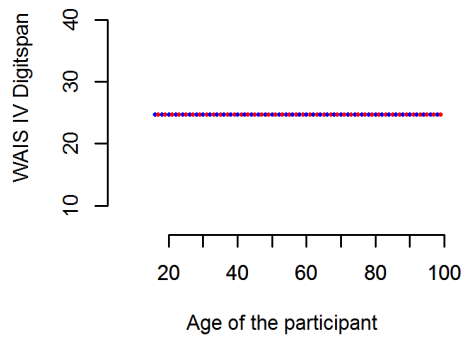
Education = 5



Education = 6



Education = 7



6.32 Wisconsin Card Sorting Test (WCST) + Modified Wisconsin Card Sorting Test (MWCST)

6.32.1 Extreme Borders of the WCST

The table shows extreme minimum and maximum scores on all WCST variables. The last column shows the number of cases removed based on these criteria.

Variable name	Min extreme border	Max extreme border	Percentage removed
WCST number of categories	1	6	0.011 %
WCST number of errors	0	128	0 %
WCST number perseverative answers	0	105	0 %
WCST number of perseverative errors	0	85	0 %
MWCST number of categories	1	6	0 %
MWCST number of errors	0	28	0.027 %
MWCST number of perseverative errors	0	20	0 %

6.32.2 BIC Selection for WCST

The table shows the selection of the effects of demographic variables for the WCST.

Variable	Demographic Effects	BIC
WCST number of categories	Initially included terms	
	$s + e$	653.26
	Dropped terms	
	s	651.92
WCST number of errors	Terms in the final model	
	e	651.92
	Initially included terms	
	$s + e$	1550.92
WCST number perseverative answers	Dropped terms	
	s	1549.43
	Terms in the final model	
	e	1549.43
WCST number of perseverative errors	Initially included terms	
	s	499.83
	Terms in the final model	
	s	499.83
MWCST number of categories	Initially included terms	
	$s + a + e + s*a + s*e$	813.26
	Dropped terms	
	$s*e$	808.39
MWCST number of errors	$s*a$	804.44
	s	800.64
	Terms in the final model	
	$a + e$	800.64
MWCST number of perseverative errors	Initially included terms	
	$s + a + e + s*a + s*e$	1617.46
	Dropped terms	
	$s*a$	1613.52
	$s*e$	1609.15
	s	1606.05
	Terms in the final model	
	$a + e$	1606.05
	Initially included terms	
	$s + a + e$	209.75
	Dropped terms	
	e	205.72
	s	204.94
	Terms in the final model	
	a	204.94

age = a, sex = s, education = e.

6.32.3 Best model fit of the WCST

The table shows the terms of the best models for the WCST variables. The last column shows the number of cases removed based on the MAD (+/-)3.5 criterion. Model fit can visually be evaluated with the plots at the end of this section where the raw data and regression curves are plotted together.

Variable name	Best model fit	Number of cases removed
WCST number of categories	e	13
WCST number of errors	e	2
WCST number perseverative answers	s	4
WCST number of perseverative errors	e	3
MWCST number of categories	a + e	16
MWCST number of errors	a + e	4
MWCST number of perseverative errors	a	3

age = a, sex = s, education = e.

6.32.4 Box-Cox power transformation of the WCST

The table shows the best Box-Cox power transformation for the WCST variables and the skewness and kurtosis of the residuals after the power transformation. Given a perfect normal distribution of the residuals, these would equal 0 and 3.

Variable name	Best power transformation	Skewness	Kurtosis
WCST number of categories	4.05	-0.591	2.424
WCST number of errors	0.2	-0.024	2.617
WCST number perseverative answers	-0.11	-0.059	2.08
WCST number of perseverative errors	0.44	-0.218	3.282
MWCST number of categories	6.58	-0.483	2.127
MWCST number of errors	0.45	-0.245	3.063
MWCST number of perseverative errors	0.174	-0.402	1.946

6.32.5 Descriptive statistics for the WCST

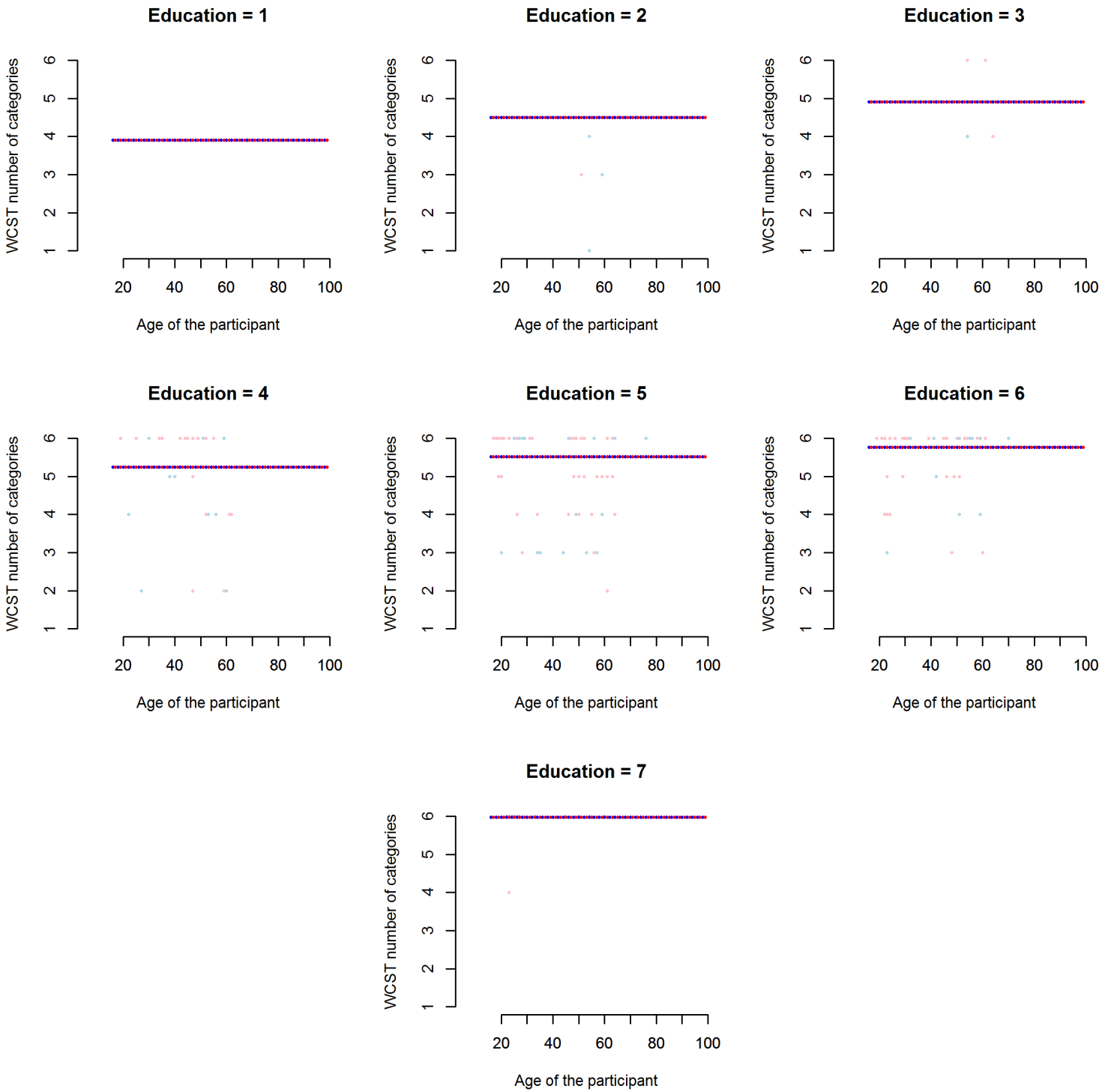
The table gives descriptives after outliers are removed on all WCST variables, for men and women separately. The scores are the raw, untransformed and unstandardized, scores.

Variable name	Male					Female				
	Min	Median	Max	N	Age range	Min	Median	Max	N	Age range
WCST number of categories	1	6	6	57	20-76	2	6	6	107	17-64
WCST number of errors	3	28	74	62	20-76	4	20	67	115	17-66
WCST number perseverative answers	4	24	46	17	27-61	4	10	40	37	19-66
WCST number of perseverative errors	0	13	41	44	22-76	0	10	45	91	17-66
MWCST number of categories	3	6	6	119	19-90	2	6	6	124	19-88
MWCST number of errors	0	5	23	121	19-90	0	7	26	127	19-91
MWCST number of perseverative errors	0	1	8	34	49-81	0	2	11	44	51-82

6.32.6 Plots with raw data points and back-transformed predicted data points

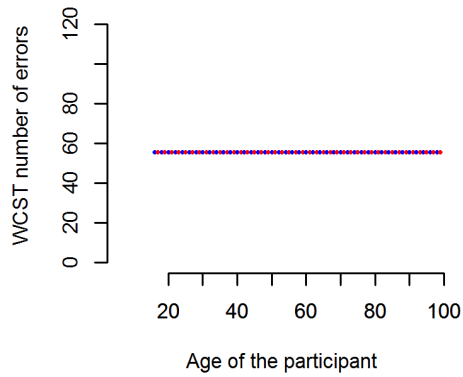
These plots show the regression lines (blue for men, red for women) plotted on the raw data points (in light blue and light red). The data have been back-transformed to the original test scales so they are easier to interpret.

1. WCST - Number of categories

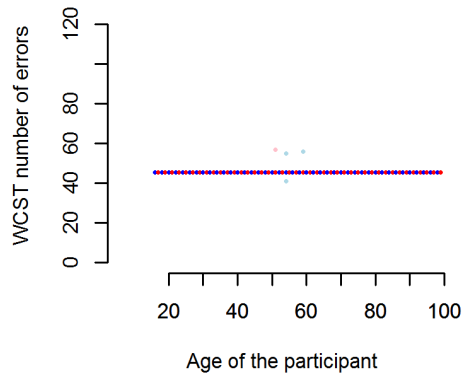


2. WCST - Number of errors

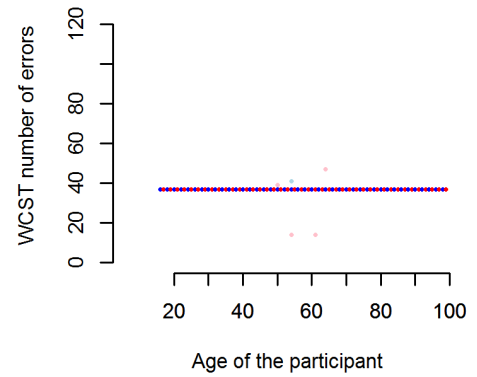
Education = 1



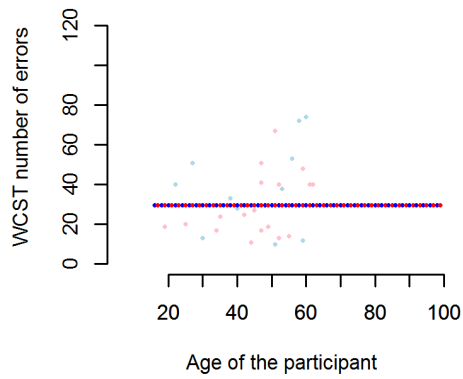
Education = 2



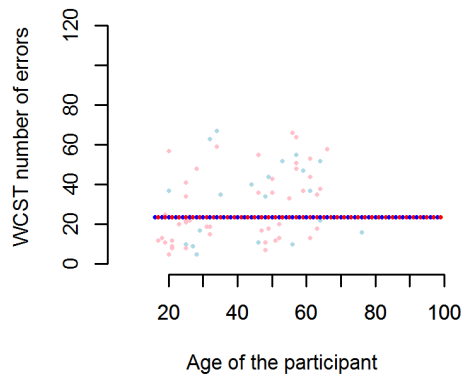
Education = 3



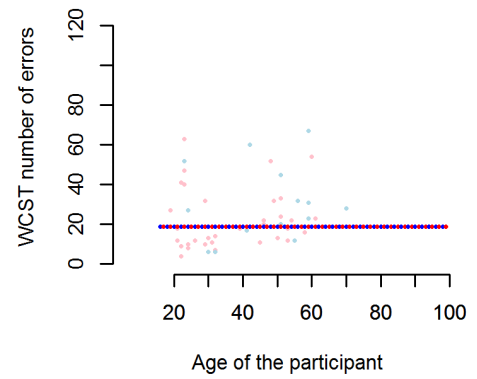
Education = 4



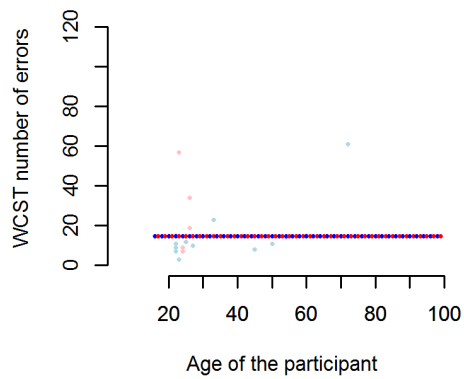
Education = 5



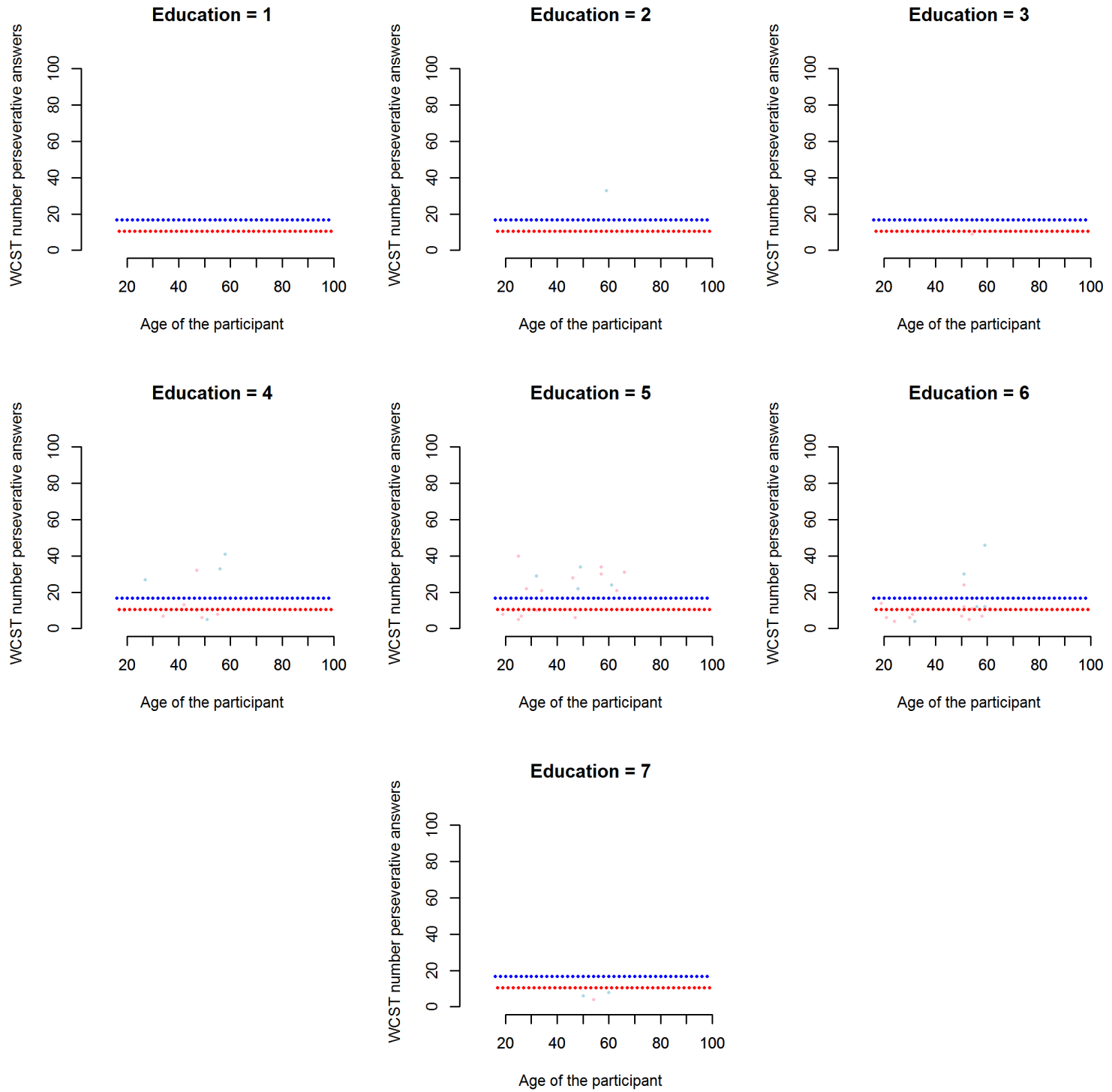
Education = 6



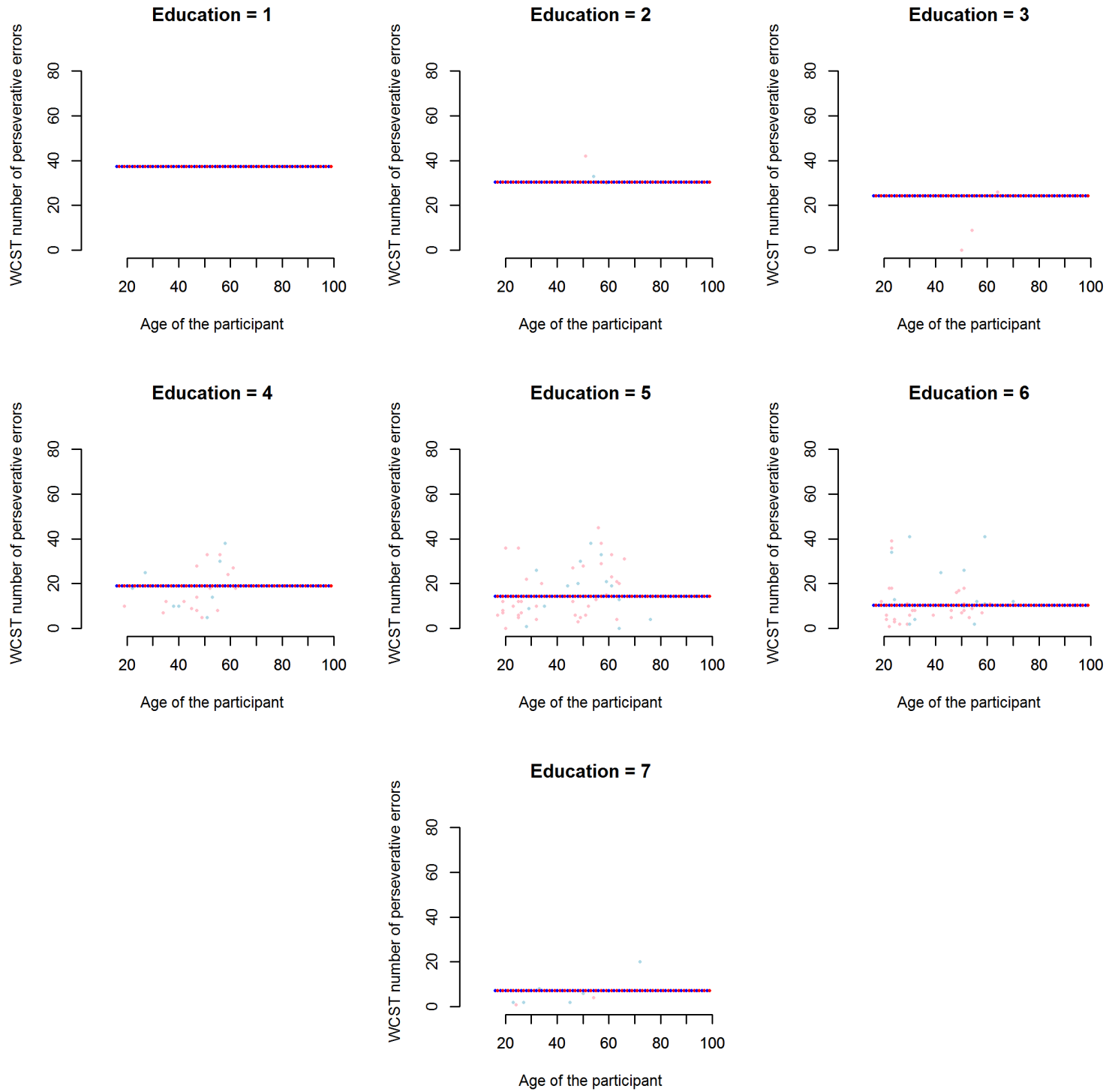
Education = 7



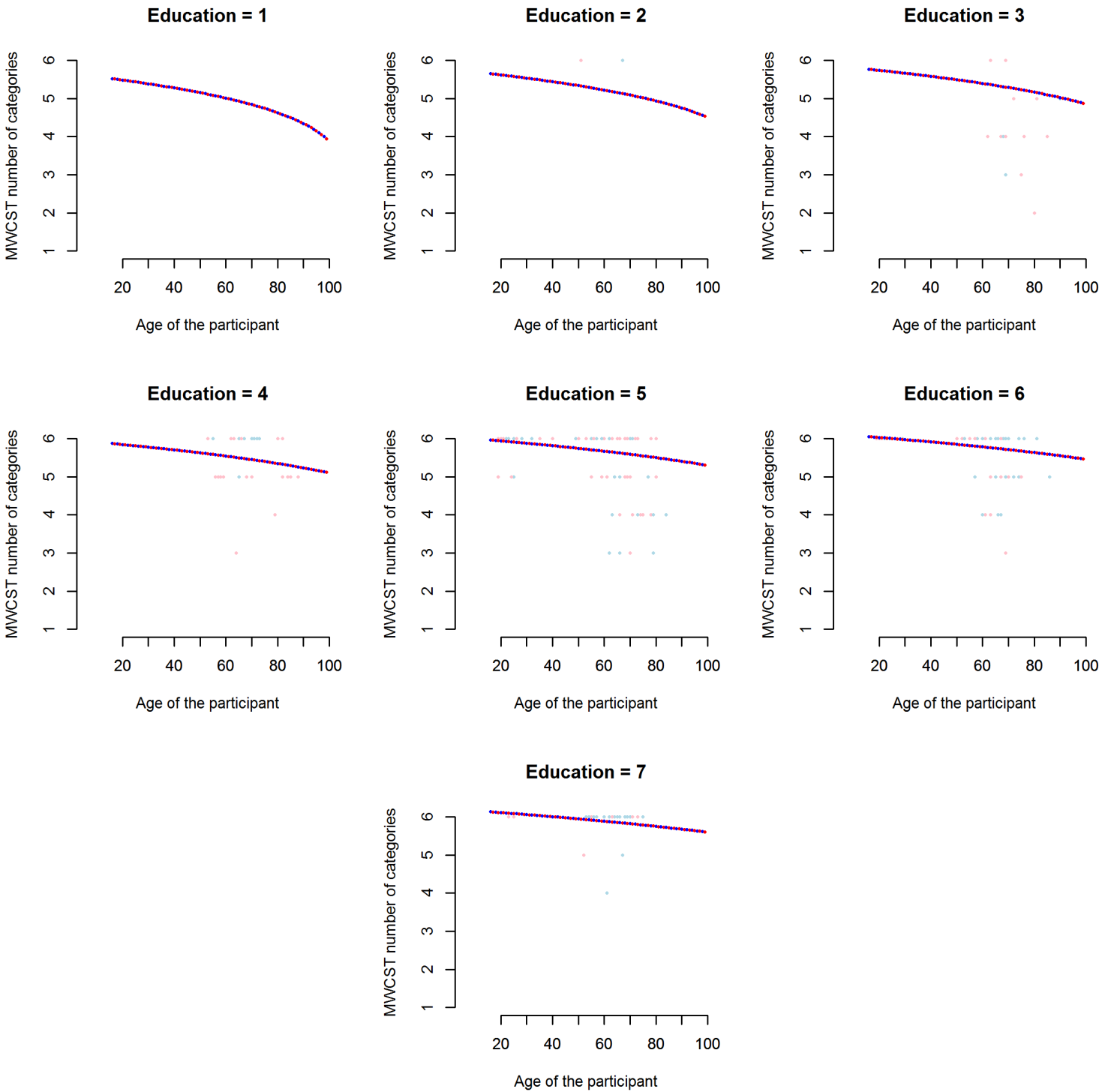
3. WCST - Perseverative answers



4. WCST - Perseverative errors

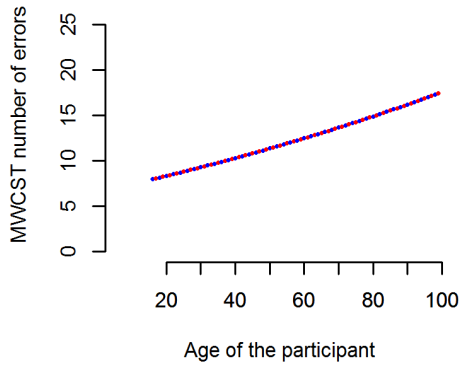


5. MWCST - Number of categories

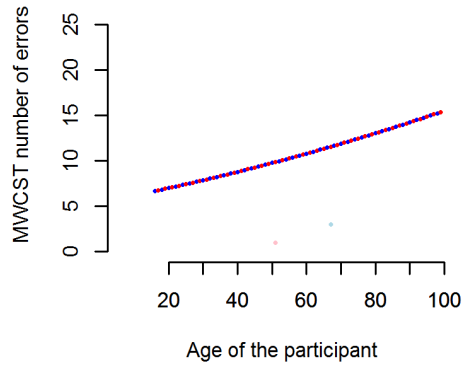


6. MWCST - Number of errors

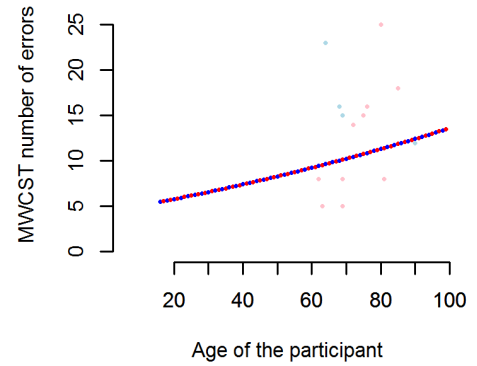
Education = 1



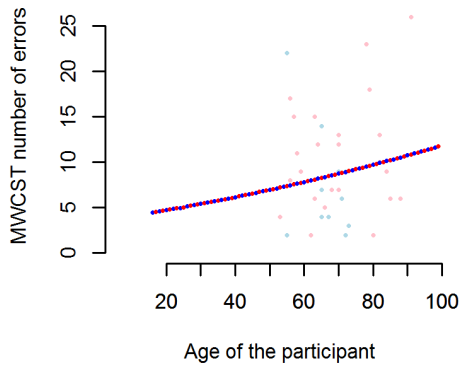
Education = 2



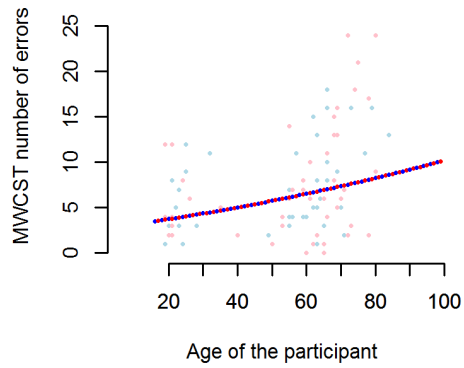
Education = 3



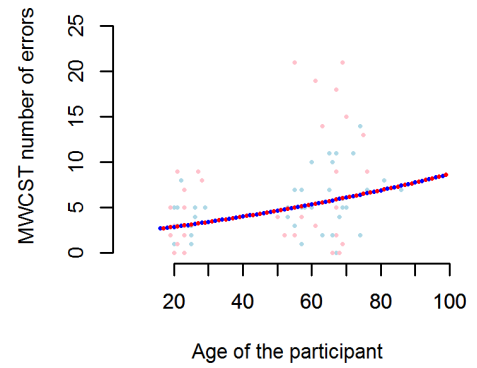
Education = 4



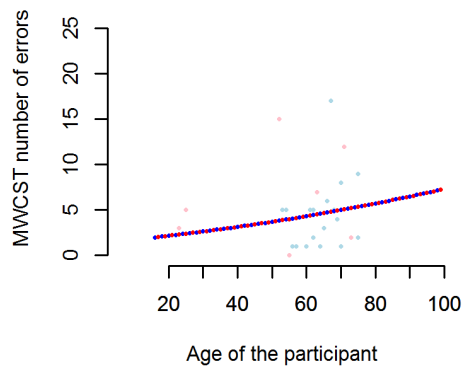
Education = 5



Education = 6



Education = 7



4. MWCST - Perseverative errors

