**DATA ANALYSIS REPORT**

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1. Descriptive Statistics.

a. The descriptive data for all DP and SNR measurements (regardless of age group)

|  |  |  |
| --- | --- | --- |
|  | **DP** | **SNR** |
| Count | 496.000000 | 493.000000 |
| Mean | 8.296976 | 18.143408 |
| Std | 5.085278 | 6.058323 |
| Min | -3.000000 | 2.900000 |
| 25% | 4.400000 | 13.800000 |
| 50% | 7.950000 | 17.900000 |
| 75% | 11.725000 | 22.700000 |
| Max | 24.300000 | 36.300000 |

b. The descriptive statistics for all DP measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| Count | 283.000000 | 213.00000 |
| Mean | 9.026502 | 7.32770 |
| Std | 5.347576 | 4.54836 |
| Min | 3.000000 | 0.00000 |
| 25% | 4.800000 | 3.60000 |
|  50% | 8.800000 | 7.00000 |
| 75% | 12.850000 | 10.40000 |
| Max | 24.300000 | 22.400000 |

c. The descriptive statistics for all SNR measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| Count | 283.000000 | 210.000000 |
| Mean | 19.159717 | 16.773810 |
| Std | 6.065476 | 5.786061 |
| Min | 2.900000 | 3.200000 |
| 25% | 15.050000 | 12.925000 |
| 50% | 19.000000 | 16.550000 |
| 75% | 23.900000 | 20.400000 |
| Max | 36.300000 | 31.900000 |

2. Boxplots to compare DP measures for each age group at all frequencies:



3. Boxplots to compare SNR measures for each age group at all frequencies:



4. To check if the data are normally distributed. I conducted the checks separately since the DP and SNR data are different measurements. The first method used will be the histogram visualization method. The results are displayed in the plot below:





While the SNR data looks normally distributed, I can conduct the Shapiro-Wilk test to ascertain this. The result is shown in the table below:

|  |  |  |
| --- | --- | --- |
|  | P value (alpha = 0.05) | Interpretation  |
| DP | 0.000008465313840133604 | Not normally distributed |
| SNR | 0.3677554726600647 | Normally distributed |

To check if this is consistent within the age groups, the test was conducted to check the distribution of DP and SNR for each age group. The result is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Age Group | P value (alpha = 0.05) | Interpretation  |
| DP | Group 1 | 0.003915222827345133 | **NOT** normally distributed |
|  | Group 2 | 0.0006874550599604845 | **NOT** Normally distributed |
| SNR | Group 1 | 0.3316843509674072 | Normally distributed |
|  | Group 2 | 0.6451948285102844 | Normally distributed |

5. Statistical tests

a. I carried out inferential statistics to investigate the difference between the two age groups. I conducted a two-sample t-test to check if there is a significant difference between the mean of the two age groups for all DP and SNR frequencies measurements (i.e. the data has not been divided into specific frequencies). I also conducted the Mann Whitney U test for both. The results are shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| Test |  | P value (alpha = 0.05) | Interpretation  |
| t-test | DP | 0.0002132974939930822 | Significant difference. |
|  | SNR | 0.000019729072110168965 | Significant difference. |
| MannWhitneyU | DP | 0.00047922483003939956 | Significant difference. |
|  | SNR | 0.00001305123232875918 | Significant difference. |

b. Statistical tests for each frequency and age group. The Bonferroni correction has been applied, therefore, alpha = 0.033.

i. Mann Whitney U test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 171.5 | 0.351328 | No significant difference. |
| dp\_freq\_1001 | 168.0 | 0.239900 | No significant difference. |
| dp\_freq\_1184 | 253.0 | 0.390191 | No significant difference. |
| dp\_freq\_1416 | 244.0 | 0.215965 | No significant difference. |
| dp\_freq\_1685 | 289.0 | 0.040589 | No significant difference. |
| dp\_freq\_2002 | 218.5 | 0.887888 | No significant difference. |
| dp\_freq\_2380 | 262.0 | 0.412527 | No significant difference. |
| dp\_freq\_2832 | 251.0 | 0.034496 | No significant difference. |
| dp\_freq\_3369 | 138.0 | 0.591149 | No significant difference. |
| dp\_freq\_4004 | 137.5 | 0.350889 | No significant difference. |
| dp\_freq\_4761 | 217.0 | 0.264463 | No significant difference. |
| dp\_freq\_5652 | 203.5 | 0.170881 | No significant difference. |
| dp\_freq\_6726 | 58.5 | 0.759412 | No significant difference. |
| dp\_freq\_7996 | 25.5 | 0.279426 | No significant difference. |
| dp\_freq\_9509 | 11.0 | 0.333333 | No significant difference. |

ii. Mann Whitney U test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 192.0 | 0.101129 | No significant difference. |
| snr\_freq\_1001 | 155.5 | 0.270496 | No significant difference. |
| snr\_freq\_1184 | 267.0 | 0.225059 | No significant difference. |
| snr\_freq\_1416 | 240.0 | 0.259132 | No significant difference. |
| snr\_freq\_1685 | 319.5 | 0.004463 | No significant difference. |
| snr\_freq\_2002 | 234.0 | 0.590492 | No significant difference. |
| snr\_freq\_2380 | 249.5 | 0.607484 | No significant difference. |
| snr\_freq\_2832 | 244.0 | 0.056223 | No significant difference. |
| snr\_freq\_3369 | 153.0 | 0.265569 | No significant difference. |
| snr\_freq\_4004 | 131.5 | 0.490458 | No significant difference. |
| snr\_freq\_4761 | 219.5 | 0.234340 | No significant difference. |
| snr\_freq\_5652 | 181.0 | 0.156360 | No significant difference. |
| snr\_freq\_6726 | 54.5 | 0.581377 | No significant difference. |
| snr\_freq\_7996 | 26.0 | 0.260140 | No significant difference. |
| snr\_freq\_9509 | 12.0 | 0.222222 | No significant difference. |

iii. Two sample t-test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 0.814208 | 0.421544 | No significant difference. |
| dp\_freq\_1001 | 1.024766 | 0.313404 | No significant difference. |
| dp\_freq\_1184 | 0.996940 | 0.324787 | No significant difference. |
| dp\_freq\_1416 | 1.298921 | 0.201798 | No significant difference. |
| dp\_freq\_1685 | 2.201899 | 0.033654 | No significant difference. |
| dp\_freq\_2002 | 0.412378 | 0.682265 | No significant difference. |
| dp\_freq\_2380 | 1.049384 | 0.300148 | No significant difference. |
| dp\_freq\_2832 | 2.190105 | 0.035078 | No significant difference. |
| dp\_freq\_3369 | 0.614217 | 0.543702 | No significant difference. |
| dp\_freq\_4004 | 0.955768 | 0.347089 | No significant difference. |
| dp\_freq\_4761 | 0.960240 | 0.343340 | No significant difference. |
| dp\_freq\_5652 | 1.608477 | 0.116979 | No significant difference. |
| dp\_freq\_6726 | -0.056004 | 0.955845 | No significant difference. |
| dp\_freq\_7996 | 1.444120 | 0.176578 | No significant difference. |
| dp\_freq\_9509 | 1.022430 | 0.340606 | No significant difference |

iv. Two sample t-test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 1.624533 | 0.114073 | No significant difference. |
| snr\_freq\_1001 | 1.371636 | 0.180349 | No significant difference. |
| snr\_freq\_1184 | 1.322938 | 0.193369 | No significant difference. |
| snr\_freq\_1416 | 0.978655 | 0.333940 | No significant difference. |
| snr\_freq\_1685 | 3.284957 | 0.002161 | Significant difference. |
| snr\_freq\_2002 | 0.759023 | 0.452289 | No significant difference. |
| snr\_freq\_2380 | 0.648509 | 0.520271 | No significant difference. |
| snr\_freq\_2832 | 1.772365 | 0.084797 | No significant difference. |
| snr\_freq\_3369 | 1.281826 | 0.209722 | No significant difference. |
| snr\_freq\_4004 | 0.714201 | 0.480812 | No significant difference. |
| snr\_freq\_4761 | 0.892626 | 0.377986 | No significant difference. |
| snr\_freq\_5652 | 1.588202 | 0.122074 | No significant difference. |
| snr\_freq\_6726 | -0.456058 | 0.652818 | No significant difference. |
| snr\_freq\_7996 | 1.439208 | 0.177934 | No significant difference. |
| snr\_freq\_9509 | 1.465497 | 0.186208 | No significant difference. |

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1. Descriptive Statistics.

a. The descriptive data for all DP and SNR measurements (regardless of age group)

|  |  |  |
| --- | --- | --- |
|  | **DP** | **SNR** |
| Count | 483.000000 | 477.000000 |
| Mean | 8.326915 | 17.651447 |
| Std | 5.075924 | 6.293482 |
| Min | 0.000000 | 0.140000 |
| 25% | 4.500000 | 13.400000 |
| 50% | 7.800000 | 17.300000 |
| 75% | 11.500000 | 22.400000 |
| Max | 22.000000 | 33.800000 |

b. The descriptive statistics for all DP measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| Count | 8.000000 | 8.000000 |
| Mean | 41.274096 | 33.849859 |
| Std | 91.835282 | 73.452171 |
| Min | 0.300000 | 0.000000 |
| 25% | 5.143361 | 4.641595 |
|  50% | 8.759142 | 7.538372 |
| 75% | 14.762500 | 13.325000 |
| Max | 268.000000 | 215.000000 |

c. The descriptive statistics for all SNR measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| Count | 8.000000 | 8.000000 |
| Mean | 46.976299 | 40.247503 |
| Std | 87.483108 | 71.236322 |
| Min | 0.140000 | 1.200000 |
| 25% | 11.841892 | 11.233320 |
| 50% | 18.251412 | 16.548372 |
| 75% | 26.000000 | 23.862500 |
| Max | 262.000000 | 215.000000 |

2. Boxplots to compare DP measures for each age group at all frequencies:



3. Boxplots to compare SNR measures for each age group at all frequencies:



4. To check if the data are normally distributed. I conducted the checks separately since the DP and SNR data are different measurements. The first method used will be the histogram visualization method. The results are displayed in the plot below:





While the SNR data looks normally distributed, I can conduct the Shapiro-Wilk test to ascertain this. The result is shown in the table below:

|  |  |  |
| --- | --- | --- |
|  | P value (alpha = 0.05) | Interpretation  |
| DP | 0.0000000430837374665316 | Not normally distributed |
| SNR | 0.05436358600854874 | Normally distributed |

To check if this is consistent within the age groups, the test was conducted to check the distribution of DP and SNR for each age group. The result is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Age Group | P value (alpha = 0.05) | Interpretation  |
| DP | Group 1 | 0.00001835893272073008 | **NOT** normally distributed |
|  | Group 2 | 0.0003288806474301964 | **NOT** Normally distributed |
| SNR | Group 1 | 0.06419827044010162 | Normally distributed |
|  | Group 2 | 0.5349607467651367 | Normally distributed |

5. Statistical tests

a. I carried out inferential statistics to investigate the difference between the two age groups. I conducted a two-sample t-test to check if there is a significant difference between the mean of the two age groups for all DP and SNR frequencies measurements (i.e. the data has not been divided into specific frequencies). I also conducted the Mann Whitney U test for both. The results are shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| Test |  | P value (alpha = 0.05) | Interpretation  |
| t-test | DP | 0.0327357135810374 | Significant difference. |
|  | SNR | 0.007082862491939675 | Significant difference. |
| MannWhitneyU | DP | 0.04933691945446292 | Significant difference. |
|  | SNR | 0.009098666380634975 | Significant difference. |

b. Statistical tests for each frequency and age group. The Bonferroni correction has been applied, therefore, alpha = 0.033.

i. Mann Whitney U test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 190.5 | 0.339355 | No significant difference. |
| dp\_freq\_1001 | 242.5 | 0.143914 | No significant difference. |
| dp\_freq\_1184 | 210.5 | 0.354926 | No significant difference. |
| dp\_freq\_1416 | 235.0 | 0.342979 | No significant difference. |
| dp\_freq\_1685 | 200.0 | 0.767288 | No significant difference. |
| dp\_freq\_2002 | 137.5 | 0.038873 | No significant difference. |
| dp\_freq\_2380 | 251.5 | 0.609009 | No significant difference. |
| dp\_freq\_2832 | 216.0 | 0.277294 | No significant difference. |
| dp\_freq\_3369 | 124.5 | 0.222124 | No significant difference. |
| dp\_freq\_4004 | 128.5 | 0.659553 | No significant difference. |
| dp\_freq\_4761 | 173.0 | 0.325438 | No significant difference. |
| dp\_freq\_5652 | 143.0 | 0.247656 | No significant difference. |
| dp\_freq\_6726 | 52.0 | 0.371093 | No significant difference. |
| dp\_freq\_7996 | 22.0 | 0.825728 | No significant difference. |
| dp\_freq\_9509 | 4.0 | 0.857143 | No significant difference. |

ii. Mann Whitney U test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 197.5 | 0.238707 | No significant difference. |
| snr\_freq\_1001 | 252.0 | 0.083737 | No significant difference. |
| snr\_freq\_1184 | 233.5 | 0.109579 | No significant difference. |
| snr\_freq\_1416 | 247.5 | 0.198210 | No significant difference. |
| snr\_freq\_1685 | 208.0 | 0.602169 | No significant difference. |
| snr\_freq\_2002 | 174.5 | 0.256975 | No significant difference. |
| snr\_freq\_2380 | 241.0 | 0.798178 | No significant difference. |
| snr\_freq\_2832 | 222.5 | 0.201505 | No significant difference. |
| snr\_freq\_3369 | 115.0 | 0.253989 | No significant difference. |
| snr\_freq\_4004 | 121.0 | 0.675433 | No significant difference. |
| snr\_freq\_4761 | 158.0 | 0.438384 | No significant difference. |
| snr\_freq\_5652 | 136.0 | 0.383145 | No significant difference. |
| snr\_freq\_6726 | 30.0 | 0.040628 | No significant difference. |
| snr\_freq\_7996 | 17.0 | 1.000000 | No significant difference. |
| snr\_freq\_9509 | 3.0 | 1.000000 | No significant difference. |

iii. Two sample t-test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 0.919366 | 0.364381 | No significant difference. |
| dp\_freq\_1001 | 1.653100 | 0.106772 | No significant difference. |
| dp\_freq\_1184 | 1.223369 | 0.229138 | No significant difference. |
| dp\_freq\_1416 | 1.030578 | 0.309254 | No significant difference. |
| dp\_freq\_1685 | 0.206793 | 0.837305 | No significant difference. |
| dp\_freq\_2002 | -1.677019 | 0.101338 | No significant difference. |
| dp\_freq\_2380 | 0.681809 | 0.499193 | No significant difference. |
| dp\_freq\_2832 | 0.975195 | 0.335971 | No significant difference. |
| dp\_freq\_3369 | 1.404937 | 0.171876 | No significant difference. |
| dp\_freq\_4004 | 0.397721 | 0.693748 | No significant difference. |
| dp\_freq\_4761 | 1.002309 | 0.323714 | No significant difference. |
| dp\_freq\_5652 | 0.856039 | 0.398994 | No significant difference. |
| dp\_freq\_6726 | -0.933030 | 0.360932 | No significant difference. |
| dp\_freq\_7996 | 0.499682 | 0.627143 | No significant difference. |
| dp\_freq\_9509 | NaN | NaN | NaN |

iv. Two sample t-test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 1.278273 | 0.209811 | No significant difference. |
| snr\_freq\_1001 | 2.255928 | 0.030075 | No significant difference. |
| snr\_freq\_1184 | 1.841883 | 0.073742 | No significant difference. |
| snr\_freq\_1416 | 1.574041 | 0.123768 | No significant difference. |
| snr\_freq\_1685 | 0.488282 | 0.628231 | No significant difference. |
| snr\_freq\_2002 | -1.227229 | 0.226910 | No significant difference. |
| snr\_freq\_2380 | 0.475761 | 0.636770 | No significant difference. |
| snr\_freq\_2832 | 1.438110 | 0.159040 | No significant difference. |
| snr\_freq\_3369 | 1.139795 | 0.265175 | No significant difference. |
| snr\_freq\_4004 | 0.552809 | 0.584781 | No significant difference. |
| snr\_freq\_4761 | 0.793518 | 0.433508 | No significant difference. |
| snr\_freq\_5652 | 0.602786 | 0.551336 | No significant difference. |
| snr\_freq\_6726 | -1.827420 | 0.081883 | No significant difference. |
| snr\_freq\_7996 | -0.146177 | 0.886686 | No significant difference. |
| snr\_freq\_9509 | NaN | NaN | NaN |

**65 Right**

1. Descriptive Statistics.

a. The descriptive data for all DP and SNR measurements (regardless of age group)

|  |  |  |
| --- | --- | --- |
|  | **DP** | **SNR** |
| count | 433.000000 | 434.000000 |
| mean | 7.611085 | 17.335484 |
| std | 4.883951 | 6.000826 |
| min | 0.000000 | 0.700000 |
| 25% | 3.700000 | 13.300000 |
| 50% | 7.200000 | 17.500000 |
| 75% | 10.800000 | 21.500000 |
| max | 24.300000 | 34.700000 |

b. The descriptive statistics for all DP measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| count | 8.000000 | 8.000000 |
| mean | 39.823296 | 28.456960 |
| std | 88.046461 | 59.987210 |
| min | 0.000000 | 0.000000 |
| 25% | 4.824214 | 4.090909 |
|  50% | 8.227043 | 6.338068 |
| 75% | 14.775000 | 12.493750 |
| max | 257.000000 | 176.000000 |

c. The descriptive statistics for all SNR measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| count | 8.000000 | 8.000000 |
| mean | 47.292644 | 34.482391 |
| std | 85.245979 | 58.270351 |
| min | 5.571110 | 0.700000 |
| 25% | 12.925000 | 10.201647 |
| 50% | 18.685019 | 15.376271 |
| 75% | 25.625000 | 22.000000 |
| max | 257.000000 | 177.000000 |

2. Boxplots to compare DP measures for each age group at all frequencies:



3. Boxplots to compare SNR measures for each age group at all frequencies:



4. To check if the data are normally distributed. I conduct the checks separately since the DP and SNR data are different measurements. The first method used will be the histogram visualization method. The results are displayed in the plot below:



While the SNR data looks normally distributed, I can conduct the Shapiro-Wilk test to ascertain this. The result is shown in the table below:

|  |  |  |
| --- | --- | --- |
|  | P value (alpha = 0.05) | Interpretation  |
| DP | 0.000000014560500360971673 | Not normally distributed |
| SNR | 0.5737723708152771 | Normally distributed |

To check if this is consistent within the age groups, the test was conducted to check the distribution of DP and SNR for each age group. The result is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Age Group | P value (alpha = 0.05) | Interpretation  |
| DP | Group 1 | 0.00008089374750852585 | **NOT** normally distributed |
|  | Group 2 | 0.000014519271644530818 | **NOT** Normally distributed |
| SNR | Group 1 | 0.3402734398841858 | Normally distributed |
|  | Group 2 | 0.6756279468536377 | Normally distributed |

5. Statistical tests

a. I carried out inferential statistics to investigate the difference between the two age groups. I conducted a two-sample t-test to check if there is a significant difference between the mean of the two age groups for all DP and SNR frequencies measurements (i.e. the data has not been divided into specific frequencies). I also conducted the Mann Whitney U test for both. The results are shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| Test |  | P value (alpha = 0.05) | Interpretation  |
| t-test | DP | 0.00011731917772615529 | Significant difference. |
|  | SNR | 0.0000000009285231235248957 | Significant difference. |
| MannWhitneyU | DP | 0.00017065842066016853 | Significant difference. |
|  | SNR | 0.000000005895869794689546 | Significant difference. |

b. Statistical tests for each frequency and age group. The Bonferroni correction has been applied, therefore, alpha = 0.033.

i. Mann Whitney U test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 160.0 | 0.167070 | No significant difference. |
| dp\_freq\_1001 | 223.0 | 0.046592 | No significant difference. |
| dp\_freq\_1184 | 197.5 | 0.260598 | No significant difference. |
| dp\_freq\_1416 | 273.0 | 0.047996 | No significant difference. |
| dp\_freq\_1685 | 240.0 | 0.034104 | No significant difference. |
| dp\_freq\_2002 | 145.5 | 0.945545 | No significant difference. |
| dp\_freq\_2380 | 179.5 | 0.371156 | No significant difference. |
| dp\_freq\_2832 | 143.5 | 0.239411 | No significant difference. |
| dp\_freq\_3369 | 88.0 | 0.814027 | No significant difference. |
| dp\_freq\_4004 | 145.5 | 0.081134 | No significant difference. |
| dp\_freq\_4761 | 154.5 | 0.104617 | No significant difference. |
| dp\_freq\_5652 | 99.0 | 0.522216 | No significant difference. |
| dp\_freq\_6726 | 54.0 | 0.173860 | No significant difference. |
| dp\_freq\_7996 | 4.5 | 0.826238 | No significant difference. |
| dp\_freq\_9509 | 10.5 | 0.169169 | No significant difference. |

ii. Mann Whitney U test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 173.0 | 0.060047 | No significant difference. |
| snr\_freq\_1001 | 250.0 | 0.004382 | No significant difference. |
| snr\_freq\_1184 | 226.5 | 0.040956 | No significant difference. |
| snr\_freq\_1416 | 300.0 | 0.006735 | No significant difference. |
| snr\_freq\_1685 | 240.5 | 0.032888 | No significant difference. |
| snr\_freq\_2002 | 139.0 | 0.904875 | No significant difference. |
| snr\_freq\_2380 | 215.0 | 0.038464 | No significant difference. |
| snr\_freq\_2832 | 153.5 | 0.113655 | No significant difference. |
| snr\_freq\_3369 | 107.0 | 0.540741 | No significant difference. |
| snr\_freq\_4004 | 151.0 | 0.047690 | No significant difference. |
| snr\_freq\_4761 | 163.0 | 0.049168 | No significant difference. |
| snr\_freq\_5652 | 96.0 | 0.622777 | No significant difference. |
| snr\_freq\_6726 | 54.0 | 0.174083 | No significant difference. |
| snr\_freq\_7996 | 10.0 | 0.500000 | No significant difference. |
| snr\_freq\_9509 | 12.0 | 0.071429 | No significant difference. |

iii. Two sample t-test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 1.008832 | 0.321123 | No significant difference. |
| dp\_freq\_1001 | 1.924525 | 0.062690 | No significant difference. |
| dp\_freq\_1184 | 0.982317 | 0.332882 | No significant difference. |
| dp\_freq\_1416 | 2.111714 | 0.041343 | No significant difference. |
| dp\_freq\_1685 | 2.177368 | 0.036282 | No significant difference. |
| dp\_freq\_2002 | 0.379570 | 0.706697 | No significant difference. |
| dp\_freq\_2380 | 1.263909 | 0.215118 | No significant difference. |
| dp\_freq\_2832 | 1.068120 | 0.294277 | No significant difference. |
| dp\_freq\_3369 | -0.083169 | 0.934355 | No significant difference. |
| dp\_freq\_4004 | 1.674139 | 0.105240 | No significant difference. |
| dp\_freq\_4761 | 1.494658 | 0.145807 | No significant difference. |
| dp\_freq\_5652 | 0.656822 | 0.517068 | No significant difference. |
| dp\_freq\_6726 | 1.521823 | 0.147570 | No significant difference. |
| dp\_freq\_7996 | NaN | NaN | NaN |
| dp\_freq\_9509 | 1.489342 | 0.186975 | No significant difference. |

iv. Two sample t-test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 1.977729 | 0.057209 | No significant difference. |
| snr\_freq\_1001 | 3.065031 | 0.004244 | No significant difference. |
| snr\_freq\_1184 | 1.917079 | 0.063662 | No significant difference. |
| snr\_freq\_1416 | 2.971534 | 0.005117 | No significant difference. |
| snr\_freq\_1685 | 2.339786 | 0.025126 | No significant difference. |
| snr\_freq\_2002 | -0.036302 | 0.971261 | No significant difference. |
| snr\_freq\_2380 | 2.243653 | 0.031684 | No significant difference. |
| snr\_freq\_2832 | 1.603557 | 0.119649 | No significant difference. |
| snr\_freq\_3369 | 0.452523 | 0.654646 | No significant difference. |
| snr\_freq\_4004 | 2.145493 | 0.040729 | No significant difference. |
| snr\_freq\_4761 | 2.220675 | 0.034344 | No significant difference. |
| snr\_freq\_5652 | 0.431379 | 0.669749 | No significant difference. |
| snr\_freq\_6726 | 1.127025 | 0.276351 | No significant difference. |
| snr\_freq\_7996 | 0.768746 | 0.467184 | No significant difference. |
| snr\_freq\_9509 | 3.562394 | 0.011893 | No significant difference. |

**65 Left**

1. Descriptive Statistics.

a. The descriptive data for all DP and SNR measurements (regardless of age group)

|  |  |  |
| --- | --- | --- |
|  | **DP** | **SNR** |
| count | 402.000000 | 402.000000 |
| mean | 7.500746 | 16.687562 |
| std | 4.693862 | 5.289598 |
| min | 0.000000 | 2.000000 |
| 25% | 4.000000 | 13.025000 |
| 50% | 6.700000 | 16.500000 |
| 75% | 10.800000 | 20.175000 |
| max | 21.100000 | 31.400000 |

b. The descriptive statistics for all DP measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| count | 8.000000 | 8.000000 |
| mean | 41.984437 | 21.004287 |
| std | 95.569181 | 41.916183 |
| min | 0.000000 | 0.000000 |
| 25% | 4.780321 | 3.643462 |
|  50% | 7.705036 | 6.067339 |
| 75% | 14.256250 | 10.506250 |
| max | 278.000000 | 124.000000 |

c. The descriptive statistics for all SNR measurements for the age groups

|  |  |  |
| --- | --- | --- |
|  | **Younger adults** | **Older Adult**s |
| count | 8.000000 | 8.000000 |
| mean | 48.458349 | 26.704957 |
| std | 93.193085 | 39.997726 |
| min | 2.200000 | 2.000000 |
| 25% | 11.908244 | 9.721405 |
| 50% | 17.641906 | 14.302016 |
| 75% | 23.862500 | 19.475000 |
| max | 278.000000 | 124.00000 |

2. Boxplots to compare DP measures for each age group at all frequencies:



3. Boxplots to compare SNR measures for each age group at all frequencies:



4. To check if the data are normally distributed. I conducted the checks separately since the DP and SNR data are different measurements. The first method used will be the histogram visualization method. The results are displayed in the plot below:



While the SNR data looks normally distributed, I can conduct the Shapiro-Wilk test to ascertain this. The result is shown in the table below:

|  |  |  |
| --- | --- | --- |
|  | P value (alpha = 0.05) | Interpretation  |
| DP | 0.00000009624377383943283 | Not normally distributed |
| SNR | 0.8641867637634277 | Normally distributed |

To check if this is consistent within the age groups, the test was conducted to check the distribution of DP and SNR for each age group. The result is shown below:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Age Group | P value (alpha = 0.05) | Interpretation  |
| DP | Group 1 | 0.000030518345738528296 | **NOT** normally distributed |
|  | Group 2 | 0.0008732065325602889 | **NOT** Normally distributed |
| SNR | Group 1 | 0.9340571165084839 | Normally distributed |
|  | Group 2 | 0.9848800301551819 | Normally distributed |

5. Statistical tests

a. I carried out inferential statistics to investigate the difference between the two age groups. I conducted a two-sample t-test to check if there is a significant difference between the mean of the two age groups for all DP and SNR frequencies measurements (i.e. the data has not been divided into specific frequencies). I also conducted the Mann Whitney U test for both. The results are shown below:

|  |  |  |  |
| --- | --- | --- | --- |
| Test |  | P value (alpha = 0.05) | Interpretation  |
| t-test | DP | 0.00008585500527970127 | Significant difference. |
|  | SNR | 0.000000008349113484345078 | Significant difference. |
| MannWhitneyU | DP | 0.000249341064862898 | Significant difference. |
|  | SNR | 0.000000007421808725107815 | Significant difference. |

b. Statistical tests for each frequency and age group. The Bonferroni correction has been applied, therefore, alpha = 0.033.

i. Mann Whitney U test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 110.5 | 0.345243 | No significant difference. |
| dp\_freq\_1001 | 137.0 | 0.183106 | No significant difference. |
| dp\_freq\_1184 | 160.5 | 0.203149 | No significant difference. |
| dp\_freq\_1416 | 202.0 | 0.310408 | No significant difference. |
| dp\_freq\_1685 | 252.5 | 0.037619 | No significant difference. |
| dp\_freq\_2002 | 216.0 | 0.199014 | No significant difference. |
| dp\_freq\_2380 | 136.5 | 0.886943 | No significant difference. |
| dp\_freq\_2832 | 130.5 | 0.055030 | No significant difference. |
| dp\_freq\_3369 | 96.0 | 0.022203 | No significant difference. |
| dp\_freq\_4004 | 81.5 | 0.071737 | No significant difference. |
| dp\_freq\_4761 | 84.0 | 0.595473 | No significant difference. |
| dp\_freq\_5652 | 123.5 | 0.003354 | No significant difference. |
| dp\_freq\_6726 | 13.0 | 0.555556 | No significant difference. |
| dp\_freq\_7996 | NaN | NaN | NaN |
| dp\_freq\_9509 | NaN | NaN | NaN |

ii. Mann Whitney U test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 121.5 | 0.143820 | No significant difference. |
| snr\_freq\_1001 | 125.0 | 0.409736 | No significant difference. |
| snr\_freq\_1184 | 167.0 | 0.129570 | No significant difference. |
| snr\_freq\_1416 | 227.0 | 0.076663 | No significant difference. |
| snr\_freq\_1685 | 290.5 | 0.001490 | Significant difference. |
| snr\_freq\_2002 | 224.0 | 0.127659 | No significant difference. |
| snr\_freq\_2380 | 147.5 | 0.593929 | No significant difference. |
| snr\_freq\_2832 | 155.5 | 0.001825 | Significant difference. |
| snr\_freq\_3369 | 87.5 | 0.080584 | No significant difference. |
| snr\_freq\_4004 | 68.0 | 0.368016 | No significant difference. |
| snr\_freq\_4761 | 77.0 | 0.876470 | No significant difference. |
| snr\_freq\_5652 | 106.5 | 0.046324 | No significant difference. |
| dp\_freq\_6726 | NaN | NaN | NaN |
| dp\_freq\_7996 | NaN | NaN | NaN |
| dp\_freq\_9509 | NaN | NaN | NaN |

iii. Two sample t-test for DP

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| dp\_freq\_842 | 1.188183 | 0.245108 | No significant difference. |
| dp\_freq\_1001 | 1.437446 | 0.161295 | No significant difference. |
| dp\_freq\_1184 | 1.146426 | 0.260391 | No significant difference. |
| dp\_freq\_1416 | 1.114891 | 0.272285 | No significant difference. |
| dp\_freq\_1685 | 2.058987 | 0.046586 | No significant difference. |
| dp\_freq\_2002 | 1.166642 | 0.251025 | No significant difference. |
| dp\_freq\_2380 | 0.349738 | 0.728757 | No significant difference. |
| dp\_freq\_2832 | 2.104805 | 0.045125 | No significant difference. |
| dp\_freq\_3369 | 2.395565 | 0.025538 | No significant difference. |
| dp\_freq\_4004 | 1.848398 | 0.078032 | No significant difference. |
| dp\_freq\_4761 | 1.111144 | 0.276676 | No significant difference. |
| dp\_freq\_5652 | 3.411136 | 0.002205 | Significant difference. |
| dp\_freq\_6726 | NaN | NaN | NaN |
| dp\_freq\_7996 | NaN | NaN | NaN |
| dp\_freq\_9509 | NaN | NaN | NaN |

iv. Two sample t-test for SNR

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency | Stat | p-value (alpha = 0.033) | Interpretation |
| snr\_freq\_842 | 1.429909 | 0.164214 | No significant difference. |
| snr\_freq\_1001 | 1.229888 | 0.228624 | No significant difference. |
| snr\_freq\_1184 | 1.790414 | 0.083159 | No significant difference. |
| snr\_freq\_1416 | 2.053887 | 0.047304 | No significant difference. |
| snr\_freq\_1685 | 3.454675 | 0.001398 | Significant difference. |
| snr\_freq\_2002 | 1.479496 | 0.147706 | No significant difference. |
| snr\_freq\_2380 | 0.476257 | 0.637029 | No significant difference. |
| snr\_freq\_2832 | 3.775655 | 0.000837 | Significant difference. |
| snr\_freq\_3369 | 1.774946 | 0.089746 | No significant difference. |
| snr\_freq\_4004 | 1.141752 | 0.265832 | No significant difference. |
| snr\_freq\_4761 | 0.373204 | 0.712022 | No significant difference. |
| snr\_freq\_5652 | 2.004259 | 0.055989 | No significant difference. |
| dp\_freq\_6726 | NaN | NaN | NaN |
| dp\_freq\_7996 | NaN | NaN | NaN |
| dp\_freq\_9509 | NaN | NaN | NaN |