

Exploring the differences between respondent groups

Clara Heath

MAX Toolkit webinar 2nd December 2016





THE LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE



Purpose of the webinar

Provide a brief overview of the variables in the ASCS and PSS SACE

Introduce you to independent t-tests and analysis of variance (ANOVA)

Demonstrate how you can carry out t-tests and ANOVAs in Excel and use the findings to explore the differences between respondent groups

Why spend time on analysis?

'Descriptives' (e.g. frequencies of responses) are commonly used to report survey data but cannot be used to guide local decisionmaking.

It's not about presenting a survey; it's about what do people need to know to develop the business [Manager]

Statistical tests can be used to explore **relationships between survey variables** and **differences between respondent groups**, and can be supplemented with qualitative data (e.g. respondent comments).

Make sense of reported outcomes

Highlight local variations + issues Inform local performance improvements

Minimise need for further local research

Analysis tools in the MAX toolkit

The MAX analysis and interpretation guide and associated tools can help users to move beyond the 'descriptives' and conduct more focused – and potentially useful – analyses.

| Analysis | No. of Variables | Tests hypotheses |
|--------------------------|---------------------|------------------|
| Cross-tabulations | 2 | No |
| Chi square | 2 | Yes |
| Independent t-tests* | 2 | Yes |
| Analysis of variance* | 2+ | Yes |

* These tests can be conducted in a blank Excel sheet. Instructions on how to this are provided in the MAX toolkit.

ASCOF indicators in the ASCS

Data from the ASCS currently populates 8 indicators in the Adult Social Care Outcomes Framework (ASCOF)

| ASCOF variables | Question |
|--|----------|
| 1A: Social care-related quality of life | 3a-9a |
| 1B: The proportion of people who use services who have control over their daily life | За |
| 11: Proportion of people who use services and their carers, who reported that they had as much social contact as they would like | 8a |
| 1J: Adjusted social care-related quality of life | See 1A |
| 3A: Overall satisfaction of people who use service with their care and support | 1 |
| 3D: The proportion of people who use services and carers who find it easy to find information about services | 12 |
| 4A: The proportion of people who use services who feel safe | 7a |
| 4B: The proportion of people who use services who say that those services have made them feel safe and secure | 7b |

Explanatory variables in the ASCS

The ASCS also contains a number of variables that can help LAs to further explore ASCOF indicators. These include:

| Explanatory variables | Questions |
|---|-------------|
| User characteristics (e.g. age, gender, ethnicity) | Data Return |
| Self-perceived health | 13 |
| Pain + discomfort / anxiety + depression | 14 |
| Abilities (ADLs and IADLs) | 15-16 |
| Self-perceived design of home | 17 |
| Getting around outside of home | 18 |
| Receipt of practical help (beyond those provided by LA) | 19 |
| Purchase additional / top up care | 20 |

Existing sources of information (e.g. LA records) can also be used to supplement ASCS data.

ASCOF indicators in the PSS SACE

Data from the PSS SACE currently populates 5 indicators in the Adult Social Care Outcomes Framework (ASCOF)

| ASCOF variables | Question |
|--|----------|
| 1D: Carer-reported quality of life | 7-12 |
| 1L: Proportion of people who use services and their carers, who reported that they had as much social contact as they would like | 11 |
| 3B: Overall satisfaction of carers with social services | 4 |
| 3C: The proportion of carers who report that they have been included or consulted in discussions about the person they care for | 18 |
| 3D: The proportion of people who use services and carers who find it easy to find information about services | 16 |

Explanatory variables in the PSS SACE

The PSS SACE also contains a number of variables that can help LAs to further explore ASCOF indicators. These include:

| Explanatory variables | Questions |
|---------------------------------------|-----------|
| Characteristics of carer | |
| Employment status | 19/20 |
| Length of time spent caring | 21 |
| Amount of time spent caring each week | 22 |
| Self-reported health | 24 |
| Age, Gender, Ethnicity | 26-28 |
| Characteristics of cared for person | |
| Age | 1 |
| Health conditions | 2 |
| Living situation | 3 |

Exploring group differences

Respondent groups – can be characterised by a wide range of features, including:

- User characteristics (e.g. age, gender, employment)
- **Survey responses**(e.g. ASCOF indicators, satisfaction)

Potential value of analysis – can help you to understand data and identify which groups report:

- Good outcomes + why → share practice
- Poor outcomes + why → inform commissioning of new services; design and delivery of existing services

Examples of LA analysis [ASCS]

Analysis of group differences noted in Adult Social Care Survey reports from 5 LAs during earlier document review.

| | Age | Gender | Ethnicity | Primary Client Group | Service Type |
|------------------------------|-----|--------|-----------|----------------------------|-----------------|
| 1A: SCRQoL | 3 | 1 | 1 | 5 | 3 |
| 1B: Control | 2 | 1 | | 2 | 2 |
| 3A: Satisfaction | 1 | | | 4 | 1 |
| 3D: Finding Info | 1 | | | 3 | 1 |
| 4A: Safety | 2 | | | 4 | 2 |
| 4B: Service impact on safety | 1 | | | 2 | 1 |
| TOTAL | 10 | 2 | 1 | 20 | 10 |

Some of the managers and commissioners interviewed for the project also conducted their own group-level analysis.

Examples of LA analysis [PSS SACE]

Analysis of group differences noted in Carers' Survey reports from 6 LAs during earlier document review.

| | Ag | ;e | Employ. | Ethnicity | Hea | lth | Length of | No of hrs |
|------------------------------|-------|-----|---------|-----------|-------|-----|-------------|-----------|
| | Carer | CFP | status | | Carer | CFP | time caring | caring pw |
| 1D: Carer reported QOL | 2 | 1 | | 2 | 2 | 2 | 1 | 3 |
| 3B: Satisfaction | 2 | 1 | 1 | | 2 | | 1 | 1 |
| 3C: Included or consulted | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| 3D: Ease of finding info | 1 | 1 | 1 | | 1 | 2 | 1 | |
| TOTAL | 6 | 4 | 3 | 3 | 6 | 6 | 4 | 5 |

Examples indicate that LA are interested in group differences. Analysis where conducted, however, was generally limited to cross-tabulations.

Hypothesis testing

Involves using inferential statistical tests such as t-tests or ANOVA to determine whether the patterns observed in a sample of data are likely to reflect those that would be found in the population.



Tests explore two hypotheses – the **null hypothesis** and the **alternative hypothesis** – and determines which one should be accepted as true.



Potentially very useful exploring group differences and for improving the local relevance and value of ASCS and PSS SACE data.

Using inferential tests to explore group differences

Independent t-tests

- Explore the differences between **two independent groups** on the same continuous variable
- For example, differences in SCRQoL scores between men and women

Analysis of variance (ANOVA)

- Explore the differences between more than two independent groups on the same continuous variable
- For example, differences in SCRQoL scores between groups classified by satisfaction with services and support

Getting started with analysis

Programme Requirements

Microsoft Excel 2010 or later + Analysis ToolPak. See **installing the analysis toolpak and real statistics resource pack** in MAX toolkit.

1. Click the File tab, and then click Options.

2. Click Add-Ins, and then in the Manage box, select Excel Add-ins and then select Go.

| Proofing Add-in: Analysis ToolPak - VBA Seve Publisher: Language Compatibility: No compatibility information available Advanced Location: Cuttornite Rabon C:\Program Files (x86)\Microsoft Office' Outlook Access Tealter Description: Mde-ins True Center Mgnage: Excel Add-ins | Proofing Add-in: Analysis ToolPak - VBA Seve Publisher: Lengunge Compatibility: No compatibility information available Advanced Location: C\Program Files (x86)\Microsoft Office' Contractions Color Analysis ToolPak Add in: Description: VBA functions for Analysis ToolPak Add in: Not Center Manage: | Formulas | No Disabled Application Add-ins |
|---|--|----------------------|---|
| Save Publisher: Lengwage Compatibility: No compatibility information available Advinced Location: C:\Program Files (x86)\Microsoft Office' Customize Rabon Out & Access Teeller Add ins Trust Center Mgnage: Excel Add-ins Co | Save Publisher: Lengwage Compatibility: No compatibility information available Advanced Location: C:\Program Files (x86)\Microsoft Office' Oxit & Access Trobbe Description: VBA functions for Analysis ToolPak Adé ins Troat Center Manage: Excel Add-ins Qo | Proofing | Add-in: Analysis ToolPak - VBA |
| Longage Compatibility: No compatibility information available Advanced Location: C:\Program Files (x86)\Microsoft Office' Cutomix Access Tealber Description: VBA functions for Analysis ToolPak Add-ins Trust Center Manage: Excel Add-ins Qo | Lengage Compatibility: No compatibility information available Advanced Location: C:\Program Files (x86)\Microsoft Office' Cutomise Ribon Ouris Access Treater Advines Thot Center Manage: Excel Add-ins | Save | Publisher: |
| Advanced Location: C:\Program Files (x86)\Microsoft Office' Cutamite Rabon Description: VBA functions for Analysis ToolPak Addrine Tout Center Manage: Excel Add-ins Go | Advinced Location: C:\Program Files (x88)\/Microsoft Office' Customic Ration Description: VBA functions for Analysis ToolPak Addrive Manage: Excel Addrive | Language | Compatibility: No compatibility information available |
| Customice Ribbon Ocide Access Teelbar Adde ins Trust Center Mgn.age: Excel Add-ins Go | Cuterine Ribbon Ouix Access Teelbar Add ini Truel Cuter Mgnage: Excel Add-ins Go | Advanced | Location: C:\Program Files (x86)\Microsoft Office |
| Ouck Accent Troble Description: VBA functions for Analysis ToolPak Addrins | Outd Access Tradber Description: VBA functions for Analysis ToolPak Ad6 ins Trud Center Manage: Excel Add-ins © | Customize Ribbon | Receiving 101 for size for both in Technic |
| Addrins Trust Center Mgnage: Excel Addrins V Go | Adé ins Truit Center Manage: Excel Add-ins V Go | Quick Access Toolbar | Description: VBA functions for Analysis ToolPak |
| Truit Center Manage: Excel Add-ins | Trust Center Mgnage: Excel Add-ins 🔹 😰 | Add-ins | |
| Mgnage: Excel Add-ins V Go | Mgnage: Excel Add-ins 👻 Go | Trust Center | |
| | | | Manage: Excel Add-ins T Go |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Knowledge Requirements

Understanding of basic statistical terminology. See **getting started with statistics** in MAX toolkit.

central limit theorem)² that a distribution will fall symmetrically around the mean to produce a **bell-shaped curve** if a sufficient sample is drawn. This means that most values will be grouped near the centre of the distribution and the remaining values will tail off away from the mean in equal measures.



The **normal distribution** which produces a bell-shaped curve and plots the percentage of the data-set that should fall within a given range.

INDEPENDENT T-TESTS

Assumptions

| Criteria | Details |
|---|---|
| DV can be measured on a continuous scale | SCRQoL, Carer-QOL and age are all continuous variables. |
| IV is categorical and independent | With the exception of SCRQoL, Carer QOL and age, all variables in surveys are categorical. |
| Independence of observations | All responses to survey are independent (i.e. respondents provide one response for each question) |
| Normal distribution | Observations are normally distributed. Tested during Step 2. |
| Homogeneity of variances | Variation in each group is approximately equal. Tested during Step 3. |

Example question

Do overall social care-related quality of life (SCRQoL) scores (ASCOF 1A) differ between men and women?

Dependent Variable

- Social care-related quality of life (SCRQoL)
- Variable is measured on a continuous scale (0 24)

Independent Variable

- Gender (men | women)
- Variable is categorical and independent

Conducting t-tests in Excel

Step 1: copy + paste relevant data from your NHS Digital data return into a blank Excel sheet.



Step 2: check whether data is **normally distributed** [go to Data tab].



The Normal Distribution [1/3]



Also known as the **bell-shaped curve**. A frequency distribution of a set of independent, randomly generated variables where:

- most values are grouped near the centre
- remaining values tail off away from the centre in equal measures
- mean, median and mode are the same

The Normal Distribution [2/3]

Based on **central limit theorem** which states that the averages (mean) of a number of variables will become normally distributed if the sample is sufficiently large.

An important concept in **inferential statistics** as parametric tests which compare sample means (e.g. t-tests, ANOVA) assume that data is normally distributed.

| | Descriptive | Inferential |
|---------|---------------|------------------|
| Dataset | Population | Sample |
| Purpose | Describe data | Make predictions |

The Normal Distribution [3/3]

Current sample: 984 respondents [341 (men) + 603 (women)]

Distribution: SCRQoL scores (0-24)



Histogram shows that data are not normally distributed but descriptive measures can be used to establish whether parametric or non-parametric statistical tests should be used.

Select **Descriptive Statistics** and press OK.

Data Analysis ? Х Analysis Tools OK Anova: Single Factor ^ Anova: Two-Factor With Replication Cancel Anova: Two-Factor Without Replication Correlation Help Covariance Descriptive Statistics Exponential Smoothing F-Test Two-Sample for Variances Fourier Analysis Histogram

Complete fields in Descriptives Statistics window.

Remember to select labels in first row

| Input | | OK |
|------------------------|-----------------|--------------|
| Input Range: | \$B\$2:\$C\$605 | |
| Grouped By: | Columns | Cancel |
| | O <u>R</u> ows | <u>H</u> elp |
| ✓ Labels in first row | | |
| Output options | | |
| | ¢F¢2 | |
| Output Range: | JLJZ HK | |
| New Worksheet Ply: | | |
| O New Workbook | | |
| Summary statistics | | |
| Confidence Level for M | lean: 95 % | |
| Kth Largest: | 1 | |
| Kth Smallest: | 1 | |

Look at **skewness** in the output data.

Skewness measures the symmetry of the frequency distribution. Perfect symmetry = 0. See Getting Started with Statistics for further information.

| Men | | Women | |
|--------------------|----------|--------------------|----------|
| Mean | 18.92962 | Mean | 18.8408 |
| Standard Error | 0.2222 | Standard Error | 0.14693 |
| Median | 20 | Median | 19 |
| Mode | 24 | Mode | 19 |
| Standard Deviation | 4.103195 | Standard Deviation | 3.608019 |
| Sample Variance | 16.83621 | Sample Variance | 13.0178 |
| Kurtosis | 0.208988 | Kurtosis | -0.15424 |
| Skewness | -0.85272 | Skewness | -0.57416 |
| Range | 18 | Range | 16 |
| Minimum | 6 | Minimum | 8 |
| Maximum | 24 | Maximum | 24 |
| Sum | 6455 | Sum | 11361 |
| Count | 341 | Count | 603 |

Data is not normally distributed so assumption is violated. In this instance, you will need to run the non-parametric equivalent [a Mann Whitney U Test].

Most, if not all, respondents generally report good quality of life. These distributions will therefore be negatively skewed.

Step 3: check whether the group variances are approximately equal. Open Real Statistics window – CTRL + M – select One Factor ANOVA

| Merce & Center 🔻 | | | |
|----------------------|----------------------|---------------|--------|
| ANOVA: Single Factor | | | × |
| Input Range She | eet1!\$8\$2:\$C\$605 | _ Fil | ОК |
| Alpha 0.0 |)5 | | Cancel |
| Input format | | | Help |
| Excel format with | | | |
| C Excel format w/o | column headings | | |
| C Standard (stacked | i) format | | |
| Options | | | |
| ANOVA | Contrasts | Contras | ts KW |
| Kruskal-Wallis | Tukey HSD | Nemeny | i KW |
| □ Welch's | Games-Howell | 🗌 Dunn Te | st KW |
| Brown-Forsythe | Dunnett's Test | C Dunnett | KW |
| Random Factor | Scheffe | ✓ Levene's | s Test |
| Alpha correction for | contrasts | $\overline{}$ | |
| No correction | | | |
| C Dunn/Sidak cor | rection | | |
| C Bonferroni corr | rection | | |
| Output Range She | eet1!\$E\$19 | New | |



Complete fields in **ANOVA: single** factor window.

Remember to select

Look at means p-value in the output data.

| _ | | - |
|---|---------|---|
| | p-value | 2 |
| | .016965 | |
| | .036295 | |
| | .018075 | |
| | | p-value 0.016965 0.036295 0.018075 |

P-value is less than 0.05. Variance in groups is not equal so assumption is violated.

| Overview of t-test options | | | | | |
|---|-----------------|---------------|-----------------|-------------------|--|
| | Norı Distrib | mal oution | Homoge Varia | eneity of ance | |
| Test | Yes | No | Yes | No | |
| T- test with equal variances assumed | \checkmark | | \checkmark | | |
| T-test with equal variances not assumed | \checkmark | | | \checkmark | |
| Mann Whitney U Test | | \checkmark | \checkmark | \checkmark | |

Step 4: run **t-test [Mann Whitney U-test**]. Open **Real Statistics window** – CTRL + M – click on the **Misc** tab and select **T-test and Non-parametric equivalents**.

| T Tests and Non-para | metric Equiva | lents | × | | | | |
|----------------------|-------------------------------------|---------------------------|------|--|--|--|--|
| Input Range 1 | Sheet1!\$8 | \$2:\$B\$343 _ Fil | ок | | | | |
| Input Range 2 | Sheet1!\$C\$2:\$C\$605 _ Fil Cancel | | | | | | |
| Column headings in | ncluded with da | ita | Help | | | | |
| Alpha 0.05 | Hyp Mean/Med | ian 0 | | | | | |
| Options | | Test type | | | | | |
| C One sample | | Ttest | | | | | |
| C Two paired sar | nples | Non-parametr | ic | | | | |
| Two independent | ent samples | | | | | | |
| Non-parametric tes | t options | | | | | | |
| Use ties correc | tion | ☑ Include exact test | | | | | |
| Use continuity | correction | ☑ Include table looku | p | | | | |
| Output Range | E46 | New | | | | | |
| | | | | | | | |



Complete fields in **T-test + non**parametric equivalents window.

Remember to select Non-parametric

Look at **p-value** in the output data.

Unless you have specified the direction of the difference between your groups, you will look at the **two tail value**

| Mann-Whitney Test | for Two In | dependent Samples | |
|-------------------|------------|-------------------|---|
| | | | |
| | Men | Women | |
| count | 341 | 603 | |
| median | 20 | 19 | |
| rank sum | 165680.5 | 280359.5 | |
| U | 98253.5 | 107369.5 | |
| | | | |
| | one tail | two tail | |
| alpha | 0.05 | | |
| U | 98253.5 | | |
| mean | 102811.5 | | |
| std dev | 4008.417 | ties | |
| z-score | 1.137107 | | |
| effect r | 0.03701 | | |
| U-crit | 96218.24 | 94955.14799 | |
| p-value | 0.127747 | 0.255493399 | 5 |
| sig (norm) | no | no | |
| | | | |
| | | | |

P-value is more than 0.05. Differences between groups is not statistically significant [**Note**: this is confirmed in last row].

Conducting parametric t-tests in Excel

Parametric versions of t-tests can be conducted using the Analysis Toolkpak.

| Data Analysis | ? × | What-If Forecast Iel Analysis ▼ Sheet Forecast | E Subtotal Outline | 6 | Analyze |
|---|---|---|---|----------|------------------------------|
| Analysis Tools Histogram Moving Average Random Number Generation Rank and Percentile Regression Sampling t-Test: Paired Two Sample for Means t-Test: Two-Sample Assuming Equal Vari t-Test: Two-Sample Assuming Unequal Vari t-Test: Two-Sample for Means | OK Cancel <u>H</u> elp | t-Test: Two-Sample Assum | ng Equal Variance | es | ? × |
| | Remember to select the most appropriate t-test [see Step 3] | Variable <u>1</u> Range: Variable <u>2</u> Range: Hypoth <u>e</u> sized Mean Differe ✓ Labels <u>A</u> lpha: 0.05 | \$B\$2:\$B\$343 \$C\$2:\$C\$605 ence: | 1 | OK Cancel <u>H</u> elp |
| See the step-by-step i Further guidance on ho | n structions for ow to do this | Output options | \$N\$21 | 5 | |

Reporting results of t-test analysis

The usual format for reporting the results of a Mann Whitney u-test is:

> U = u value, p = significance value u statistic value Taken from output (step 4) u statistic p value Either one or two tailed. Taken from output (Step 4)

You should also include the **median** for each group. For example,

Social care-related quality of life (SCRQoL) scores [ASCOF 1A] for men (Mdn = 20) did not differ significantly from women (Mdn = 19) (U = 94955.47, p = 0.26).

The usual format for reporting the results of a t-test is:



You should also include the **mean** and **standard error** for each group. For example,

Men who responded to the adult social care survey did not report significantly different social carerelated quality of life (SCRQoL) [ASCOF 1A] (M = 18.9, SE = 0.22) than women (M = 18.8, SE = 0.15), (t (634) = 0.33, p = 0.74).

ANALYSIS OF VARIANCE (ANOVA)

Assumptions

| Criteria | Details | | | |
|---|---|--|--|--|
| DV can be measured on a continuous scale | SCRQoL, Carer-QOL and age are all continuous variables. | | | |
| IV is categorical and independent | With the exception of SCRQoL, Carer QOL and age, all variables in surveys are categorical. | | | |
| Independence of observations | All responses to survey are independent (i.e. respondents provide one response for each question) | | | |
| Normal distribution | Observations are normally distributed. Tested during Step 2. | | | |
| Homogeneity of variances | Variation in each group is approximately equal. Tested during Step 3. | | | |

Example question

Do overall social care-related quality of life (SCRQoL) scores (ASCOF 1A) differ by rating of satisfaction with services?

Dependent Variable

- Social care-related quality of life (SCRQoL)
- Variable is measured on a continuous scale (0 24)

Independent Variable

- Satisfaction with services
 - Extremely satisfied
 - Very satisfied
 - Quite satisfied
 - Neither satisfied nor dissatisfied
 - Quite dissatisfied
 - Very dissatisfied
 - Extremely dissatisfied
- Variable is categorical and independent

Conducting ANOVA in Excel

Step 1: copy + paste relevant data from your NHS Digital data return into a blank Excel sheet.

| Put data in separate | Extremely/ very satisfied | Quite satisfied | Neither | Quite, very or extremely dissatisfied | Include labels for the |
|----------------------|---------------------------------|--------------------|---------|--|------------------------|
| columns | 10 | 7 | 8 | 8 | groups |
| | 11 | 8 | 8 | 9 | 6 1 |
| | 12 | 9 | 9 | 9 | |
| | 12 | 9 | 10 | 9 | |
| | 12 | 9 | 10 | 10 | |
| | 12 | 9 | 11 | 11 | |

Step 2: check whether data is **normally distributed** [go to Data tab].



Select **Descriptive Statistics** and press OK.



Complete fields in Descriptives Statistics window.

Remember to select labels in first row

| Input Input Range: | SBS2:SES564 | 1 | OK |
|---------------------------|-------------|---|--------|
| Grouped By: | Columns | | Cancel |
| | <u>Rows</u> | | Help |
| ✓ Labels in first row | | | |
| Output options | | | |
| Output Range: | SGS2 | 1 | |
| O New Worksheet Ply: | | | |
| O New Workbook | | | |
| ✓ Summary statistics | | | |
| Confidence Level for Mean | : 95 | % | |
| Kth Largest: | 1 | | |
| Kth Smallest | 1 | | |

Look at **skewness** in the output data.

| Extremely/very satisfie | ed | Quite satisfied | | Neither | | Quite, very or extremely | dissatisfied |
|-------------------------|-------|--------------------|-------|--------------------|-------|--------------------------|--------------|
| Moon | 20.19 | Moon | 17.45 | Moon | 16 77 | Moon | 14.62 |
| Standard Error | 0.12 | Standard Error | 0.23 | Standard Error | 0.56 | Standard Error | 0.71 |
| Median | 21.00 | Median | 18.00 | Median | 17.00 | Median | 13.50 |
| Mode | 24.00 | Mode | 18.00 | Mode | 15.00 | Mode | 13.00 |
| Standard Deviation | 2.96 | Standard Deviation | 3.70 | Standard Deviation | 4.20 | Standard Deviation | 4.63 |
| Sample Variance | 8.73 | Sample Variance | 13.68 | Sample Variance | 17.60 | Sample Variance | 21.46 |
| Kurtosis | -0.10 | Kurtosis | -0.30 | Kurtosis | -0.79 | Kurtosis | -0.65 |
| Skewness | -0.62 | Skewness | -0.34 | Skewness | -0.29 | Skewness | 0.38 |
| Range | 14 | Range | 17 | Range | 16 | Range | 17 |
| Minimum | 10 | Minimum | 7 | Minimum | 8 | Minimum | 7 |
| Maximum | 24 | Maximum | 24 | Maximum | 24 | Maximum | 24 |
| Sum | 11348 | Sum | 4523 | Sum | 939 | Sum | 614 |
| | 5.00 | Count | 259 | Count | 56 | Count | 42 |

Data is not normally distributed so assumption is violated. In this instance, you will need to run the non-parametric equivalent [a Kruskal Wallis Test].

Most, if not all, respondents generally report good quality of life. These distributions will therefore be negatively skewed.

Step 3: check whether the group variances are approximately equal. Open Real Statistics window – CTRL + M – select One Factor ANOVA

| ANOVA: Single Factor | | | × |
|---------------------------------|----------------------|------------|--------|
| Input Range Sh | eet1!\$8\$2:\$E\$564 | - Fil | ОК |
| Alpha 0.0 |)5 | | Cancel |
| Input format Fycel format with | column headings | | Help |
| C Excel format w/o | | | |
| C Standard (stacker | t) format | | |
| | i) format | | |
| Options | | | |
| | Contrasts | Contras | ts KW |
| Kruskal-Wallis | Tukey HSD | Nemeny | i KW |
| Welch's | Games-Howell | 🗌 Dunn Te | st KW |
| Brown-Forsythe | Dunnett's Test | | KW |
| Random Factor | Scheffe | ✓ Levene's | s Test |
| Alpha correction for | contrasts | \sim | |
| No correction | | | |
| C Dunn/Sidak co | rrection | | |
| C Bonferroni con | rection | | |
| Output Range Sh | eet1!\$G\$19 | New | |



Complete fields in **ANOVA: single** factor window.

> Remember to select Levene's Test

Look at **means p-value** in the output data.

| Levene's Tests | |
|----------------|---------|
| type | p-value |
| means | 0.00 |
| medians | 0.00 |
| trimmed | 0.00 |

P-value is less than 0.05. Variance in groups is not equal so assumption is violated.

| Overview of ANOVA options | | | | |
|----------------------------------|------------------------|--------------|----------------------------|--------------|
| | Normal Distribution | | Homogeneity of Variance | |
| Test | Yes | No | Yes | No |
| Single factor ANOVA | \checkmark | | \checkmark | |
| Kruskal Wallis Test | | \checkmark | \checkmark | \checkmark |

Step 4: run t-test [Kruskal-Wallis test]. Open Real Statistics window – CTRL + M – click on the Anova tab and select One Factor Anova.

| ANOVA: Single Factor | · | | × |
|------------------------|-------------------------------|-------------|--------|
| Input Range She | eet1! \$ B\$2:\$E\$564 | _ Fill | ок |
| Alpha 0.0 | 5 | | Cancel |
| Input format | | | Help |
| Excel format with | column headings | | |
| C Excel format w/o o | olumn headings | | |
| C Standard (stacked |) format | | |
| Options | | | |
| ANOVA | Contrasts | Contrast | s KW |
| Kruskal-Wallis | 🔲 Tukey HSD | 🗌 Nemenyi | кw |
| Welch's | Games-Howell | 🗌 Dunn Tes | st KW |
| Brown-Forsythe | 🗌 Dunnett's Test | 🗌 Dunnett I | ĸw |
| Random Factor | Scheffe | Levene's | Test |
| Alpha correction for c | contrasts | | |
| No correction | | | |
| C Dunn/Sidak cor | rection | | |
| C Bonferroni corr | ection | | |
| Output Range J20 |) | _ New | |

| De | sc Reg Anova Time S Multi Var Misc | ОК |
|----|--|--------|
| | One Factor Anova Two Factor Anova Three Fixed Factor Anova One Pereated Measures Anova | Cancel |
| | Mixed Repeated Measures Anova Nested Anova | Help |
| | Randomized Complete Block Anova Split-Plot Anova Latin Squares Anova Follow-up Two Factor Anova Ancova | Config |
| | Manova | |

Complete fields in **ANOVA: Single Factor window**.

Look at **p-value** in the output data.

| Kruskal-Wallis Test | | | | | |
|---------------------|----------------|-----------------|-------------|-----------------------|------------------|
| | Extremely/very | Quite satisfied | Neither | Quite, very or extrer | nely dissatisfie |
| median | 21 | 18 | 17 | 13.5 | |
| rank sum | 305066.5 | 90581 | 17997.5 | 9095 | |
| count | 562 | 259 | 56 | 42 | 919 |
| r^2/n | 165597098.6 | 31679218.38 | 5784107.254 | 1969500.595 | 205029924.8 |
| H-stat | | | | | 150.01 |
| H-ties | | | | | 151.21 |
| df | | | | | 3.00 |
| p-value | | | | | 0.00 |
| alpha | | | | | 0.05 |
| sig | | | | | ves |

P-value is less than 0.05. Differences between groups is statistically significant [**Note**: this is confirmed in last row].

Conducting parametric ANOVA in Excel

Parametric versions of ANOVA can be conducted using the Analysis Toolkpak.

| ata Analysis | | ? | \times |
|---|---|-----|----------|
| Analysis Tools | | 0 | K |
| Anova: Single Factor Anova: Two-Factor With Replication Anova: Two-Factor Without Replication | Â | Car | ncel |
| Correlation Covariance | | He | elp |
| Exponential Smoothing F-Test Two-Sample for Variances | | | |
| Fourier Analysis Histogram | ~ | | |

See the **step-by-step instructions** for further guidance on how to do this



| nput | | 01 |
|---------------------|-----------------|--------|
| Input Range: | \$B\$2:\$E\$564 | OK |
| Grouped By: | <u>C</u> olumns | Cancel |
| | O <u>R</u> ows | Help |
| Labels in first row | | |
| <u>Alpha:</u> 0.05 | | |
| Output options | | |
| Output Range: | \$G\$27 | 1 |
| | | 1 |
| New Worksheet Plv: | | |

Reporting results of ANOVA

The usual format for reporting the results of a Kruskal Wallis test is:



Try to report in everyday terms. For example,

Social care related quality of life (SCRQoL) [ASCOF 1A] is significantly affected by satisfaction with services, H (3) = 150.01, p = 0.00.

The usual format for reporting the results of a **single factor ANOVA** is:



Try to report in everyday terms. For example,

Social care related quality of life (SCRQoL) [ASCOF 1A] is significantly affected by ratings of satisfaction with services, *F* (3,915) = 74, p = 0.00.

Conducting post-hoc analysis

Post-hoc t-tests can be conducted to **compare individual groups** (e.g. extremely / very satisfied vs. quite satisfied) and may help you to further **understand statistically significant differences**.

Guidance on how to conduct post-hoc t-tests is provided in stepby-step instructions, available in the MAX toolkit.

Further Information

To find out more about the MAX project, download the reports on earlier research activities or access the MAX toolkit:

Website:www.maxproject.org.ukEmail:maxproject@kent.ac.uk

Disclaimer

Department of Health and Social Care disclaimer: The MAX toolkit and website are based on independent research commissioned and funded by the NIHR Policy Research Programme (Maximising the value of survey data in adult social care (MAX) project and the MAX toolkit implementation and impact project). The views expressed on the website and in publications are those of the author(s) and not necessarily those of the NHS, the NIHR, the Department of Health and Social Care or its arm's length bodies or other government departments.