1 GUIDELINES FOR STATISTICAL ANALYSIS OF SURVEYS

Two types of statistical analysis are often encountered. In the first, the student has the whole population *(e.g. data on all Slovenian municipalities, EU countries ...),* in the second, a sample from a part of the population, usually a survey. The guidelines written here refer mainly to surveys.

1.1 PREPARING FOR THE SURVEY

1.1.1 Survey questionnaire

The first step in preparing a questionnaire is to study previous surveys. It is very likely that someone else has already dealt with a similar problem, so it makes sense to take their questionnaire and adapt it to your needs if necessary. This should take into account the theoretical background and the structure of the concepts (constructs) to be addressed should be properly implemented in the questionnaire.

1.1.2 Preparation of the survey

The simplest way to do this is to take the survey online. There are many online survey tools, one of the most commonly used is 1ka.[1] The tool is free and there are guidelines and warnings about common mistakes which are worth reading before entering the survey. For Likert scales, the levels of attitudes towards the statements should be given descriptively (numerical treatment is done in the background).

1.1.3 Sample selection

First, it is necessary to clearly define what is the population being studied. Consideration should then be given to whether a representative sample can be selected from the population under study. This is often a difficult, even unrealistic task, and a compromise must be made between validity of conclusions and ease of implementation. Students can read about the problems of representativeness in the content of the 1ka website .[2]

Another important question is how large the sample size should be. This depends mainly on the statistical methods to be used. A sample of 30 units may be large enough to estimate the mean of a variable, and it may also be large enough to compare the means of two groups of approximately equal size. However, if a regression analysis is to be carried out with many independent variables, such a sample will be much too

[1] https://www.1ka.si/
[2] https://www.1ka.si/c/701/Reprezentativnost/

small. There is no general rule, the student can be guided by the "calculator"[3] or the "rule of thumb for regression".[4]

1.2 DEMONSTRATION OF THE MEASURING INSTRUMENT

The questionnaire as a data collection method must be validated by previous research. The presentation of the questionnaire defines what is being measured (constructs, concepts, etc.) and presents this view in a structured way**, which is also** the basis for the reporting structure of the survey results. It is important that the way the measurement is done is presented in a way that can be replicated at a later stage.

1.3 PRESENTATION OF RESULTS

The presentation of the results starts with basic information about the population, the sample and the sampling method. If it is known that the sample was non-probability, this is emphasised. It shall also be explained that inference on the population may not be entirely correct. It shall be described how many surveys were obtained and what the response rate was. Descriptive statistics are then displayed. Most often, the demographic variables (sex, education, age, etc.) are shown first. When explaining demographic variables, a comparison of the structure of the sample and the structure of the population is made wherever possible. Other variables are then followed.

Reporting should be structured according to groups of concepts (concepts, constructs). Illustrations (charts, tables) should be as simple as possible, i.e. without 3D design, unnecessary shading, lines, etc., and a uniform colour appearance. As a general advice, circular (pie) charts should not be used (bar charts should be used instead). In particular, these charts are inappropriate for the presentation of ordinal variables (education, level of agreement, etc.).

Typically, surveys contain a set of opinion questions where respondents express their agreement on ordered scales (e.g. from strongly disagree to strongly agree). Then, instead of frequency distributions for each variable, it makes more sense to calculate the average agreement and order the statements according to the average. Certain variables are expressed numerically, for example if age is asked for without offering possible classes. This type of data is then displayed using a histogram, either setting the class boundaries in a meaningful way or leaving it to the software (Excel 2016 and SPSS have histograms included). The display is usually fitted with a mean and standard deviation. The display of two variables depends mainly on which type the variables are. If they are measured at least at the interval level, they may be displayed

[3] https://www.surveymonkey.com/mp/sample-size-calculator/

[4] https://stats.stackexchange.com/questions/10079/rules-of-thumb-for-minimum-sample-size-for-multiple-regression

with a scatter plot, otherwise the graph display is avoided and instead reports the value of the chosen measure of association.

When explaining graphs or tables, an attempt is made to present the essential features of the phenomenon. The facts that are apparent from the graphical representation are never repeated, but merely used as an argument for the conclusions drawn.

1.4 HYPOTHESIS TESTING

Statistical tests should be used to test hypotheses, as conclusions based on descriptive statistics are subjective and therefore inappropriate. Tests should only be avoided if the data are on the whole population, and then only to emphasise that their results are not intended for statistical inference. However, when analysing a survey based on a sample, tests are necessary.

Table 2 shows some examples of hypotheses. Citizens of a municipality were surveyed and asked how satisfied they were with the work of the police and the police. The respondents answered the questions on a scale of satisfaction (e.g. from 1 - totally dissatisfied to 5 - totally satisfied). Finally, they were asked about their gender, age, marital status and whether they came from an urban or rural environment.

Table 2: Examples of hypotheses and corresponding tests

Example hypothesis	Appropriate test	Test assumptions	Alternatives (e.g. non-parametric test)	Notes
Citizens are satisfied with the work of the police.	one-sample t-test	large enough sample (n > 30) or normally distributed data	test for median, test for proportion	We need a clear definition of what is meant by "satisfaction" - perhaps the mean (a value of 3 on a scale of 1 to 5) or the score previous research.
Men are more satisfied with the work of the police than women.	t-test for independent samples	sufficiently large sample (n > 30) or normally distributed data; equality of variances in both Groups	Mann-Whitney test	The interpretation of the Mann-Whitney test is more complex, there is a correction for unequal variances.
Citizens at work more satisfied with the work of the police than with the work of the police.	t-test for dependent samples	sufficiently large sample size (n > 30) or normally distributed data	Wilcoxon test	
Citizens who are more satisfied with the work of the police are also more satisfied with the work of the policing.	test for correlation (Pearson, Spearman coefficient)		Spearman's coefficient	The Spearman coefficient is a very appropriate measure of correlation for ordinal data.

Married people are most satisfied with police work, followed by divorced people, and least satisfied with work police are happy singles.	ANOVA (analysis of variance)	sufficiently large sample (n > 30) or normally distributed data; equality of variances between groups	Kruskall-Wallis test	The interpretation of the Kruskall-Wallis test is more complex.
Example hypothesis	**Appropriate test**	**Test assumptions**	**Alternatives (e.g. non-parametric test)**	**Notes**
Among people from rural areas the proportion of married people is higher than among people from the city.	share test, can also χ^2 to analyse the correlation between two categorical to the variables	a sufficiently large sample, in at least 80% of the cells of the expected frequencies greater than 5	Fisher Precision Test	The χ test^2 can be used to analyse whether between two there is a correlation between the two categorical variables. As a result, this test can be used to compare proportions. The assumptions that the test must meet are checked by SPSS itself and reported to us in the form of a note.

Source: Novak (2010, p. 15)

Note: The table may be on several pages, and the table header must be inserted on each new page as shown in Table 2 above.