Briefing Note: confidence intervals and statistical significance within the Active People Survey

The Active People Survey is a **sample-based** survey. It is a telephone[1] market research survey interviewing a random sample of the English adult population (16 plus). The results are then used to draw conclusions about the English population as a whole.

How does interviewing c160,000 people give an accurate picture for a total population of over 40 million?

The Active People Survey uses a genuine random sample of the England population so the findings of the survey are therefore representative of the England population. This is the basic principle of sample-based surveys and is founded on mathematical probability theory.

So, interviewing 500 people out of a 40 million population is as statistically valid as interviewing 500 out of 100,000 people?

Yes, if the sample drawn is genuinely random then statistically, the underlying population total is irrelevant if it is a large population.

How therefore does a sample-based survey differ from interviewing the whole population?

A census interviews everybody in a given population, for example the UK Census 2011, so there is no statistical chance the findings do not represent the whole population.

All sample-based surveys contain a level of uncertainty to the findings because they are based on a proportion (a sample) of the population, not the whole population. However, we are able to measure how likely it is the survey would show the same results if the whole population was interviewed. This 'likelihood' (also known as 'uncertainty', 'sampling error' or 'confidence') in results from a sample survey can be measured through using the standard statistical tests summarised below:

- **Confidence level –** the Active People Survey results are presented using the 95% confidence level. This means there is only a one in 20 chance the findings of the survey are not a true representation of the population; in other words, there is a 95% chance that the confidence interval covers the true, underlying population mean. The 95% confidence level is the most commonly used confidence level in social research.

- **Confidence interval -** this calculates the range within which the 'true' figure will sit if the whole population was interviewed. For example, if Active People Survey 1 found that 22.0% of respondents in a local authority with 1000 sample size undertook 3x30[2], the associated confidence interval with this

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[1] See appendix A for information on the inclusion of 'mobile phone only' respondents within Active People.

[2] Active People Survey KPI 1 – 3x30 – 3 days a week, 30 minutes moderate intensity sport and active recreation

result is ±2.6%. This means we are 95% sure (confidence level), if the whole local authority population was interviewed, the 3x30 result would be between 19.6% and 24.6% (22.0% ±2.6%).

- Another way of describing the confidence interval is to refer to the level of precision. The smaller the confidence interval the greater the level of precision.

What does the confidence interval depend on?

Whilst confidence intervals are most strongly affected by the sample size, the population size can also have an effect on it. If the population is finite, then the actual confidence interval would be somewhat narrower than it would otherwise be if the population was infinite. This effect only normally occurs where the population size is 10 times (or less) as large as the sample; otherwise it can be ignored.

This effect is not critical with respect to the Active People Survey as it based on the entire adult population in England. Therefore a 1000 sample for a national population of 40 million will still have, to all intents and purposes, the same confidence interval as a 1000 sample for a local authority with a population of 800,000.

The confidence intervals for results from the Active People Survey depend on two main factors: a) the sample size used within the survey and b) the result (or prevalence) obtained from the survey:

- **The sample size**

For any given random sample as the sample size of the survey increases (i.e. the number of respondents interviewed), the confidence interval decreases. This is the same as saying that if you interview more people you get a more accurate result. For example Table 1 shows that 95 times out of 100, the *true* value for the whole population would lie between 22.4% and 22.6% (a confidence interval of plus or minus 0.1%). Likewise, at local authority level, with a smaller sample size, 95 times out of 100, the *true* value for the whole population would be between 19.9% and 25.1% (a confidence interval of plus or minus 2.6%). The larger confidence interval for the local authority in this example is solely due to the much smaller sample size of 1,000.

Table 1

	Active People Survey 1 (95% confidence level)		
	%	Sample size	Confidence interval
National	22.5%	363,000	±0.1%
Local Authority 1	22.5%	1,000	±2.6%

- **The prevalence (percentage obtained) (%)**

Confidence intervals decrease as the survey result becomes polarised, away from 50%. For example a 99% prevalence has a smaller confidence interval than a 50% prevalence. In Table 2, the sample size for each area is the same (1,000)

so the difference in the associated confidence intervals is due to the different prevalence obtained for each area (92.5% compared with 22.5%).

Table 2

	Active People Survey 1 (95% confidence level)		
	%	Sample size	Confidence interval
Local Authority 1	22.5%	1,000	±2.6%
Local Authority 2	50%	1,000	± 3.1%
Local Authority 3	92.5%	1,000	±1.6%

What are the advantages of a larger sample size?

A larger sample size provides a greater level of precision within any population and in turn allows analysis of more sub-groups within the survey. When comparing cross sectional results (two independent surveys carried out at different points in time) (discussed later), the scale of the Active People Survey enables detailed analysis of the results by demographic subgroups and at all geographies, down to a Local Authority level. The overall sample of Active People Survey 1 of c.363,000 is exceptional compared to other national population surveys, such as the Health Survey for England, which has an annual sample size of 15,000 and the Taking Part Survey (27,000 per year). By way of comparison, National Opinion Polls conducted during election periods are usually based on a national sample of approximately 1,500/2,000 people. The larger sample size of Active People enables an increased level of precision when analysing results.

How do confidence intervals apply when interpreting results within a single survey, for example Active People Survey 1 or Active People Survey 2?

When comparing results within a single survey, for example Active People Survey 1 or Active People Survey 2, it is necessary to consider the confidence intervals. The confidence intervals may vary for different geographical areas, for example a local authority and a region, mainly due to sample size differences, as explained above. What the confidence interval tells you is a measure of how close your sample-based result is likely to be to that of the population. From a purist point of view, if 100 experimenters independently generated samples of the same size from the same population and calculated the results with an associated confidence interval, then 95 of the confidence intervals would cover the population result. In this case 2 or 3 of the confidence intervals would have their upper limits falling below the population result and 2 or 3 would have their lower limits falling above the population result. From a pragmatic point of view, one can consider a 95% confidence interval as having a 95% chance of covering the population result.

Figure 1 shows a scenario where there is no statistically significant difference between the two results from a single survey. This is illustrated by the confidence interval for Result 1 overlapping with the confidence interval for Result 2, therefore the overall difference between the two results is not statistically significant. Conversely, Figure 2 shows the confidence interval for Result 3 does not overlap with the confidence interval for Result 4, therefore there is a statistically significant difference between the results.
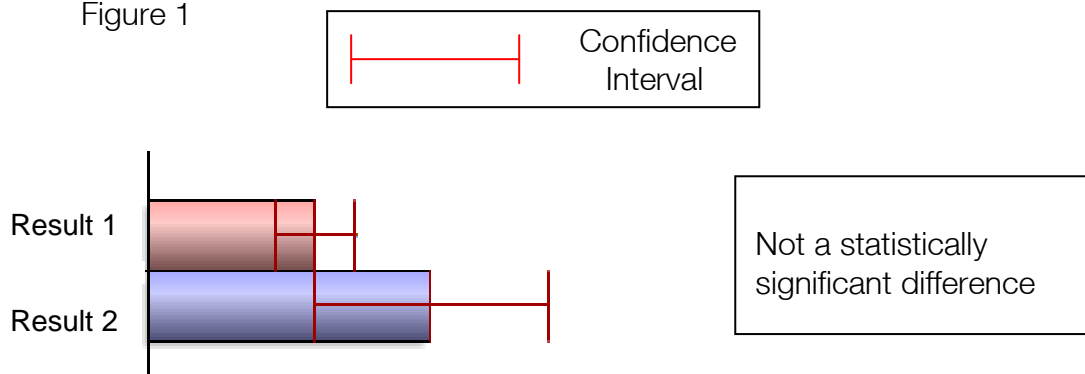
Figure 1

| Confidence Interval |

Result 1

Result 2

Not a statistically significant difference

Figure 2

Result 3

Result 4

A statistically significant difference

Confidence intervals are only normally used to describe results of single surveys, or to compare a single survey against a target / baseline. When comparing two independently sampled surveys, one should not use / compare confidence intervals of each of the two surveys, but should instead perform tests of statistical significance, which is described in the following paragraph. Confidence intervals to compare two survey waves may be used, but this is restricted to the context of calculating a confidence interval around the **difference** in the results between the two surveys.

Useful Links:

Sport England's Active People Interactive

Research Glossaries:
http://www.mrs.org.uk/mrindustry/glossary.htm

http://www.marketresearchworld.net/index.php?option=com_glossary&Itemid=26