Sample size.doc

FAM SAMPLING WORKSHOP
WESTMINSTER CATERING AND CONFERENCE CENTER
WESTMINSTER, MARYLAND

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09:15 - 10:30 Sample Size

- Magnitude of change
- Power and significance
- Screening
- Multiple indicators
- One-time surveys

Determining Sample Size Requirements

Two types of factors drive sample size requirements for a survey:

- Population parameters (over which the survey designer has no control)
  - Population/household size & composition
  - Initial levels of indicators at start of program
  - Underlying frequency or prevalence of diseases or conditions of interest (e.g., diarrhea in last two weeks)
  - Correlation of characteristics and behaviors within clusters
- Parameters specified by the survey designer
  - Desired statistical confidence
  - Desired statistical power

Determining sample size for a cross-sectional (one-time) survey:

- Primary objective of a cross-sectional survey – estimate a set of population parameters as accurately as possible given available resources

- Result of a survey:

    - Point estimate of parameter being estimated (proportion, mean, total)

    - Confidence interval around point estimate

p

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95% confidence interval (+/- 2 standard errors)

- Example: estimated p = .25 (95% C.I. = .15, .35)

- Sample size formula for cross-sectional surveys – proportions:

  $n \geq d\, Z^2\, p\, (1-p) / D^2$

where:

n = minimum sample size required

d = cluster sampling design effect

Z = desired confidence that the survey estimate of p will not differ from the true value of p by more than +/- D

p = anticipated value of the proportion being estimated

D = tolerable error

- Example: want to estimate proportion of children aged 6-59 months who are stunted and be 95% certain that the estimated proportion p lies within +/- 5 percentage points of the true population proportion P. Since there is no information available on what p might be in the population of interest, set p =.50 in sample size formula. Assume deft = 2.0.

  $n \geq d\, Z^2\, p\, (1\text{-}p) / D^2$

  $\geq 2.0\, (1.96)^2\, (.5)(.5) / (.05)^2$

  $\geq 2.0\, (1.96)^2\, (.5)(.5) / (.05)^2$

  $\geq 1.9208 / .0025$

  $\geq 768 = 770$

Determining sample size for surveys designed to measure changes over time:

- Primary objective – to estimate the magnitude of change on a set of population parameters as accurately as possible given available resources

  - Want to measure change $p_2 - p_1$

  - In order to do so, need to ensure that confidence intervals around estimates p_1 and p_2 don't overlap (otherwise, cannot be certain whether change was "real" or the result of random measurement error)

    - Statistically significant change
      (Non-overlapping confidence intervals)

      p_1 p_2

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    - Statistically non-significant change
      (Overlapping confidence intervals)

      p_1 p_2

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    - Bottom line – need larger sample sizes to measure changes than to measure parameters in the cross-section

- Sample size formulae for measuring change over time – see Sampling Guide for formulae and lookup table

- Conditional indicators – need to take into account prevalence of underlying conditions in the population (e.g., indicators for children with diarrhea in last two weeks). Such indicators require larger sample sizes than unconditional indicators

- Translating sample size requirements for elements into number of households required – see Figure 3-6 in Sampling Guide

- In surveys that measure changes on multiple indicators, which sample size should be used?

  - Choose largest of sample sizes calculated for the various indicators to be measured (i.e., that for the most demanding indicator)

  - Choose sample size for the most important indicator(s)

  - Example (hypothetical data):

    Minimum sample sizes (number of households) for key indicators:

    % children 24-59 months stunted – 905

    % infants fed extra food after diarrhea – 1,654

    % households with access to safe water – 476

    If sample size of n=1,654 were to be used, requirements of all indicators would be satisfied

- Making allowance for non-response when estimating sample size requirements
  - Some non-response will be encountered in every survey
  - Because non-response bias is biggest threat, first priority is to minimize level of non-response
  - However, survey designers typically add 5-10% to the estimated sample size as “insurance”

- How many clusters should be covered?
  - Although the use of 30 clusters has been popularized, there is nothing magical about 30 clusters (30 should, however, be viewed as a minimum)
  - Formulae available to determine optimal sample size per cluster from which number of clusters could be determined, but necessary information to use is rarely available
  - General guidelines:
    - Choose as many clusters as resources will permit – a sampling plan with more clusters and smaller cluster sample sizes is preferable to one with fewer clusters of larger size
    - Avoid clusters of > 50 elements (note: may need > 50 households to find 50 elements)
    - DHS – 25 to 40 per cluster

What is the power and confidence for subgroups?

Problem: Sample size, n, computed on basis of one target group (e.g., children under 23 months), but what is the power and confidence for other subgroups (e.g., children 12-23 months)?

Assumptions: $\forall$ = .95; $\exists$ = .8;
Magnitude of difference, $p_1 - p_2$, is the same for both subgroups

- For any subgroup larger (n is greater) than original group, power and significance will be larger, and acceptable by definition.

What is the power and confidence for subgroups? *Continued*

- If subgroup has small n, approximate values are:

Ratio of sample sizes	$\forall$	$\exists$
.9 (10% smaller)	.937	.776
.8	.920	.748
.75	.911	.732
.6	.871	.678
.5 (half as big)	.834	.634
.33 (one third)	.740	.540
.25 (one fourth)	.673	.478
.20 (one fifth)	.619	.433
.17 (one sixth)	.576	.399
.14 (one seventh)	.541	.372
.13 (one eighth)	.513	.349
.10 (one tenth)	.465	.314

Rule of thumb: power and significance are too loose for sound subgroup conclusions if ratio of sample sizes is half or less.