Principles of Survey Design and Management

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Is a Survey Needed?

- **Required data not available from other sources**
- **Existing data out-of-date**
- **Existing data is inaccurate, incomplete or confidential**

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Considerations When Deciding to Conduct a Survey

- **Is the information collectible?**
- **Is the survey affordable?**
- **Will the data be available when needed?**
- **Is the information available and obtainable from other sources?**
- **Can the target population be identified?**
- **Can the target population be interviewed?**

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Elements of a Survey

- **The Analysis Plan**
- **Data Collection Methods**
- **Questionnaire Design and Testing**
- **Probability Sampling**
- **Interviewing Procedures**
- **Non-response and Bias**
- **Data Processing**
- **Analysis**
- **Confidentiality and Data Limitations**
- **Contract Management**

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The Analysis Plan

- **The first step in designing a survey**
- **Need to define the basic aspects of the survey**
- **Purpose of the survey**
  - **Objectives of the research**
  - **Data variables**
  - **Analytic methods**
  - **Preliminary tabulations**

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Factors Affecting Choice of Data Collection Method(s)

- **Characteristics of target population**
- **Data requirements**
- **Obligation to reply**
- **Definition and target response rate**
- **Available time**
- **Available funds**

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Data Collection Methods - I

- **Basic Methods:**
  - **Face-to-face**
    - **Paper and pencil**
    - **Computer Assisted Personal Interview (CAPI)**
    - **Computer assisted Self Interview (CASI)**

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Data Collection Methods - II

- **Self-Administered Interviews**
  - **Questionnaire delivered by mail and returned by mail**
  - **Can be hand-delivered and deposited in box or returned by mail**
  - **Internet surveys**
    - **Invitation by e-mail or letter**

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Data Collection Methods - III

- **Telephone Interviews**
  - **Manual Dial-up**
  - **Computer Assisted Telephone Interviews (CATI)**
  - **Random Digit Dial List Assisted Sampling**

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Data Collection Methods - IV

- Cell Phones in Telephone Surveys
  - Growing number of "cell phone only households"
    - 2007, Estimated 16 percent of households
    - 2004, estimate was three percent
  - Not geographically based and affects the representativeness of the sample
  - Owner pays cost of incoming calls
  - Studies indicate low response rates among people reached by cell phone

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Questionnaire Design and Testing - I

- **Draft list of topics and suggested questions**
  - ➤ **Conduct exploratory group or individual interviews**
  - ➤ **Prepare first draft of questionnaire**
  - ➤ **Review and approve draft of questionnaire**
  - ➤ **Prepare questionnaire for pretest**
  - ➤ **Initiate OMB clearances for pretest and main survey**

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Questionnaire Design and Testing - II

- ➤ **Conduct and observe pretest**
- ➤ **Debrief pretest interviewers and assess findings**
- ➤ **Revise questionnaire and prepare plan for pilot test**
- ➤ **Review revised questionnaire and pilot test plan**

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Questionnaire Design and Testing - III

- Recruit interviewers and prepare training materials
- Pilot test final questionnaire
- Revise procedures and questionnaire for main survey
- Review and approve procedures for main survey
- Print or program final questionnaire

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Sampling

- Selecting some portion of a target population (or study population)
- Probability and non-probability sampling
- For virtually all EPA surveys, probability sampling should be used.
- Non- probability sampling appropriate for qualitative research such as focus groups

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Definition of Probability Sampling

- **Every member of a target population has a known non-zero chance of being selected into a sample**
- **Sampled target population members selected by chance**
- **Sample consists of individuals or establishments**

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Advantages of Probability Sampling

- **Allows inferences to the target population with known precision**
- **Lower cost**
- **Reduction of burden**
- **Enables concentration of resources on fewer individuals or establishments**
- **Faster results**
- **More accurate results**

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Major Components of a Probability Sampling Plan

- **Sampling frame**
  - **List of population elements**
- **Sample selection procedures**
  - **Specifications for selecting the sample**
- **Estimation procedures and weighting**
  - **Methods to convert sample data into estimates**
  - **Inverse of the probability of selection**
  - **Adjustment for non-response**
- **Sample error calculations**

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Probability Sampling Methods - I

- **Simple random sampling**
  Each unit in the target population has an equal and known chance of being selected
- **Stratified sampling**
  The population is divided into two or more subgroups and the sample is selected separately from each subgroup
- **Cluster sampling**
  groups of units are formed and the groups are selected randomly

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Probability Sampling Methods -II

- **Systematic Sampling**
  - ➤ **With a random start, select every nth unit in the frame**
- **Sampling with Probability Proportional to Size (PPS)**
  - ➤ **Units are selected based on a measure of size**
  - ➤ **Larger units have a greater probability of being selected**
- **Multi-Stage Sampling**
  - ➤ **The process of selecting subgroups within clusters chosen at a previous stage**

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Non-Probability Sampling -I

- **Subjective Sampling**
- **Cannot make inferences**
- **Cannot calculate confidence intervals**

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Non-Probability Sampling - II

- **Convenience or Haphazard Sampling**
  - **Visitors to a shopping center**
  - **Volunteer subjects**
- **Judgment or purpose Sampling**
  - **Subjects representative of a population**
- **Quota Sampling**
  - **Specified number of subjects to interview**
  - **Selected non-randomly**

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Sampling Error

- **The extent to which the mean or proportion from the sample differs from the entire population**
- **The desired level of precision**

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Determining Sample Size

- **Achieve a specified level of precision allowed by the budget and required by regulations or policy makers**

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Sample Size Estimation Formula

- **For a Simple Random Sample and estimation of proportion:**
    - $N_0 = Z^2 * P * Q / d^2$

    - **Where Z (or T) is the value needed to achieve a specified confidence level**
    - **P is the proportion being estimated**
    - **Q = 1 - P**
    - **- d is the desired precision level**

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Factors Affecting Sample Size Requirements

- **Desired level of precision**
- **Level of geographic detail**
- **Variability of target population values**
- **Sample design**
- **Expected level of nonresponse**
- **Budget and time**

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Adjustments to Sample Size Estimates

- **Finite Correction Factor**
  - $N_1 = (N - n_0)/N$
  - **Where N is the population size**
  - N_0 **is the original sample size using the SRS formula**
  - **Design Effect Adjustment (DEFF)**
    - **Accounts for the complexity of the sample design**
    - **For multi-stage sampling design effect is usually greater than one**

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Interviewing Procedures

- **Quality assurance procedures**
- **Field operations - organizing, staffing and training**
- **Conducting Interviews**
- **Monitoring the interviewing process**

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Quality Assurance Considerations - I

- **Respondent rules**
  - **Respondent rules: who will be interviewed**
  - **Follow-up procedures: effort of interviewer to obtain an interview**
  - **Quality control strategies: strategies used to ensure the collection of high quality data**
- **Follow-up procedures**
  - **Number of attempts to obtain an interview**
  - **Times of day to make initial and subsequent visits**
  - **Allowable deviations from rules**
- **Quality control strategies**
  - **Coverage errors,**
  - **Non-response errors and**
  - **Response errors**

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Coverage Errors

- **Poorly Constructed Questionnaire**
- **Outdated sampling frame**
- **Interviewer error**
  - **Interview the wrong units**

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Non-response Errors

- **Total non-response**
  - **No data or not enough data obtained**
- **Partial non-response**
  - **Failure to obtain acceptable responses to one or more questions**
  - **Questionnaire still counts as complete**
- **Item non-response**
  - **Failure to obtain data for one or more specific questions**

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Response Errors

- **Respondent gives inaccurate or false answer**
- **Interviewer records the answer incorrectly**
- **Interviewer misreads a question**

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Quality assurance Considerations - II

- **Monitor interviewer completion rates**
- **Observe interviews**
- **Screen completed questionnaires**
- **Validate interviews**
- **Re-interview**

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Monitoring Interviewer Completion Rates

- **Completion rate – percentage of eligible cases completed**
- **Interviewers should record specific outcomes of each eligible contact**
- **Record reasons given for ineligible units**
- **Interviewers should prepare periodic summaries of work**

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Observing Interviews

- **Face-to-face interviews**
  - **Direct observation**
  - **Audio recording with permission**
- **Telephone interviews**
  - **Monitor interviewer side of conversation**
  - **Can monitor both sides with permission**

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Screening Completed Questionnaires

- **Field screening by supervisors to correct errors**
- **May reveal systematic procedural errors or omissions**
- **May reveal faulty instructions or training materials**
- **Spot checks are usually sufficient**
- **May lead to retraining or firing of an interviewer**

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Validating Interviews

- **Verify that interviews are actually being conducted**
- **Accomplished by mailing a postcard to a small sample of respondents**
  - **Were they interviewed?**
  - **How long did interview last?**
  - **Comments**

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Re-interviews

- **Conducted by supervisor or other interviewer**
- **A subset of questions asked**
- **May attempt to contact persons classified as ineligible or housing units reported as vacant**

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Organizing and Staffing Field Organizations

- **Prepare Instructions and training materials**
- **Staff field operations**
- **Train interviewers**
- **Coordinate and control field work**

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Preparing Instructions and Training Materials

- **Instructions for supervisors**
  - **Communications between supervisor and central staff**
  - **Quality Assurance strategies**
  - **Supervisor's performance criteria**
- **Interviewer's training manual**
  - **Standard training manual should exist**
  - **Additions should include specific information about the survey**

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Preparing Instructions and Training Materials – Training Guide

- **Includes topics the trainers should cover**
- **Order in which they are covered**
- **Mock interviewer instructions**
- **Taped demonstration interviews**
- **Maps of sampling areas**
- **Copies of questionnaires and other forms**

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Staffing Field Operations

- **Field Supervisors**
  - **Responsible for hiring, training and maintaining an interviewing staff**
  - **May be responsible for support staff**
- **Interviewers**
  - **Firms may have interviewers on retainer**
  - **May need to hire new interviewers**

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Training interviewers (Re-training)

- Specific objectives, rules and procedures of the survey
- Quality assurance procedures
- Procedures for reporting progress
- The standard format for recording respondent answers
- Basic interviewing skills
- Best use of time

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Coordinating and Controlling Field Work

- **Scheduling and tracking the interviewers' work**
- **Controlling the flow of materials to and from the field**
- **Resolving problems in the field**

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Conducting Interviews

- **Locating the sampled units**
  - **Households**
  - **Establishments**
- **Gaining cooperation from sampled persons**
- **Asking questions**
- **Recording and editing responses**
- **Ensuring respondent Privacy and Confidentiality**

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Recording and Editing Responses

- **Check for following items while respondent is still available:**
  - **Omissions**
  - **Ambiguities**
  - **Illegible entries**
  - **Clerical errors**

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Gaining Cooperation Securing an Interview

- **Characteristics of interviewer**
  - **Well-dressed**
  - **Positive and pleasant attitude**
  - **Must have proper identification including picture ID and business card**
- **Explain the Study**
  - **Promise privacy and confidentiality, if appropriate**
  - **How the data will be used**
  - **How much time the interview will take**
  - **Offer incentive to participate**
  - **Mention OMB clearance**

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Asking Questions

- **Interviewer should try to establish good rapport with respondent at beginning of interview**
  - **Whether question should be clarified or repeated**
  - **Provide feedback about adequacy of reply**
  - **Clarify aspects of respondent's task**
  - **Check to determine if question was correctly heard**
  - **Motivate respondent to complete the questionnaire**
  - **Control the direction and extent of the respondent's answers**

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Data Processing

- **Develop procedures**
- **Select and train staff**
- **Screen incoming questionnaires**
- **Review and edit questionnaires**
- **Code open questions**
- **Enter data**
- **Detect and resolve errors**
- **Prepare outputs**

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Code Open Questions

- **Questions that generate a large number of different responses**
- **Responses grouped into a reasonable number of categories**
- **Codes assigned to open questions' responses**
- **Quality control – the work of each coder must be checked for accuracy**

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Develop Data Processing Procedures

- **Produce error-free data file**
- **Software – *SPSS, SAS, S+, SUDAAN, WESTVAR***
- **Provisions for training processing personnel**
- **Quality control techniques to minimize error**
- **List of tabulations**

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Select and Train Staff

- **Data processing manager**
- **Computer center manager**
- **Operations personnel**
- **Clerical**
- **Coding**
- **Editing personnel**
- **Operational control unit**
- **Data entry personnel**
- **Systems analysts**
- **Programming personnel**

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Screen Incoming Questionnaires

- **Maintain strict control of incoming questionnaires**
- **Assign a control number**
- **Maintain capability to identify data from each questionnaire at any point during processing**

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Review and Edit Questionnaires

- **Preliminary screening by field supervisors**
- **Additional review by project management and processing staff**

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Entering data

- **Transfer coded data onto a machine readable medium**
  - **Manual keying**
  - **Optical scanning**

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Detecting and Resolving Errors in the Data File

- **Data cleaning to detect and resolve inaccuracies and omissions in the data file**
- **Computer editing**
  - **Inadmissible codes**
  - **Out–of-range entries**
  - **Omissions**
  - **Inconsistencies**
  - **Math errors**
- **Error resolution**
  - **Consult questionnaires**
  - **Impute missing values**
  - **Create categories for unreported responses**
    - *Don't know*
    - *Not sure*
    - *Don't remember*

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Preparing Outputs

- **Weight the data file**
  - **Probabilities used in selecting the sample**
  - **Adjust for nonresponse**
  - **Make other adjustments**
- **Prepare preliminary tabulations**
  - **Frequency distributions**
  - **Cross-tabulations**
  - **Estimates of totals, means, proportions**
  - **Tabulations of key variables**
- **Finalize the computation of sampling errors**
- **Document processing operations**
  - **Procedures used to edit, code and weight the data**
  - **Source of each data item –the questionnaire or other documents**
  - **Prepare a data dictionary**

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Analysis

- **Implement the analysis plan**
  - **Analyze each research topic using survey and auxiliary data**
  - **Run models using survey data**
  - **Incorporate results of past studies, if any**
- **Prepare one or more reports of findings and recommendations**

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Respondent Privacy and Confidentiality (Larry)

- **Limit Identification of respondents**
- **Limit the likelihood of inadvertent disclosure**

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Contract Management (Barry)

- **Decide to conduct survey in-house or hire organization**
- **If competitively hiring organization**
  - **Issue procurement for new contract or task order for existing contract**
  - **Manage proposal selection committee**
- **Obtain OMB clearance**
- **Become actively involved in the project**
- **Actively manage contractor activities**
- **Provide liaison with EPA staff**

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Quality Assurance in Survey Management

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EPA QA = Systematic Planning

- Based on the scientific method

- Iterative process

- Applies to
  - Environmental programs
  - Data linked to environmental decision making:
    - Either collected for the purpose at hand
    - Or the use of existing data

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EPA QA Project Plans

- *Or equivalent* (often the work or sampling plan) document the systematic planning process
- Require approval before data collection begins
- Ensure data meet intended purpose through elements covering:
  - A Management & description (objectives)
  - B Data generation & acquisition (sample design & criteria)
  - C Assessment and oversight
  - D Data validation and usability

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Survey Handbook Advocates QA

- Analysis Plan defines survey (Group A elements)
  - Research objectives/hypotheses/information needs
  - Stepwise plan construction
- Group B elements
  - Data collection methods justification
  - Questionnaire design
  - Sampling plan

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Survey Handbook Advocates QA (2)

- Group C elements
  - QA & Oversight for data collection through interviewing
- Group D elements
  - Data processing
  - Analysis plan includes:
    - analytic methods
    - preliminary tabulations

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Anecdotal Survey re QA

- 3 QA colleagues questioned on QA in 3 surveys
- None knew about the handbook
- "QAPP not required"; "Would have helped"
- 2 surveys were disappointing (one is too recent)
  - Usability of results
  - Response rates

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Next Steps re QA

- Advertise handbook
- Acknowledge technical support in OEI
- Create example QAPP
- Create tools, for example
  - Generic QAPP
  - Checklists
- Link handbook to quality website

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Future of Surveys re QA

- Include in new policy?
- Acknowledge in QMP?
- Add a review and/or approval procedure?
- Require QA Project Plans?
- Provide training?
- What do you think?

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