CENTER FOR PROGRAM EVALUATION AND RESEARCH

TOBACCO CONTROL EVALUATION CENTER

TIPS & TOOLS #9: SAMPLING DECISIONS

This tip sheet attempts to clarify some of the most common questions local tobacco control programs may have about selecting a sample from which to collect evaluation data. Decisions about what sampling method to use depend on your project's tobacco control objective, the nature of your population of interest, your project's resources, and the extent to which you want to be able to generalize your findings.

The following sections start with definitions and then give explanations and examples. Next, a Sampling Decision Tree gives an overview of steps along the sampling decision path. The tip sheet concludes with a set of links to other sampling resources on the Tobacco Control Evaluation website and some frequently asked questions.

1. Definitions and Examples

Population = All members of a group about which you want to learn

Example:
If you are working towards an objective that involves reducing the sale of tobacco to minors, you might have an evaluation design that includes interviews with store managers. All managers of stores that sell tobacco in the area in which your intervention will be carried out comprise your "population." If your evaluation design includes data collection about the stores themselves (e.g., tobacco ads displayed in storefronts), all stores selling tobacco in your target area make up the population. Clearly defining your population is very important, since the sample from which your project will collect data will come from that population.

Census = All members of the population of interest

Sample = A selected portion of the population

Sampling unit = The objects, people, documents, time slots, etc. that are being sampled

If your population is relatively small, it may be feasible for you to use a census sample and attempt to gather data from the entire population of interest.

Example:
If a project is working on a retail licensing objective and the county has only 15 stores that sell tobacco, it might make sense to gather data from the entire population of interest. Depending on your specific objective, this could mean interviewing all tobacco retailers or collecting Youth Tobacco Purchase Survey data at all stores that sell tobacco in the county.
In most cases, the population is too large for a census sample, and the interview, survey, or observation can only be done with a small portion of the entire population. There are a number of different ways to choose a sample.

Random sample = Every member of the population, or a subset of the population, has the same chance of being selected in the sample

The following section will cover three types of random sampling:

- **Simple random sample = Every member of the entire population has the same chance of being selected**

When selecting your sample randomly, you will be able to claim that your evaluation results were not influenced by your choice of who is included in your sample. Observers and stakeholders of your project might look for this and other sources of bias when judging the validity of your evaluation results.

Example:
The names of all of the 120 tobacco retailers in the county are put into a hat. You have determined that you need a sample size of 40, so you draw 40 names from the hat. These constitute the sample from which you will collect data. You could also put the names of all retailers on a list in alphabetical order and choose every third person on the list, assign them random numbers and then draw numbers, or let a computer program randomly pick.

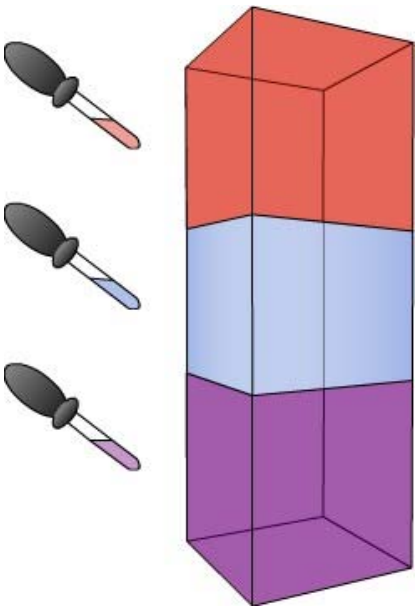
Random sampling makes sense if you have information about the members of your population. In this example, it would be possible to do a random sample because you can obtain a list of all tobacco retailers from city or county sources.

Stratified random sample = The same sample size is selected randomly from pre-determined sub-groups of the population.

Sometimes it is not feasible or desired to sample from an entire population, as you do with random sampling. If you wanted to be able to separate out results from various sub-groups (e.g., ages, ethnicities, districts), you could use stratified random sampling to choose your subjects. To do this, first decide what your minimum sample size can be, and then randomly sample the same number from each sub-group. The *advantage* is that this allows you to share results of sub groups as well as of the entire group. However, the *disadvantage* is that the sum of the samples of all strata does not produce the same result as a simple random sample of the entire area. Critics might object that your sample is not true to the distribution of the population if you use combined numbers of all strata to make your claims.

Example 1:
You believe that strong support from district residents could convince their district representatives to become spokespeople for your policy work. The representatives are interested in the opinions of people in their district, not the entire county. Therefore, you would want to take samples of equal size from each district. Even though the districts might vary by population size, ethnic makeup, etc., the sample size for each district is the same. Conclusions drawn from data sampled in this way would be valid in providing a picture of individual districts, but would not be appropriate to combine with other district level data to represent the entire county. This is because the combined sample does not accurately represent the population diversity; its proportions are skewed. The smaller counties will get

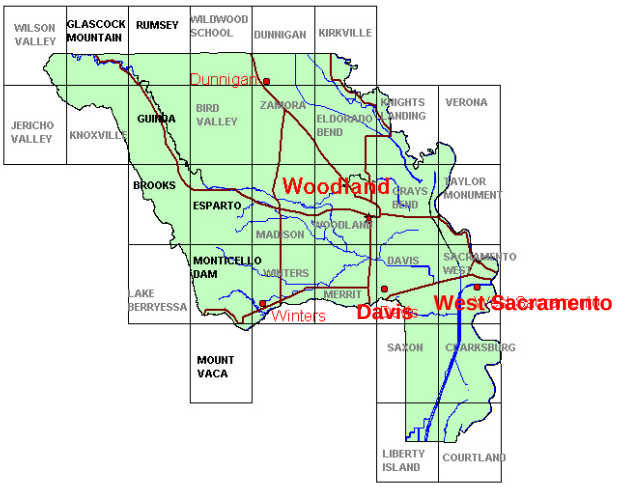
more representation than they actually should based on population size. You would need to explain this in your reporting of data so people can properly assess the results.



Example 2:
There might be times when there is a good reason for doing stratified sampling. For instance, if you want to conduct a survey of retailers to determine how they feel about mandating licenses for the sale of tobacco, a simple random sample would give every retailer in the community the same chance of being selected for the survey. If there are more chain retailers than small businesses that sell tobacco in the city, a majority opinion might drown out the voices of the small retailers who you think are vital to the local economy. For this reason, you might want to make sure that low-income neighborhoods with small businesses selling tobacco are represented. You could choose to divide your city into neighborhoods (your strata) and take an equally sized sample from each of the neighborhoods. Your justification would be that tobacco licensing has a great impact on small businesses in some small neighborhoods and therefore their voice should be heard as loudly as the voices from larger, wealthier neighborhoods where the licensing will have less of an effect on businesses. This is acceptable whenever you can make a good case for minority right over majority rule, even though it might not convince all policy makers.

- **Cluster sample = Sub-groups (clusters) of the population are randomly chosen and each member of the population in the sub-groups is in the sample**

If the geographical area from which the sample will be taken is very large, this area can be divided into smaller areas. For instance, a city could be divided into neighborhoods or school districts (called "clusters"). Entire clusters are then randomly chosen and each member of the population in the selected clusters will become part of the sample. In this instance, cluster sampling may enable a tobacco control project to collect evaluation data in a more resource-efficient manner while also being able to generalize the findings to the entire population of interest.



Example:
If you are trying to sample from a population of multi-unit housing complexes in a large county, it could happen that randomly chosen complexes are very far apart and would make data collection time consuming and costly. A cluster sample could reduce time and cost. All the cities in the county could become your clusters, or you could create an artificial geographic grid as in the map on the previous page. Randomly choose a small number of clusters, and then go to each of the complexes in the chosen clusters. In the example map, Yolo County is shown with a geographic grid. One could randomly select a number of areas from the grid for the intended survey. Note, though, that it is possible that the randomly chosen clusters in this case will turn out to be

rural and none of the larger cities like West Sacramento, Davis, or Woodland will be in the sample. If you think that your results will be distorted because of the clusters you randomly selected, you might do better with purposive sampling.

Purposive sample = Choosing members of the population for a particular reason/purpose, e.g., knowledgeable people who have important information, or timeslots during an event when you expect to have a high smoking incidence

You might choose not to do random sampling at all for any number of reasons — for example, when you need to gather data from certain individuals (or a particular segment) of your population. In key informant interviews, participants are chosen because the evaluator believes that particular people have specific knowledge. When conducting observations, for instance at the county fair, the "population" of interest would be all possible locations people might be smoking, and/or all possible time segments the fair is open to the public. For practical reasons, it would be impossible to draw a random sample from all the people visiting the fair, and you might not be able to conduct an observation at randomly chosen timeslots. Knowing that the fair entrance is a place where many people smoke at the time the fair opens in the morning, it makes sense to choose that location and time rather than others for observation.

Example:
Let's say that you want to have representation of apartment complexes in your sample from each type of community: one socio-economically diverse city like Los Angeles, one city that is more ethnically and socio-economically homogenous like the university town of Santa Barbara, and three or four rural areas. Your purpose is to capture a sample from each of these areas because you anticipate very different results from each. You sample from within the purposively chosen areas. This is not the same as cluster random sampling, where the clusters are randomly selected.

Convenience sample = The sample is selected for convenience reasons, for instance accessibility or time restraints

Often, you don't have the time, resources or access to sample an entire population so it's not possible to do either random sampling or purposive sampling. In that case, it becomes necessary to select your sample based on convenience factors. You choose the type, location and/or characteristics of a population that fits the constraints of your data collection that will give you the best evaluation data given any constraints your project is faced with. When a sample is limited by convenience criteria, it is referred to as a convenience sample. Intercept surveys fall in this category because the interviewer chooses anybody who happens to be around and willing to take part in the survey. With a convenience sample, there is no guarantee that the results are representative of the entire population of interest, but there is often value in the data collected. Analysis of the data collected from a convenience sample can be done using basic descriptive statistics, but be careful not to assert that the findings can be generalized to the larger population. Even with this caveat, many audiences accept the results as good indicators of a trend if the sample size is big enough.

Example1:
Interviewing shoppers at a shopping center is a convenience sample of all shoppers at the mall. You are restricted to the shoppers that will be around during the time you conduct the interview, because obviously you can't interview all everyone at the same time.

Example 2:
Perhaps your objective is to pass a non-smoking policy in the common areas of a multi-unit housing complex. In order to save time, you decide to survey the tenant association members at their meeting instead of doing a random sample of all tenants and going door-to-door. In your analysis, you need to mention as a limitation that the tenant association members might not reflect the interests and opinions of all tenants.

2. Sample Size

Sample size = The number of population members you will use to collect data

Confidence level = The level of certainty (usually set at 95%) that your sample represents the whole population

Confidence interval = The percentage of error you expect in your results

If results need to reflect the proportions of population segments accurately, determine your confidence level and confidence interval (see below) and use a sample size calculator or calculation table. If proportionality is not as important or not achievable, use the sample size that you and your audience will find acceptable in drawing conclusions about your target population. Since some members of your chosen sample will not be reachable, adjust the sample size for anticipated non-responses. The answer to how many should be in your sample depends on whether or not it is important to you or other stakeholders that your sample is representative of the entire population from which it is drawn. That is, do you want to be able to say that the data collected from your sample represent what would have been found if you had included the entire population in your sample? Full representativeness is not possible by choosing a sample, but you can come pretty close. Your sample size increases the greater the accuracy of representativeness you want to achieve. Accuracy is expressed through confidence level and confidence interval. To determine your sample size, you need to know your population size, decide on the confidence level and interval you can live with, and follow mathematical rules to calculate the sample size.

The *confidence level* is the percentage of certainty that your sample represents the whole population. It is usually set at 95% because if you go higher, your sample size must increase considerably. The *confidence interval* is the margin of error that you are willing to allow for in the accuracy of your results. For instance, if 60% of your sample responded one way and your confidence interval is 6, the actual result could be anywhere between 57% and 63% — three percent plus and three percent minus. The higher you set your confidence level and the lower you set your confidence interval, the greater your sample size has to be. When you use a sample size calculator, you can play with the variables to see how your numbers change.

In many tobacco control evaluation activities, this level of precision is not possible because it is too difficult to determine the population size (for instance all people visiting the fair or all people buying tobacco products at retail stores). However, if you know your population size and want your results to be representative, you need to figure your sample size mathematically. To make this easy, you can use calculators or pre-calculated charts available on the Internet.

Once you know your population size, the chart will show you the sample size you need for various confidence levels and intervals. You can find a calculator at: http://www.surveysystem.com/sscalc.htm.

Example:
Let's say you want to find out from tobacco retail managers whether or not their clerks have had training on the STAKE Act. Your population of all retail managers in Fresno is 150. In order to find out what sample size you need, you can use a sample size calculator like the one at surveysystem.com. First select the confidence level at 95%. Now you need to set your confidence interval at 10. The calculator states for those parameters, a sample size of at least 59 will be needed. After conducting the survey with 59 retailers, it turns out that 60% of them said that their retail clerks received training. Now it can be said with 95% certainty that 60% ± 5 (or anywhere between 55% and 65%) of *the entire population of 150 store managers report that their clerks have been trained on the Stake Act. If you feel that range is too wide, you can lessen it by setting a higher confidence interval. However, your sample size will need to increase to achieve this. For example, to increase the confidence interval to 6 (or ± 3), your sample size will go up to 96 in the calculator. For a confidence interval of 4 (or ± 2), your sample size must be even larger. You have to assess your resources and determine if you can handle a larger sample and whether the increased confidence of your data is worth it to you.*

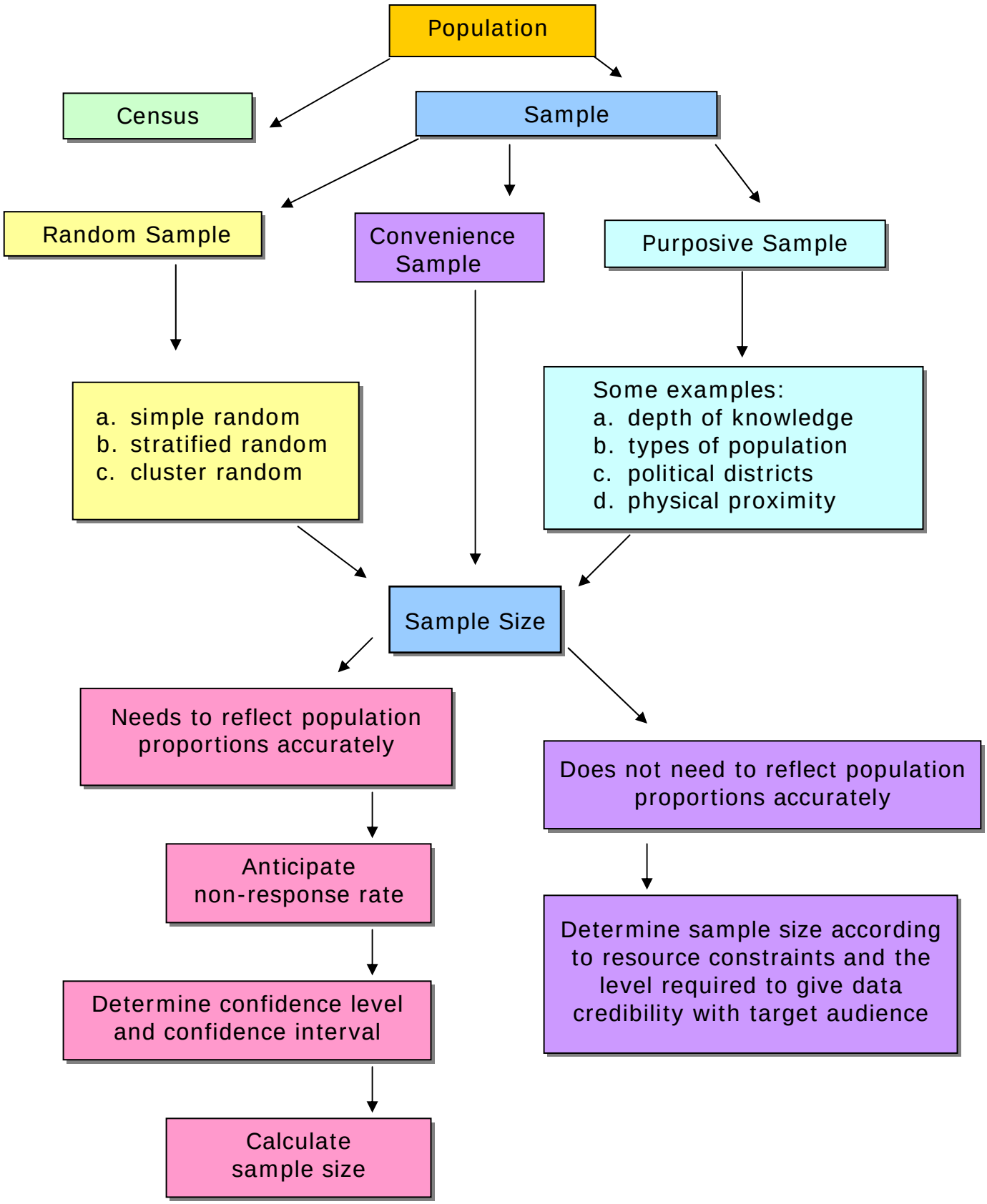
Population size	*Confidence level*	*Confidence interval*	*Sample size*
150	*95%*	*10*	*59*
150	*95%*	*6*	*96*
150	*95%*	*4*	*120*

If being representative is not necessary
In trying to decide how important higher confidence levels and intervals might be to your data, try to envision the various ways you might want to use the results, for what purposes, and with what audiences. Even without being representative, your evaluation is still important and useful. You just won't be able to claim that your data speaks for the whole target population. Instead, figure out what sample size you'll need for your results to carry any weight with your target audiences.

Example:
If you are trying to convince pharmacy owners and managers to adopt a voluntary policy of not selling tobacco products in their stores, you can conduct a public opinion poll with people who are going into and coming out of pharmacies in their community to assess the level of support for tobacco-free pharmacies. Most likely you will not be able to obtain exact population numbers – you will not know how many people shop at these pharmacies. Therefore, you cannot know for sure how large the sample size needs to be in order to be representative. The question should be: What will most likely convince the pharmacy owner to adopt a policy prohibiting the sale of tobacco products in the store? If 85% of all customers exiting a pharmacy (and willing to take a survey on that day) said that they favor a policy of no-tobacco sales in pharmacies, this might be enough to convince the store owner. If you think you need to do several such surveys over a longer period of time because different kinds of customers shop at other times of the day and week, then you need to increase your sample size and times of conducting the surveys. If you have done key informant interviews with pharmacy owners before the public opinion poll, you might have an indication of what they would accept as convincing evidence.

3. Decision Tree

(This sampling decision tree shows the steps the evaluator must take and choices that need to be made when choosing a sample. Please refer to the previous sections for definitions and explanations).



4. Frequently Asked Questions

1. Is random sampling always better than purposive sampling?

No. The two are used for different reasons. Random sampling is used to get information from a cross section of the population of interest, while purposive sampling is used to garner specific information that you need.

2. What is the difference between random sampling and random assignment to groups?

Both are random samples, but random assignment to groups is only relevant in experimental designs, where there are two comparison groups and members of the population of interest are randomly assigned to either of the groups.

3. Is a larger sample size always better than a smaller one?

The larger the size the closer you get to the real distribution, but at some point the increase in accuracy does not justify the extra resources needed to capture the larger sample size. The closer you get to 100% accuracy, the more the sample size increases exponentially. Every sample will have at least a small margin of error. Allowing for a margin of error is acceptable and is necessary to make sampling feasible.

4. Who will be in the sample?

Always keep in mind what your sampling unit is — the group of people or objects that are of interest to you. Use random sampling if you want to get a cross section of your target population. Use purposive sampling if you have a reason for selecting a particular group of members from your target population.

5. How large does the sample need to be?

If you need to show that your sample represents the whole, (meaning that you got a typical cross section of your population of interest) determine your sample size by using sample size calculators or tables. Otherwise, if representativeness is not crucial, determine your sample size by estimating what will convince you and your audience.

6. What kind of sampling is necessary in experimental designs?

Experimental designs require an intervention and a control group (a group that doesn't receive the intervention), and random assignment of members to both groups.

7. What kind of sampling is necessary in quasi-experimental designs?

Quasi-experimental designs do not require random assignment, but they do need to have comparison groups — either an intervention and a control group, or the same intervention group at different points in time (before and after the intervention).

8. What kind of sampling is used in non-experimental designs?

Non-experimental designs may use any variety of sampling, whether a type of random sampling or purposive sampling. What sets them apart from experimental or quasi-experimental designs is that non-experimental designs do not utilize comparison groups (either over time or by receiving an intervention).

5. Additional Resources

- For a guide to sampling for **Youth Tobacco Purchase Surveys and Key Informant Interviews,** check the step-by-step instructions on the "Sampling Teleconference" on our website: Sampling Teleconference August 16, 2005 ~ Detailed Presentation Outline

- For **observation sampling,** check TIPS AND TOOLS #8 Observation Methods on this website

Acknowledgments:

The images representing simple random and stratified sampling are from the California Environmental Protection Agency, California Department of Toxic Substance Control website at cclearn.csus.edu/wasteclass/mod9/mod9_05.html.

The Yolo County Map is from the California Department of Water Resources website at www.fpm.water.ca.gov/.../yolo/yolo_index.cfm.

Special thanks go to Julie Elmen and Robin Kipke at TCEC for their feedback and editing.

Suggested citation:

Treiber, Jeanette. 2007. Sampling Decisions for Tobacco Control Evaluation. Tips and Tools # 9, Tobacco Control Evaluation Center, UC Davis. www.tobaccoeval.ucdavis.edu

For questions or comments please contact Jeanette Treiber: jtreiber@ucdavis.edu

For more Tips & Tools and other resources, go to our website:
http://tobaccoeval.ucdavis.edu