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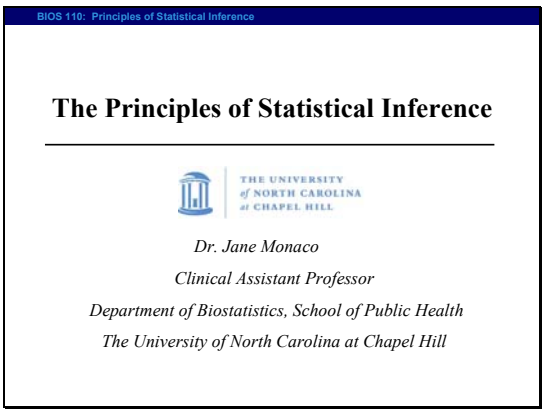

Welcome to the online version of the introductory course in biostatistics offered by the Department of Biostatistics at the University of North Carolina at Chapel Hill.

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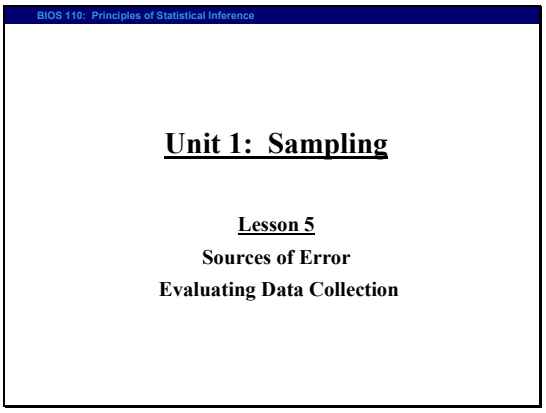

This Lesson explores some the sources of error that can occur in sampling and data collection. Also, we will look at evaluating a survey and data collection, and cover some miscellaneous other topics.

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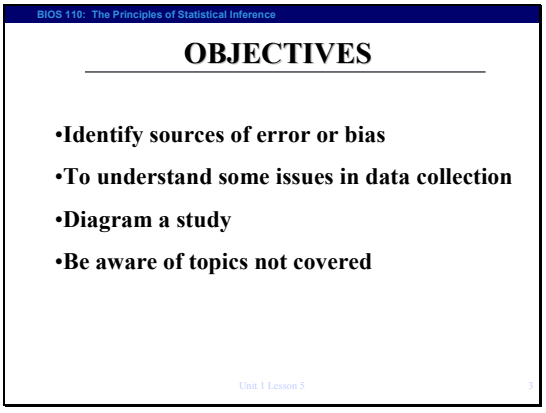

The objectives of this lesson are to identify sources of error or bias, to understand some issues in data collection, to identify some important issues in evaluating a study, diagram a study and be aware of some topics that we won't cover.

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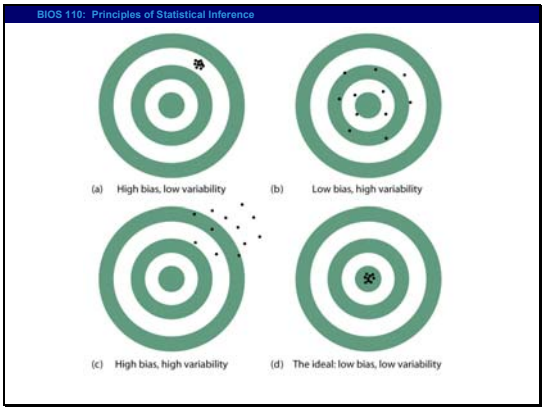

Several situations can occur when conducting a survey.
The first is (a) high bias and low variability. We can think of this as getting an estimate with a small standard error, however the estimate is not close to the true parameter. This happens usually when the sample size is sufficient but there problems with the study design. You are aiming at the wrong target.
(b) Is the situation of low bias and high variability… you are aiming at the bulls-eye, the parameter… however you are not getting very close to that parameter.
(c) Is the worst case.. You are aiming at the wrong target and you aren't getting very close.
(d) ideally, we would like to have low bias (a well designed study) and low variability (sufficient sample size).

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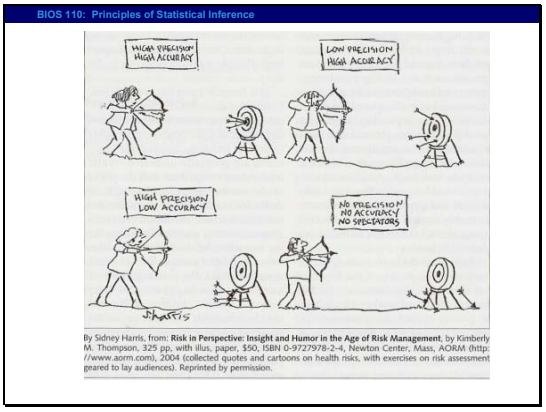

As this cartoon notes,
You can have 'high precision and high accuracy' (best case scenario),
'Low precision and high accuracy' (next best scenario)
'High precision and low accuracy' (misleading results)
Or 'No precision, no accuracy and no spectators'.
The first time that I saw this cartoon, I wondered if the 'no spectators' meant that 'no one is interested' so therefore no spectators or that there were no spectators simply because people were just plain scared to be around the situation… they might get hit by a stray arrow! Either way, we want to avoid these last two scenarios.

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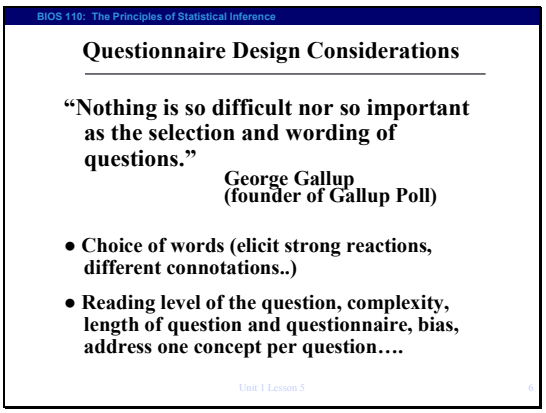

The founder of the Gallup Poll said "Nothing is so difficult nor so important as the selection and wording of questions."
Questionnaire design is often an underestimated part of the design of a survey study.
Questionnaire design is very important and can also be difficult– it is whole topic unto itself but here are some of the considerations.
The choice of words can be highly influential in the result of any survey. We have talked about this before. Anyone remember when the 'prune' industry changed the name of the product to 'dried plums'? Same thing, but don't dried plums taste much better?. I would much rather eat Vitamin B-6 than pyridoxine.

Another example is the effect of the reading level of the questions (vocabulary). Does the target population understand what the question means? The survey population's reading comprehensive is a consideration. Not only are reading level and language (for example, Spanish translation) important, but also the cultural vernacular needs to be considered. The use of slang terms should be addressed.

Is the question clear? There are lots of ways to write and unclear question !! Writing clearly is an art form in my opinion. For example, watch out for the use of negatives – "Do you not agree that the funding for vaccinations is not adequate?" Huh?)
Length of question and questionnaire are important – assume your audience has a short attention span.
Questions can be written in a biased way, "Considering that each vaccination rate in this country is less than 3 in 10 preschool children, do you favor increased efforts to promote vaccinations within the public health clinics?"
It is important that each question address just one concept.

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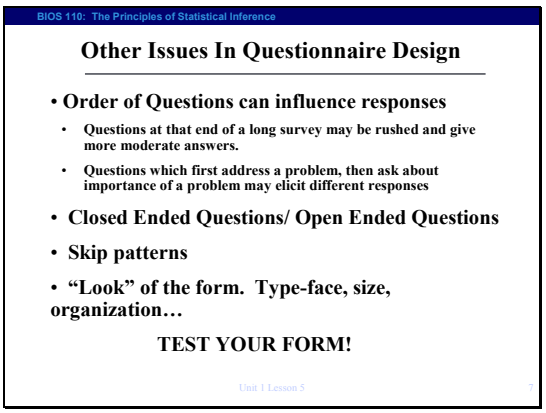


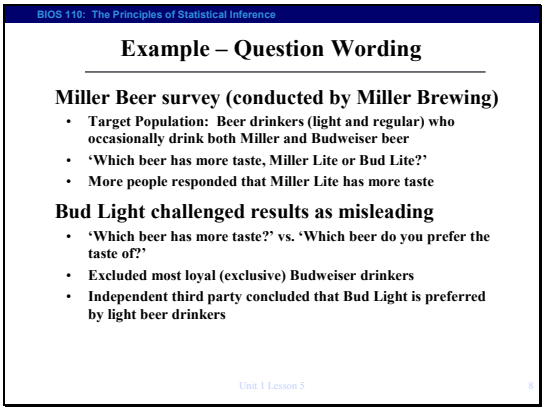
The order of questions, believe it or not, can influence responses. For long questionnaires, questions towards the end may be less likely to elicit strong reactions. Responders may rush through to the end and select "moderately agree" for example rather than closely reading the question and selecting, for example, 'strongly agree'.

If you first ask questions about a public health issue then ask about the issue in relationship to other, say diseases, responders may place more importance on the issue first addressed. For example, consider that you are from the HIV task force in your community and first ask many questions about HIV awareness, sexually transmitted disease, treatments, perceptions of risk. You then follow with questions about the importance of AIDs funding compared with other diseases. You have the person thinking about importance of HIV education, the prevalence, etc.
The responses to these last funding questions may differ from the same questions if they were asked at the beginning of a survey.

Open Ended Questions are very difficult to analyze- Statisticians prefer well-developed, well-tested closed-ended questions.
Skip patterns an important element to a well-designed questionnaire. For example, skip patterns allow responders to skip questions which do not apply to them. "If male, skip to question 10" bypassing questions about history of pregnancies, menstrual cycle, etc. Clarity is key in form design. Letting respondents skip over questions that don't apply is efficient for both respondents and data entry.
Don't underestimate simple things about the form, things like the type face, the type size (for elderly), the lay of the form.

TESTING TESTING TESTING – give the questionnaire to coworkers, test groups, your grandmother, anyone to check for errors, poorly worded questions, possible areas of bias… etc.

Slide 8



This example does not address a burning public health question… but I think it is interesting! It demonstrates some of what I mean by the importance of the wording of a question.

A commercial for Miller Lite beer reports that in a taste test, Miller Lite was found to have 'more taste' than Bud Lite. Sounds straight forward to me.
A little investigation shows that the target population was beer drinkers who occasionally drink both Miller and Budweiser beer and also drink both light and regular beer.
Investigators asked 'which beer has more taste or flavor, Miller Lite or Bud Light?'
Result: In taste tests among these occasional light beer drinkers, Miller Lite had more taste.
It wasn't long before Bud Light challenged these results calling them misleading.
The Budweiser folks pointed out that the question asked "Which beer has more taste or more flavor?" not "Which beer do you prefer the taste of?" Miller beer's own brewing staff (according to the Bud Light website) has characterized Miller beer as more bitter and as having more after- taste. Budweiser argues that most light beer consumers don't prefer beers with these qualities.
Budweiser also pointed out that the study excluded most loyal Budweiser drinkers – those that drink Bud light exclusively.
So, Budweiser hired an "independent third party" to conduct a blinded taste test (target population=?). The results of this test were that most tasters preferred the taste of Bud Light.

CBS then subsequently pulled the Miller Lite commercials- agreeing that the ads were misleading.

Where did I get this information? … After reading about it in a recent news story, the information was available, where else..… the anheuser busch website… hardly a neutral source….
In a 30 second commercial or a news story (paper or TV) it is difficult to address these sorts of issues. Yet 'the devil is in the details'….

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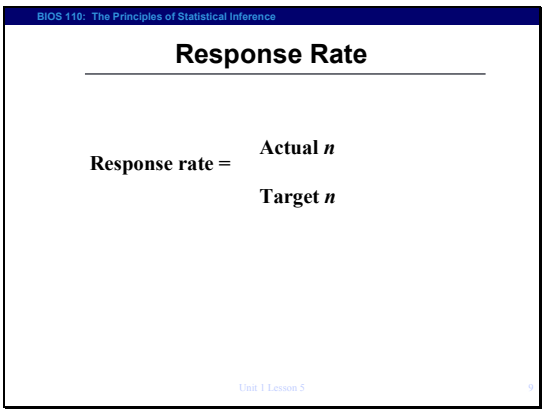

The response rate is defined as the actual sample size divided by the target sample size. Of course, investigators aim to have a response rate as close to 1 as possible. The response rate of any survey is an important factor in evaluating the value the results. As noted before, we would like to know how nonresponders differ from responders in order to access the possibility of bias.

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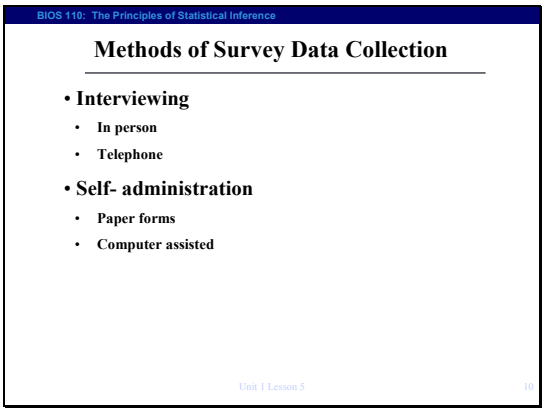

There are different methods for data collection for a survey including interviewing and self administration.
Interviewing could take place in-person or by telephone.
A self-administered questionnaire could be done through paper forms or through a computer assigned method.

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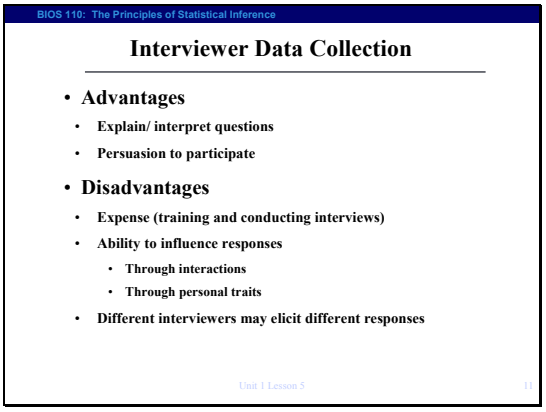

Collecting data through an interviewer has advantages and disadvantages.
With a person there to ask the questions, the interviewer can help explain the question or interpret a question when responders need more information. Also having a person asking a member of the population to participate will often increase participation in a survey.
Unfortunately the disadvantages are that using interviewers is more expensive – interviewers need to be trained (expensive) and paid to conduct the interviews. Having interviewers trained consistently is extremely important.
An interviewer can influence the participant responses… for example, a participant may be less likely to answer truthfully about illegal behavior with a person-to-person interviewer. Participants may give different answers to women vs. men interviewers (or interviewers who are perceived as judgmental) for some questions, perhaps personal questions. There can be inconsistencies between interviewers that result in different responses.

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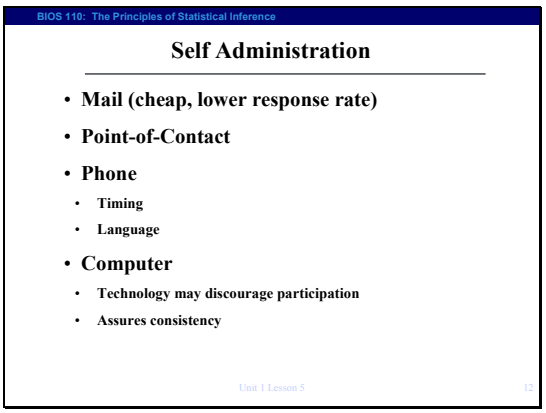

Self administered data collection also has advantages and disadvantages.
Mailing questionnaire is relatively cheap but may have a relatively low response rate.
Giving out questionnaires at say a doctor visit is relatively cheap, but again the response rate may be lower than if done face-to-face.
Interviews done over the phone (whether by interview or self-administered) present their own problems. Calling when potential participants are home and being able to complete a survey is difficult. Language barriers can be issues in both self administered or interview scenarios.
Computer aided self administration of questionnaire offer more issues including the discomfort with the technology among some populations.
With self administered questionnaires, since there is no one to explain the questions or the questionnaire, participants are often frustrated with questions that don't apply or poorly worded questions. However, computer administered questionnaires offer a method which is consistent and not dependent on the interviewer.

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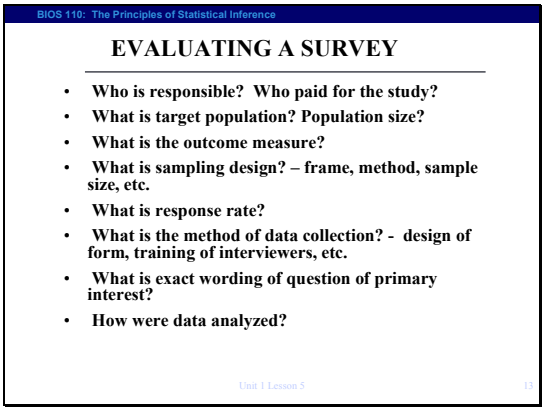
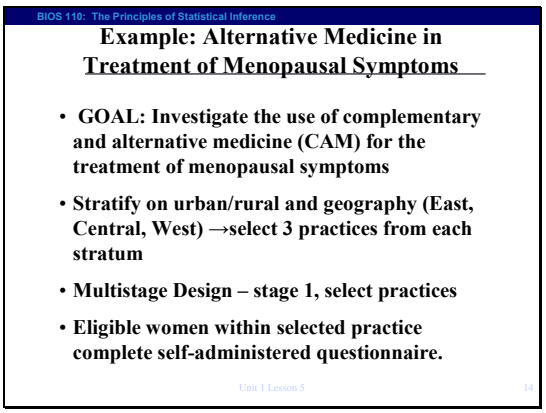


When evaluating the results of a survey, it is important to consider lots of issues…just as when you are designing a survey.
Some the questions you may ask are…. (not a comprehensive list)…
Who did the study? Who paid for the study? Do these folks have an interest in a specific result?
What exactly is the target population and how big is it?
Exactly how will the primary outcome measure be collected?
How were the data sampled? How was the sampling frame selected? What's the sampling method (stratified, systematic…)How are the people (units, members) who are in the study get selected for the study?
What is the response rate?
How were the data collected? (interview? Self administered questionnaire? Paper form?)
When?
What was the exact wording of the question?
Finally, how were the data analyzed? Tallied by hand, computer? Data entry or scanned forms?

Slide 14



Consider the following study to illustrate a few of these points.

Suppose we wish to investigate the use of complementary and alternative medicine (CAM) for the treatment of menopausal symptoms. We would need to make our target population more specific, such as specifying women in NC seen in private GYN (or OB/GYN) practices from Jan. 1 to Jan. 31, 2004 and identified by their physician as having mild to moderate menopausal symptoms.

We decide to use a multistage sampling design and select clinics for the first stage. Also we wish to ensure that we have a representation of clinics from across the state as well as both urban and rural clinics. We decide to stratify on urban/rural and geography (East, Central, West). Then there are six strata –urban west, urban central, urban east, rural west, rural central and rural east. We select a SRS of 3 clinics from each stratum for a total of 18 clinics. Four clinics refuse to participate and are replaced by another clinic within the same stratum. [What are the implications here of refusals? Are they different from participating practices (larger, smaller, different ethnic makeup, etc.]

All eligible women in those clinics complete self-administered questionnaire addressing their knowledge, use and perceived results concerning different alternative therapies (such as herbs, diet, stress reduction…) .

Among those who complete that initial questionnaire, we ask if we may contact them via mail with a followup questionnaire.

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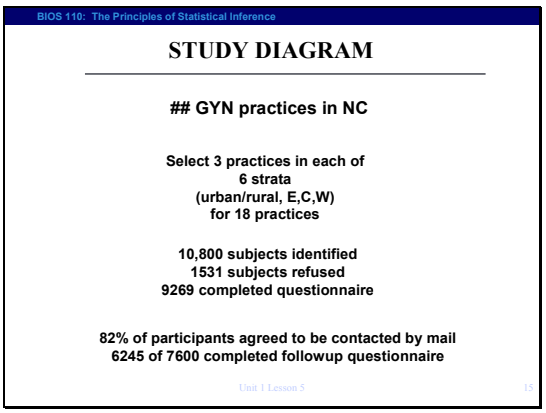
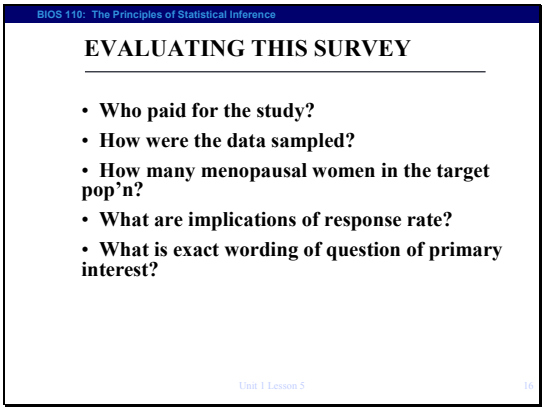


Sometimes it is easier understand a study design through a study diagram.
There is no magic formula for a study diagram because all studies are different.
Basically, the diagram should relate much of the important information about the study design in a visual way.
Here is a typical example –
We start out with the entire population of practices eligible for the study. It would also be nice to have an estimate of total number of women with menopausal symptoms in those clinics. Sometimes we may be given this information, some times not.
Next we indicate the strata and report the total number of practices selected.
The number of eligible subjects and number of refusals are listed.
Finally we indicate the number of initial respondents who later completed a followup mailed questionnaire.
All this gives a visual way to access the study.

Slide 16



Some additional questions that I'd be interested in this example would be…
Who paid for the study? Makers of hormone replacement therapy or vitamin supplements or independent group…
How were the data sampled? How was the frame of GYN clinics developed? What are the possible implications of practices that are left out (or women who receive care from other sources)?
I'd like an estimate of the number of total number menopausal women eligible in NC. That way, I can get a ball park idea of whether 9269 participants is a relatively small or large proportion of those eligible.
We can figure out the response rate –both for the clinics, the initial survey and the followup – what would be interesting is how the nonresponders (or refusals) differ from the responders.
The exact wording of the questions would be interesting. For example, are the alternative methods compared to traditional methods?
What sort of demographic information and history is collected….

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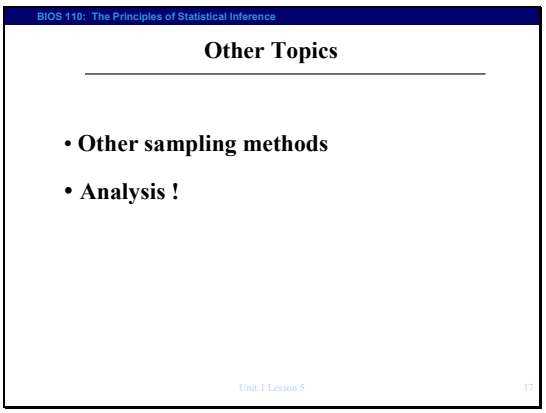
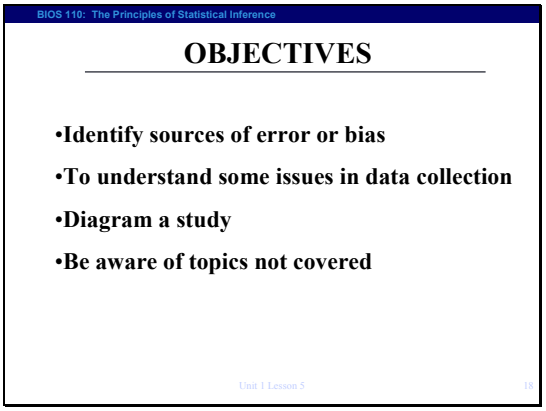


In this Unit on Sampling, Lessons 1 to 5 we have addressed lots of issues in Survey Sampling.
I hope that you are confident in your ability to read and understand studies in your discipline that involve sampling.

If your interest has been piqued by this unit, (I hope so!) you are in luck. There is more to learn about sampling.
There are lots of other topics (such as equal cluster sizes vs. unequal cluster size, a technique called probability proportional to size,…) which are interesting.

We have concentrated on the area of study design in this overview. One area that we have NOT addressed,' is now that I have designed this really great study, how do I analyze the data?!' These sampling schemes (like multistage, stratified…) require special treatment in the analysis stage. Just be aware that when you have more complicated study designs, special statistical analysis and specialized software are often required.

Slide 18



The objectives of this lesson are to identify sources of error of bias and to deal with some issues in data collection. We diagramed a study and covered some final topics.

Slide 19

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- www.anheuser-busch.com

Slide 20

Theory and practice are the same in theory. In practice they are different.