VIDEO ON HUMANS AND CELL PHONES AND RATS AND RADIO FREQUENCY.

INSTRUCTOR 1: In both studies, the goal

was to determine if radio frequencies from cellphones

increase the risk of contracting brain tumors.

Whether the individual contracted a brain tumor or not

was the response variable.

For the human study, the explanatory variable

of interest was cellphone usage or not.

For the rat study, the explanatory variable

was radiofrequency radiation, which

had three possible levels--

no RFR, GSM, or CDMA.

In research, we wish to determine

how varying an explanatory variable affects the value

of a response variable.

INSTRUCTOR 2: What are the differences between the studies

in Example 1 and 2?

I know the study in Example 1 was on humans

and the research in Example 2 was on rats,

but what are the other differences?

INSTRUCTOR 1: In Example 1, the human study,

no attempt was made to influence the individuals in the study.

The researchers simply followed the women over a 7-year period

and recorded their behavior, cellphone usage.

In other words, no attempt was made

to influence the value of the explanatory variable, exposure

to radio frequencies from cellphones.

This type of study is referred to as an observational study.

An observational study measures the value of the response

variable without attempting to influence

the value of either the response variable

or explanatory variable.

That is, in an observational study,

the researcher simply observes the behavior of the individuals

in the study and records the values

of the explanatory and response variables.

In Example 2, the rat study, researchers obtained 90 rats

and randomly assigned the rats to one of three groups.

Each group was intentionally exposed

to a certain treatment--

no radio frequency radiation, GSM RFR, or CDMA RFR.

Other factors that may affect the rats--

temperature, humidity, food, and so on--

was held fixed for all 90 rats.

The researchers then recorded whether the rat

contracted a brain tumor or not after two years of exposing

the rat to the treatment.

The key with this study was the attempt

to influence the response variable

by changing the values of the explanatory variable

of interest, RFR exposure.

Because the researchers manipulated

the value of one explanatory variable, RFR exposure,

and controlled other values of explanatory variables,

such as temperature, humidity, food,

and so on, at fixed values, and there was random assignment,

the study is called a designed experiment.

If a researcher randomly assigns the individuals

in a study to groups, intentionally manipulates

the value of an explanatory variable,

and controls other explanatory variables at fixed values,

and then records the value of the response variable

for each group, the study is a designed experiment.

Which is Better- Designed or Observational? SENIORS VIDEO

INSTRUCTOR: Researchers wanted to determine the long term

benefits of the influenza vaccine on seniors age

65 years or older.

The researchers looked at records of over 36,000 seniors

for 10 years.

The seniors were divided into two groups.

Group one were seniors who chose to get a flu vaccine shot.

And group 2 were seniors who chose

not to get flu vaccine shot.

After observing seniors for 10 years

it was determined that the seniors who get flu shots

are 27% less likely to be hospitalized for pneumonia

or influenza, and 48% less likely to die

from pneumonia or influenza.

So do you think that this is an observational study

or a designed experiment?

STUDENT: Observational.

INSTRUCTOR: Observational study.

How do we know this?

STUDENT: The seniors chose to or to not get the--

INSTRUCTOR: There you go.

We, as researchers, did not force the seniors

to either get a flu shot or not.

But rather it was the seniors who decided that, hey I'm

going to go get a flu shot, or I'm

going to choose not to get a flu shot.

In addition, we as researchers did not

impose any other conditions on the study.

We didn't say, all you seniors are

going to eat chicken soup every day for the next two years,

or 10 years.

All you seniors are going to work out three times a week,

for an hour a day, for the next 10 years.

None of that was done.

I mean, think about it this way.

Suppose we did decide to do this as a designed experiment.

It would basically mean that we would

have to identify say 500 seniors, say all right,

you 250, you're going to get the flu shot, you 250 over here,

you're not going to get the flu shot.

And then we're going to see who's alive after 10 years.

How would you like to be in the non-flu shot area?

Can you go out and say that all seniors should go and get

a flu shot?

In other words, do we want to conclude

that getting a flu shot causes a lower rate of pneumonia,

causes a lower rate of influenza?

STUDENT: No.

INSTRUCTOR: No?

Why not?

STUDENT: Because there's a lot of other variables to people's

lives that aren't measured.

INSTRUCTOR: Yeah, there's a ton of other variables out there

that may impact whether or not one contracts influenza or not.

It's when you can't necessarily distinguish

between the explanatory response variable

and some other variable, it's called confounding,

confounding.

We don't know for 100% certainty that getting a flu shot

causes one to get a lower rate of influenza or pneumonia,

because there might be other variables out there that

equally impact that particular response variable-- contracting

pneumonia or not, contracting influenza or not.

Can you think of some of these other variables?

STUDENT: Their health, in general.

INSTRUCTOR: Yeah, the general health of the senior

in the first place.

I mean, think about it, related to that is whether or not

the senior's ambulatory or not.

I mean if the senior can't get around

because they're not healthy then they're

not going to go get the flu shot,

because they have to go out and get it.

I mean maybe they have mobile carts now

that come to the house and give these flu shots.

I don't know for sure.

But you can go to the airport.

You can go to the grocery store.

You can get flu shots now, right?

But if you're not out and about you're

not going to get a flu shot.

So it might be that they're contracting pneumonia

because they're not in good health in the first place, bot

because of the flu shot.

STUDENT: Genetics.

INSTRUCTOR: Yeah, genetics would be a variable

that we didn't take into account.

STUDENT: Specific age, because it's only 65 and older.

INSTRUCTOR: Specific age.

I mean, it just so happens that all the folks

in the non-flu shot arena were in their late '80s,

and all the folks in the flu shot group

were in their early '60s, or at least '60s,

that might have played a role as well.

I mean we could go on and on and on about all the other factors

that go into whether or not one contracts

pneumonia that are confounding our results,

because we weren't able to necessarily account

for them in the study.

So again, confounding in a study occurs

when the effect of two or more explanatory variables

are not separated.

Therefore, any relation that may exist

between an explanatory variable and the response variable

may be due to some other variable or variables

not accounted for in the study.

So the health of the senior was not accounted for,

as far as we know yet, in this study

and therefore there might be some confounding.

A major source of confounding is the lurking variable.

Lurking means hanging out in the background

but not being really paid attention to.

So a lurking variable is an explanatory variable

that was not considered in the study,

but that effects the value of the response variable.

If you're a health fanatic as a senior

you're probably going to say to yourself,

I'm going to go out and get a flu vaccine because I want

to stay healthy over the winter.

Well if you're a health fanatic as a senior,

you're probably eating differently.

You're probably exercising regularly.

If you say to yourself, eh, I don't

need to go and get that flu vaccine,

maybe you're not exercising as much.

Maybe you're not eating the right foods.

Maybe you're a senior that's going

to get your free cup of coffee at McDonald's and oh, I

might as well have a few sausage biscuits while I'm at it.

You just don't know.

And so could it be that the general health of the senior

is what contributed to the higher rate of pneumonia

rather than the flu vaccine?

Perhaps it was.

So we already identified some lurking variables

in the influenza study-- age, health status, mobility

of the senior.

Now what researcher can do in observational studies

is still account for these potential lurking variables.

And even after accounting for potential lurking variables,

the authors of the study concluded

that getting an influenza shot is associated with a lower

risk of being hospitalized or dying from influenza.

The reason that I italicized associated

is because in observational studies

we are never allowed to make statements of causality.

You cannot say the changes in an explanatory variable cause some

change in a response variable in observational studies.

You can only say that there's an association.

It requires designed experiments to make

statements of causality.

So observational studies do not allow a researcher

to claim causation, only association.

TYPES OF OBSERVATIONAL STUDIES

There are many different types of observational studies

that exist.

We are going to talk about the three broad categories

of observational studies and look at their strengths

and weaknesses.

The first type of observational study

is something called a cross-sectional study.

And this is an observational study that collects information

about individuals at a specific point in time

or over a very short period of time.

Do smokers have a higher resting heart rate than nonsmokers?

You just go out and ask people.

Hey, are you a smoker or are you not a smoker?

That's how you segment your population.

And then, you would measure their heart rate.

This would be a cross-sectional study,

because it's over a very short period of time.

A case control study.

These studies are retrospective.

Retrospective basically means that you look back in time.

Case control studies look back in time

or require the researcher or to look at existing record, which

is also looking back in time.

In case control studies, individuals

that have certain characteristics

are matched with those that do not.

That's why it's case control, because with this smoker thing

we might say, well, how many packs of cigarettes

have you smoked on average each week for the past 10 years.

And we would match those folks with people

with similar demographics, characteristics

that did not smoke.

And then, we might compare the rate of lung cancer

in the two groups.

The negative thing about case control studies

is there's a memory issue here.

People might not remember how many packs of cigarettes

they smoked on average for the past 10 years.

And therefore, you might get bogus information out

of the study.

Or records might not exist or might be somewhat flawed,

which impacts the study.

But case control studies, none the less,

are better than cross-sectional studies,

because you have a matching going on.

You have a control group to compare

against your sort of research group, nonsmokers

versus the smokers.

But the negative, again, is that, looking back in time,

you often get erroneous information.

The last type of observational study is a cohort study.

A cohort study first identifies a group of individuals

to participate in the study.

This is called your cohort.

And then, the cohort is observed over a period of time.

Over this period of time, characteristics

about individuals are recorded.

So these are called prospective studies,

because they are done going forward.

So basically, what I would do is something along these lines.

I would identify 5,000 individuals

and literally follow them over time, periodically

recording information about the individuals.

The advantage here is that you don't

have to rely on folks looking back in time.

And you don't have to rely on existing records,

because you are collecting the information over time.

The negative about these studies is

that they are extremely time intensive and labor

intensive and, therefore, usually very expensive.

The famous cohort study that exists

is the Framingham Heart Study, which

has been going on for years.

And in fact, is now in new generations

and because of this Framingham Heart cohort study,

a lot of new ideas and breakthroughs in medicine

have occurred.

OBSERVATIONAL VS DESIGNED EXPERIMENT

INSTRUCTOR: We're going to determine

whether each of the following studies

depicts an observational study or an experiment.

And if the result is an observational study,

we want to be in that type of observational study.

So part A-- researchers wanted to assess

the long-term psychological effects on children

evacuated during World War II.

They obtained a sample of 169 former evacuees

and a control group of 43 people who

were children during the war but were not evacuated.

The subjects' mental states were evaluated using questionnaires.

It was determined that the psychological well-being

of individuals was adversely affected by the evacuation.

So first, is this a designed experiment

or an observational study?

STUDENT: [INAUDIBLE]

INSTRUCTOR: Observational study.

We didn't impose any treatment on the individuals

in the study.

So now we've got to ask ourselves,

is it cross-sectional?

STUDENT: No.

INSTRUCTOR: Was it case control--

case control we're going with?

STUDENT: Yes.

INSTRUCTOR: How come?

STUDENT: [INAUDIBLE]

INSTRUCTOR: Yeah, we looked back in time.

And secondly, we have a control group,

the 43 individuals who were children during the war

but not evacuated.

So all the three cross-sectional study, case control,

or cohort--

this is a case control.

Xylitol has proven effective in preventing dental cavities when

included in good or gum.

A total of 75 Peruvian children were given milk,

both with and without xylitol, and were asked

to evaluate the taste of each.

Overall, the children preferred the milk flavored with xylitol.

Is this an observational study or a designed experiment

[INAUDIBLE]?

STUDENT: [INAUDIBLE]

INSTRUCTOR: Yeah, it's a designed experiment

because we imposed the treatment-- milk

with xylitol and milk without.

And the response variable here presumably

was, which milk do you like?

I guess the idea here is, can you

taste the xylitol in the milk, because if you can,

you're maybe less likely to drink the milk.

It's kind of like putting fluoride in water now.

C-- a total of 974 homeless women in the Los Angeles area

were surveyed to determine their level of satisfaction

with the health care provided by shelter

clinics versus the health care provided by government clinics.

The women reported greater quality satisfaction

with the shelter and outreach clinics

compared to the government clinics.

Is this an observational study or a designed experiment?

STUDENT: Observational study.

INSTRUCTOR: Observational study.

We didn't say, hey, you go to the government clinic,

and you go to the shelter, and tell me

what your level of satisfaction is.

We let these individuals sort of choose and give us

their opinion.

So is this cross-sectional, case control, or cohort?

STUDENT: Cohort.

INSTRUCTOR: Well, if it was cohort, we would be doing what?

STUDENT: [INAUDIBLE]

INSTRUCTOR: Following them over many years, collecting

information about them.

STUDENT: [INAUDIBLE] cross-sectional.

INSTRUCTOR: Yeah, it's probably cross-functional

because all we did is say, hey, which do you like?

And so it's a very short period of time.

There's no matching.

There's no control group going on here.

It's simply an opinion-- which did you like better.

So it's an observational study, cross-sectional.

The cancer prevention study is funded and conducted

by the American Cancer Society.

Its goal is to examine the relationship

among environmental and lifestyle

factors on cancer cases by tracking approximately 1.2

million men and women.

Study participants completed an initial study questionnaire

in 1982 providing information on a range of lifestyle factors,

such as diet, alcohol, tobacco use, occupation,

medical history, family cancer history.

These data have been examined extensively in relation

to cancer mortality.

Vital status of study participants is updated.

Cause of death has been documented

for over 90% of all deaths that have occurred.

Mortality follow-up of the CPS participants

is complete through 2002 and is expected

to continue for many years.

Is this observational or a designed experiment?

STUDENT: Observational.

INSTRUCTOR: Observational.

What kind of observational is this?

STUDENT: Cohort.

INSTRUCTOR: Most definitely cohort

because it's prospective, working and tracking

folks and collecting information about those folks

over many, many, many years.