Lecture 30
Chapter 25: Meta-Analysis

- Thought Questions
- Chi-Square: Separate or Combine?
- Issues in Results from Multiple Studies
- Simpson's Paradox

Example: *Thought Question: 10 Similar Studies*

- **Background**: Suppose 10 similar studies, all on the same kind of population, have been conducted to determine the relative risk of heart attack for those who take aspirin and those who don't. To get an overall picture of the relative risk we could compute a separate confidence interval for each study or combine all the data to create one confidence interval.
- **Question:** Which method is preferable, and why?
- **Response:**

Example: *Thought Question: 2 Different Studies*

- **Background**: Suppose two studies have been done to compare surgery vs. relaxation for sufferers of chronic back pain. One study was done at a back specialty clinic and the other at a suburban medical center. The result of interest in each case was the relative risk of further back problems following surgery vs. following relaxation training. To get an overall picture of the relative risk, we compute a separate confidence interval for each study or combine to create one interval.
- **Question:** Which method is preferable, and why?
- **Response:**

Example: *Thought Question: Separate/Combine?*

- **Background**: Suppose two or more studies involving the same explanatory and response variables have been done to measure relative risk.
- **Question:** What are the advantages or disadvantages of considering the studies separately or combined?
- **Response:** Separating ______________________________
  combining ______________________________

Example: *Discrimination? (Larger Sample)*

- **Background**: Data on trial vs. religion gave chi-square = 0.7, P-value not small, no evidence of a relationship.

Obs	Acq	Conv	Total
Prot	8	7	15
Cath	27	38	65
Total	35	45	80

Obs×10	Acq	Conv	Total
Prot	80	70	150
Cath	270	380	650
Total	350	450	800

- **Question:** What if all counts were multiplied by 10?
- **Response:** Expected counts would also be ×10, so would comparison counts, so chi-square=0.7×10=7.0.

  The *P*-value would be __________ (compared to_____): ________ evidence of a relationship.

Handling Results from Multiple Studies

Vote-counting (out-dated method): Record how many produced statistically significant results.

- Disadvantage: doesn't take sample size into account (Example: If data in original religious discrimination table had occurred in 10 separate studies, none would produce a small *P*-value.)

Meta-analysis: focuses on magnitude of effect in each study.

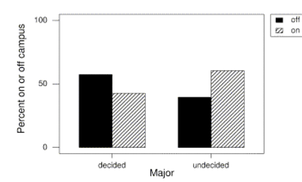
Issues to be Considered in Meta-Analysis

- Which studies should be included?
  - What types of studies to include---all those available, or only those which meet specific requirements, such as publication in a properly reviewed journal?
  - Timing of the studies---only "modern"? If so, how old do we consider to be "outdated"?
  - Quality control---should we exclude or segregate studies guilty of "difficulties and disasters" outlined in Chapter 5?
- Should results be compared or combined?

Example: *When Results Are Combined*

- **Background**: Survey results for full-time students:

	On Campus	Off Campus	Total	Rate On Campus
Undecided	124	81	205	124/205=60%
Decided	96	129	225	96/225=43%

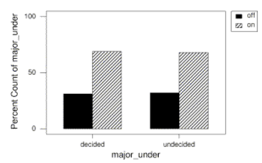


- **Question:** Is there a relationship between whether or not major is decided and living on or off campus?
- **Response:**

Example: *Handling Confounding Variables*

- **Background**: Year at school may be confounding variable in relationship between major decided or not and living on or off campus.
- **Question:** How should we handle the data?
- **Response:** Separate according to year: 1st and 2nd (underclassmen) or 3rd and 4th (upperclassmen):

Underclassmen	On Campus	Off Campus	Total	Rate On Campus
Undecided	117	55	172	117/172=68%
Decided	82	37	119	82/119=69%

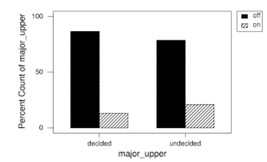


For underclassmen, proportions on campus are ______________ for those with major decided or undecided.

Example: *Confounding Variables*

- **Background**: Year at school may be confounding variable in relationship between major decided or not and living on or off campus.
- **Response:** Separate according to year: 1st and 2nd (underclassmen) or 3rd and 4th (upperclassmen):

Upperclassmen	On Campus	Off Campus	Total	Rate On Campus
Undecided	7	26	33	7/33=21%
Decided	14	92	106	14/106=13%



For upperclassmen, proportions on campus are ____________ for those with major decided or undecided.

Example: *Confounding Variables*

- **Background**: Students of all years: chi-square=13.6

	On Campus	Off Campus	Total	Rate On Campus
Undecided	124	81	205	124/205=60%
Decided	96	129	225	96/225=43%

Underclassmen: chi-square=0.025

Underclassmen	On Campus	Off Campus	Total	Rate On Campus
Undecided	117	55	172	117/172=68%
Decided	82	37	119	82/119=69%

Upperclassmen: chi-square=1.26

Upperclassmen	On Campus	Off Campus	Total	Rate On Campus
Undecided	7	26	33	7/33=21%
Decided	14	92	106	14/106=13%

- **Question:** Major (dec?) and living situation related?
- **Response:**

Simpson's Paradox

If the nature of a relationship changes, depending on whether groups are combined or kept separate, we call this phenomenon "Simpson's Paradox".

Example: *Handling Confounding Variables*

- **Background**: Hypothetical results for sugar and activity from observational study:

Obs	Norm	Hyper	Total
Low S	100	75	175
High S	75	108	183
Total	175	183	358

Exp	Norm	Hyper	Total
Low S	86	89	175
High S	89	94	183
Total	175	183	358

- **Question:** What do the data suggest?
- **Response:** chi-square=

  Suggests

Example: *Handling Confounding Variables*

- **Background**: Hypothetical results for sugar and activity from observational study, separated by gender:

Girls	Norm	Hyper	Total
Low S	75	25	100
High S	25	8	33
Total	100	33	133

Boys	Norm	Hyper	Total
Low S	25	50	75
High S	50	100	150
Total	75	150	225

- **Question:** What do the data suggest?
- **Response:** Girls:

  Boys:

  Each chi-square would be

THE MAGIC FLUKE Jesus had his Judas. Caesar had his Brutus. And sometimes, Frances Rauscher says sadly, it seems that Mozart has his Frances Rauscher."Every time I listen to his music I feel like, ` Oh my, I never should have done this to this man,' " said Rauscher, a psychologist at the U of Wis. What Rauscher did in 1993 was discover what has since become known as the "Mozart effect." In a set of experiments on college students, she and two colleagues showed that 10 minutes of listening to Mozart's Sonata for Two Pianos in D Major could boost a person's score on a portion of the standard IQ test.

It was a small study that showed a short-lived, modest improvement in adults' performance of a specific mental task. But it wasn't long before Mozart's heavenly oeuvre got co-opted by coldly utilitarian pedagogues and parents hoping to squeeze from the master's musical scores a few extra points on their kids' SAT scores. Then, to make matters worse, the marketing began. One entrepreneur quickly turned the preliminary finding into a seemingly authoritative self-help book.

(continued) It was against that backdrop of bloated expectations and blatant profiteering that researchers recently dropped a classical bombshell: Repeated efforts to confirm Rauscher's original results had found the Mozart effect disconcertingly elusive. "If there is any Mozart effect at all, it's really small and has nothing to do with the specifics of Mozart's music, said Christopher Chabris, a cognitive neuroscientist at Harvard Medical School who conducted one of two related studies published in the latest issue of the scientific journal Nature. "It's smaller than originally claimed and certainly smaller than people believe."

But proponents are not taking that requiem lying down. The controversy arose innocently enough with Rauscher's hypothesis that learning music, and perhaps even just listening to it, could enhance people's cognitive abilities. She and her colleagues, then at the University of California at Irvine, chose Mozart in part because his music is rich in mathematically complex motifs that seem to resonate figuratively and perhaps even literally, with the highly organized and iterative neutronal structure of the brain.

(continued) The initial study, published in Nature in 1993, found that listening to Mozart's two-piano sonata helped college students visualize the final shape of a piece of paper as it was folded and cut in various ways. The test is a small part of the Stanford Binet IQ test, but the researchers made a novel (and controversial) calculation that gave the students "spatial IQ" scores of 119 after listening to the music.

That was 8 or 9 points higher than the scores achieved after either a blood pressure-lowering relaxation tape or silence.

Rauscher's results have been confirmed by a few others, and some studies have even hinted at broader salutary effects. John Hughes, director of clinical neurophysiology at the U. of Illinois Medical Center in Chicago, conducted experiments on comatose patients whose brains were wracked by nonstop epileptic seizures. A few minutes of Mozart radically reduced the frequency of seizures and calmed their brain wave spikes.

Experimenters also have shown that Mozart can improve a rat's performance in a maze: "There's just too much evidence out

(continued) there that there really is an effect," Hughes said. "You can't explain this effect away."

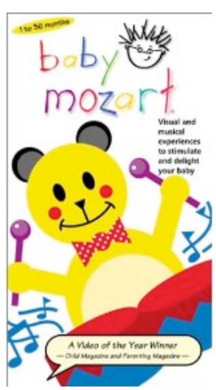
Unless you are Harvard's Chabris. He conducted a "meta-analysis" which combined the results of all 16 published studies of the effect. Taken together, he found there was little or no improvement in test scores among subjects who listened to Mozart.

On one point all sides seem to agree. Too much was made of the initial findings. "We never made claims regarding general intelligene or other abstract abilities," Rauscher said. "But the next thing you know, people are saying, 'Mozart makes you smarter.'"

If nothing else, it seems, the rise and fall of the Mozart effect may teach the public a lesson about the tentativeness of all scientific discovery. If that happens, then the incomparable composer will have made people wiser, after all, if not actually smarter.

Ideal for all ages, the Mozart Magic Cube is a music toy that inspires creativity and interactive play while having fun with music! Mozart Magic Cube teaches little ones how sounds combine to form musical masterpieces… Baby can add and subtract instruments at the touch of a button without missing a beat!

Discover the joy of classical music together with your baby! Pique your little one's curiosity with Mozart's most popular works.



IS DIET RELATED TO HYPERACTIVITY? For a quarter of a century now, parents of hyperactive children have been besieged by claims that various common foods, food additives and preservatives were the cause of the syndrome that is now called attention-deficit/hyperactivity disorder.And over and over again, many leading health organizations, bolstered by a collection of mostly small and often poorly done studies, have disputed such claims.Children with the disorder are hard to manage, disruptive, and they often fail in school. The main symptoms are difficulty concentrating, easy distractivity, excessive activity and impulsiveness.

The vast majority of children with diagnoses of the disorder are given Ritalin (methylphenidate) a stimulant that has the paradoxical effect of calming them down and helping them focus on the task at hand. The use of Ritalin in children has skyrocketed in the last decade, increasing two and a half times in the first five years of the 1990s.

While Ritalin is highly effective--it helps 70% to 90% of children (continued) with the disorder, often significantly--there is growing concern about its extensive use and occasional abuse, its common side-effects and its possible and still unknown long-term effects on children who take it for many years.

Prompted by these concerns and nagging questions about the effects of diet on behavior, the Center for Science in the Public Interest, a nutrition advocacy group, has taken a new look at the studies that explored dietary factors in ADHD and the pronouncements by health authorities that there is little or not evidence to support such a link.

A new report, released late last month, reviews 23 of the best studies conducted since the mid-1970s and public statements from the FDA, the American Academy of Pediatrics, the International Food Information Council and the American Council on Science and Health. It concludes that the evidence strongly indicates that for some children, behavioral disorders are caused or aggravated by certain food additives, artificial colors, the foods themselves, or a combination.

(continued) The center and a group of physicians and scientists who share this conclusion have urged the Department of Health and Human Services to advise parents and health professionals to try changing a child's diet before turning to stimulant drugs (Ritalin or amphetamines) that may suppress their appetites and cause weight loss, insomnia, and stomach aches. The petitioners also expressed concern about a study that found an increase in liver tumors in mice given doses of Ritalin not much greater than what children receive. The center has also asked the Health and Human Services Department to commission new and better studies on the relationship between diet and behavior in children, and the FDA to require behavioral tests for certain food additives.

Controlling behavior through diet requires first identifying and then removing from the child's diet those foods or chemicals that seem to cause the unwanted behaviors. There are several ways to approach the problem. One is to start with a very basic diet of foods that are beyond suspicion and one at a time add back possible culprits for a few days and carefully monitor the results.

(continued) Another is to eliminate one suspect food substance at a time from the child's usual diet and see if there is an improvement.

The substances that have most often been linked to worsening ADHD symptoms include artificial colors and flavors, foods that contain salicylates, like apricots, cherries, and tomatoes, and foods that sometimes cause allergic reactions, like milk, wheat, and corn. Some children may also react to chocolate.