Episode 91: Mary Ellen and William Marelich

# MEDS: Mary Ellen Dello Stritto

# WM: William Marelich

# KL: You’re listening to “Research in Action”: episode ninety-one.

# [intro music]

# Segment 1:

# KL: Welcome to “Research in Action,” a weekly podcast where you can hear about topics and issues related to research in higher education from experts across a range of disciplines. I’m your host, Dr. Katie Linder, director of research at Oregon State University Ecampus. Along with every episode, we post show notes with links to resources mentioned in the episode, full transcript, and an instructor guide for incorporating the episode into your courses. Check out the shows website at ecampus.oregonstate.edu/podcast to find all of these resources.

**MEDS:** I'm your guest host Dr. Mary Ellen Dello Stritto, assistant director of research at Oregon State University Ecampus. I'm pleased to kick off our periodic series focusing on quantitative methodology and statistics. On this episode, I'm joined by Dr. William Marelich, professor of psychology at California State University Fullerton and consulting statistician for health risk reduction projects, integrative substance abuse programs from the Department of Psychiatry and Biobehavioral Sciences at the David Geffen School of Medicine at the University of California, Los Angeles. His research interests in publications address decision-making strategies and health settings, patient provider interactions, HIV/AIDS, and statistical or methodological approaches, and experimental and applied research. Dr. Marelich is co-author of the book *The Social Psychology of Health: Essays and Readings*, and is an editorial board member of the *International Journal of Adolescents and Youth.* He also has an interest in sports psychology with applications to baseball.

Thank you for joining me today, William.

WM: Great, well thanks for having me.

MEDS: Fantastic. I'm glad to have you with us. So, as a social psychologist, your work incorporates an applied quantitative perspective. So first, can you briefly describe social psychology for our listeners?

**WM:** Sure, my pleasure. So social applied, well social psychology and in particular, applied social psychology, is the study of how social influence and social perceptions and social interactions, actually influence the individual and their ultimate behavior. And the environment there is what social psychologists are really focusing on, more or less, is the idea of the social environment as well as sometimes the physical environment. So that's what social psychology and applied social psychology in particular, what we try to focus on. And then we can go ahead and bridge those, or that, those areas into areas such as health or industrial organizational psychology and in other types of applications out there. So the beauty of doing applied social psychology, or even just social psychology, you can bridge into a number of different sub-disciplines, or even you know very strong disciplines like I/O psych, industrial organization psychology, or health psychology, which are stand-alone entities now very easy to bridge into those and do that type of work. You're not just having to stick with pure working on pure social psychology issues and questions.

**MEDS:** Great, and I appreciate you kind of explaining that applied piece and how it can be applied to, you know, different areas, so that's really helpful. So can you talk about what the applied quantitative perspective means and how that relates to your work?

**WM:** Certainly. So, the applied quantitative perspective is taking the idea of statistics and certain methodologies within quantitative methods of statistics, and actually, taking those and applying them to real research, real-world research settings and situations. So, as opposed to working purely in a safe, besides collecting information on individuals in a laboratory setting and just working with certain statistical approaches within that setting, it's literally taking information from individuals from outside of a laboratory, etcetera, and then actually taking up more complicated statistics, or even more simplistic statistics, and applying those statistics to understanding what's going with us individuals out in the real world.

So for example, one area of research that I've, I work on quite a bit, published quite a bit with, is on mothers who are infected with HIV AIDS. So not only are we going into the field and actually interviewing real individuals who are infected with the H with HIV, but then once that those data are collected, they’re brought back, and then I will go ahead and take different types of multivariate statistics or other types of, or even univariate statistics, and taking a look and seeing well, what—for instance—what variables are associated with, let's say, disclosure of someone's HIV to their friends and families? Trying to get a better understanding of how all these different variables are related to each other using real individuals and real applied settings. So when I think of, you know applied quantitative methods, that's what I think about it, is that. Other people are going to have slightly different definitions of that. We see this as well where, in just, in the field of social psychology and applied social psychology words essentially all social psychologists are really applied social psychologist—I guess more or less—but really I think just like with applied social psychologists who are out working with real individuals outside of laboratory settings, applied quantitative methods individuals are crunching numbers and, and applying statistical methodologies on individuals who are actually living within a community or out in the real world. So, we’re actually applying these things, not just within an ivory tower, but actually using real people in real situations and trying to make sense of the world that way.

**MEDS:** I really like how you have talked about this idea that all psy--, all social psychologists, are applied and I like I would agree with you on that and that, you know, our listeners may know that I am a social psychologist as well, and I'm working in distance and online education research. So it's another really great example, Bill, of what you were saying in this situation.

**WM:** And one of the things two days just to add on about applied, in this case applied quantitative methods, it’s-- there is a field of psychology, which is you know, quantitative methods, and you get a PhD in that. There are some, some universities offer master's degrees that focus on that, and in the PHD programs mostly, and certainly they’ll work with, you know, populations within laboratory settings and outside of laboratory settings. But the focus of a lot of those programs are you know deriving new types of test statistics, or new ways to evaluate particular outcomes, etcetera, and while applied quantitative methods is a little different. What, when we go out, when I go out and apply the quantitative methods I'm not inventing something new, I'm actually utilizing what's already there to understand kind of bigger picture issues. So that's a that's another, in my opinion, kind of difference between straight up quantitative methods as compared to applied quantitative methods. So in the work that I will do, I'm not inventing something new I'm taking what's already been developed, and I'm actually applying it in and hopefully out into real-world settings.

**MEDS:** So you mentioned using some of these statistics in HIV and AIDS research, and I know you mentioned you know different types of statistics. Can you say a little bit more about you know, kind of in some basic terms, what those statistics have given you and in that realm like what did you learn?

**WM:** Well it's a way, for many the projects I've been involved in, it's a way to really understand how certain outcomes are affected longitudinally. So, in other words, many of the things that I end up I've been part of, really good, number of research teams for the last couple decades and, and so a lot of the studies that we end up doing our longitudinal. So a lot of the applied quantitative methods on applying have everything to do with longitudinal studies. So whether, in particular, using let's say growth curve modeling to understanding particular outcomes. For example, we-- there's a study where we followed a large group of HIV-positive women over a 15-year period with something like twelve or fifteen different time points across this 15-year period. So how do you really understand the phenomena of change depending on what your outcome is—what's going on with these mothers and their levels of depression—over a 15-year period being infected with HIV? What happens to family outcomes, you know, so we've looked at that as well over 15-year period. And so the more advanced quantitative methods all end up applying, in this case, growth curve modeling allows us to take a look over a long period of time how the infection ends up affecting the person who's infected as well as what's going on with family variables. As well as going on with other types of, even outcomes associated with the children of these HIV-positive mothers. So in other, so we've done some work where it's, where we have you know, a 15-year outcome, and it's-- it's a child outcome because we followed some of these some of the some of the children of the mothers as well. So that's been very, very powerful.

**MEDS:** Well, we're going to take a brief break. And when we come back we'll hear more from William about his expertise in statistics.

# Segment 2:

**MEDS:** Okay, so we're back as this is our first episode focusing on quantitative methods and statistics, I'm going to ask William about his experience as a professor teaching statistics courses. So I'd like to begin by asking for your perspective on the key statistical concepts that we should understand in order to be able to read and understand research reports or publications?

**WM:** Sure, so one thing that I've noticed over the last few decades, and really I've been even including teaching back in the in the 1990s and even late 1980s, where when I get new students in—for even introductory statistics courses in psychology—and there's a slight difference between statistics courses in mathematics departments and in psychology. And we're a little less formula-heavy and much more computer oriented in terms of doing analyses. The point that from day one try to make clear to my students is that, okay now what we're going to try to do is really see whether or not, let's say, two groups of individuals are really different from each other or they're not and or two variables actually move together in some way or they don't. And really it's the principles of mean differences and the principles of covariation, or what might be known more in in the public realm of correlation. And as things move together. So just trying to lay that out is important and to point out that in psychology we take samples of things.

As a sample with one group of individuals has a mean value—that mean it's just the average of score on something—where this group has a mean value—let's say of 10, and this other group has a mean value of 15. Because it's a sample, we just can't say “Hey,” you know this, “group one that got the 10 is different than the group that got the 15.” You just can't say that because there's error involved in, not only you know drawing samples, you hope the samples are representative of the population, but there's error, there skewness sometimes that's derived from pulling a sample from a population. So you could have, you know, ten people and the mean value could be 10, but it doesn't mean everybody got 10 on, you know, scoring on something. It could mean that some individuals score twos and threes and others scored eighteens and nineteens. And overall though that the mean value is ends up being a ten. So there's a lot of error, you, left so from the sampling if you did a random sample. It should look somewhat like the population, and that's based on something called “the central limit theorem,” but going beyond that because that's-- a whole lecture within itself. So, but beyond that, just you know, what error is there beneath a mean value and just trying to point that out the students, “Hey, you know we got an average here and in but this average has a lot of error in it.” Or sometimes we might refer to as error, we might just refer to it as variability. And so the mean is 10, so what is the variance? You know, the variance is a measure of variability, and then we can also we so therefore then in making mean comparisons what we end up doing is try-- we not only use the mean value, but we also end up using the variances and to go ahead and try to-- some corrections, but to give that mean value a footing in reality. In other words, “Hey,” you know, “here's our marker, here's our best guess for what somebody scores in a group.” But we also know that there's a lot of variability around that particular mean value. So given that, does this group that actually got a 10, does it really differ from the group that got a 15 once we once we account for the variability in individual scores. So that's the-- that's the mean comparison thing I try to make clear to classes.

And then for the for the correlation one because things move together, same thing. There's variability again in terms of as one – if somebody has a score on one variable and someone has a score on another variable same percent score another variable. In a sample of let’s say 100 people, how do these variables move together? Do they move in the same direction, do they move in an opposite direction, and how much variability is there uh associated with these scores? So we try to account for that as well. And so -- and again, we have the same issue, too with sampling. So there's going to be a little bit of error from going from a, you know, a sample back to a population. So these are things that I try to, you know, on the surface, you know, It's just like yeah, these groups will look different or these variables, they moved together, but the reality is we haven't really assessed that. And one thing too I try to point out is, look if we had the total population of individuals out there, like if I fight every individual who owned a widget, and if I if I was curious -- I want to compare that group who own widgets to another group that owned different kind of widget, but I have the entire populations. I could go ahead and actually just make straight up statements without any statistical testing at all. Why? It's because I have the entire population so I mentioned HIV/AIDS research earlier in the earlier segment. And years and years ago I actually I worked for the state of California as an analyst with the office of AIDS with the Department Health Services -- up in California. And there, and this was around the mid-1980s, the AIDS epidemic had just kind of sprung up, and we actually had something referred to as an AIDS registry. And so I the opportunity, working in a small epidemiologic unit there – epidemiology unit there, to go ahead and analyze some of the AIDS registry data. And there were no - we did no statistical tests for the some of the reports we were giving back to the legislature and back to the governor. We - because we had the entire population of AIDS cases, because it was reportable disease, and within this registry which at that time was a single room in a nondescript office building in, Sacramento, California area. Literally we were just okay, “Well, okay. Here's the mean here for this group and here's the mean here if we look at race ethnicity case differences, there were no statistical tests, because we didn't have to do that because we had the entire population. Now getting back to I was talking about earlier, when we're taking samples of things now, you know, it's -- now we know for sure that these mean values, there’s going to be issues with samples versus populations. And therefore then to go ahead and use the mean value as a point estimate for something, we need to take that variability into account.

**MEDS:** That's really interesting and rather rare that you actually have a set of data that includes the population, isn't it?

**WM:** Yeah, absolutely! I mean, what's interesting is currently in in San Diego County, which is, you know, we're in here in California where Titus A outbreak that's going on in San Diego within the homeless population, and those data there if you - if you go out and in you take a look at some of the public health information that's out in San Diego from the health department there. You'll see that they just report raw numbers, because they have the entire population of hepatitis cases kind of captured right now, and they're not doing comparisons -- they might do projections and things like that. You know, if we don't do something, if we don't get, you know, some treatment going on, you know, this is where the numbers could go, but otherwise they just report the numbers as they are. They don't report -- there's something sometimes called confidence intervals where you can calculate conference intervals around these things, you don’t do that with population data, because you don't need it. You know that, this is the estimated the number. This is, you know, based on based on this. It is rare when you get an entire population and took to work with, but it does happen. You know, unfortunately, it's with kind of dark things like HIV or hepatitis A infections, or maybe sometimes other types of disease outbreaks.

**MEDS:** So we're going to take a brief break, and when we come back we'll hear more from William about his research.

# Segment 3:

**MEDS:** So William, is there anything else related to quantitative methods or statistics that's coming on the horizon that you see that we might need to be aware of and look out for?

**WM:** There's also kind of the growth of new statistics programs. Although for people who do this for a living, they're aware of the program, R, which is just R but it's free software and you can download it, and program it, and they're things that will sit on top of it, and you know right now some of the bigger, there for more complex statistical analyses certainly have – fast. You have SPSS or now called IBM SPSS, and you have R. and certainly there are others as well, so I don't want to upset anybody who's using something else, but R is really gaining a lot of steam out there, and its open source, people are writing new modules here, there and everywhere. It's something that I actually teach now a little bit. We have another person my department who primarily teaches using R, so it is -- that's really gaining a lot of steam and, you know, and hasn't quite surpassed SPSS yet, but it is gaining market share so that's new. But one other thing too that – we were talking about p-values earlier. One thing that's popped up, especially in social psychology in the last few years, and in some of your listeners may have heard a term that's called um ‘P Hacking’ and ‘P Curves’. So that's something that we're beginning to pay a little more attention to. In a nutshell, let me try to explain what the two are. They're kind of interrelated, but P hacking is an idea of where if you're out collecting data, whether it's a laboratory or out in an applied setting, and as you collect data, as somebody who's who collects data all the time, you sit there and you get early results and you just sometimes for fun start analyzing the data to see what you have it, and there's nothing wrong with that, and you know, you say “I want to sample of a five hundred people. I have a hundred and fifty that have come in already. Let me just see what the numbers start looking like.” And then you look at it and you go, “Oh yay” or “that's not good” and then, you know, you continue to collect the rest of your sample, and then because you set out to collect a sample of 500 and that's what you should be doing your hypothesis testing on and Etcetera. What P hacking is, is basically instead of collecting data, one way to do it is you collect only part of your data, and then you check and as soon as you get a finding that you like, then you stop collecting data. And then you report that result as a result. So basically you're doing these fine adjustments, uh you know, concurrent with the research you're doing and so that's the kind of one way to do P hacking. Another way is, what you can do is you can realign cells and your analyses, and that's a little more complicated to do, but you can go ahead and categorize some people here and categorize some people there, and you know, “Okay median split not working, what if I create a quartiles? Oh? Well maybe that works now.” And because you're now—what you're doing is you're looking for significance. And there has been a little bit of buzz in the social psychology community where some researchers have been called out for kind of this this P hacking stuff, which is really, really unfortunate because, you know, anytime a science is called into question. And this other idea, a related idea is what’s called a p curve. And a p curve is where, let's say you can take meta-analysis results. Let's say, say someone publishes a meta-analysis on 50 studies looking at the effects of widgets on people's behavior. So what you can-- meta-analysis is a synthesis of all the research findings across those 50 studies, and then you also try to find unpublished studies. Not just published, but unpublished studies that also have been done, and you’re calling researchers up to get this information. Anyway, so let's say the meta-analysis is published. Well what you'd like to see, you can actually bought out all these different studies, and what and if in what you should see - is you should see almost like a random distribution of p values. In other words, some of these studies are going to have p is less than 0.05, and some are going to have p is less than .01, and some will be p less than .001. Or sometimes they'll report -- sometimes with the test statistics themselves in the sample size, you can plug things into a computer and actually get the exact probability. So you can actually calculate the exact probabilities. So what you'd like to see kind of just nice kind of randomness with these P values. When you actually see a curved form right around the .04, .05 mark. So in other words, you kind of get this, kind of this random set of p-values, if you will, at the lower levels. And all of a sudden you see this big kind of bulking number of 0.04s and 0.05s starting to kind of tail up on the distribution. Are you just picking studies that are going to be positive for what you're doing or you really picking all studies?” And not only that, but if you're - if the researcher really picked all studies that were out there. They were able to get ahold of all the studies out there, including the unpublished ones, and if you still have a pile up at the .04 and .05 level, it’s like, “Yeah. This is all kind of you questionable. Everything's borderline” and you shouldn't really get that if you're getting a real true effect. And I know other researchers are paying much more close attention to this now than let's say we did, you know ten years ago, you know again, what we try to do, hopefully we’re ethical about this, is where, you know, you try to -- you're going to go ahead and do your statistical test. Some, you know, some variables, some outcomes will be, “P is less than 0.05 or less than 0.04” but others are also going to be point, you know, .01 or less. And I think for most of us doing research out there, if we - I don't think we would publish a study where everything, all of our findings were borderline. It just wouldn't go out to press. But occasionally there are people out there who do that, and this way of kind of evaluating p hacking and p curves now can kind of help us identify studies that are questionable like that.

**MEDS:** That's really interesting. I had not heard of either of those terms before, but I understand based on how you described it, you know, how that could be, you know, make a big impact particularly in terms of, you know, understanding what you're reading and understanding. You know, what is being published out there, so that's really, really interesting. So what we can also do is put some links in our show notes to a couple of things that you mentioned. So R was one and then p hacking and p curves. Well that's a great place to wrap up. So thanks for talking with me today, William.

**WM:** You're welcome, my pleasure!

**MEDS:** And thanks also to our listeners for joining us for this week's episode of Research in Action. I'm Mary Ellen Dello Stritto, join us next week for another episode.

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# Bonus Clip #1:

**MEDS:** In this first bonus clip for episode 91 of the research and action podcast, Dr. William Marelich discusses longitudinal statistical approaches take a listen:

**WML:** But it and other types of uh, you know, methods, let’s say or statistical approaches are applied as is a technique referred to a structural equation modeling, which is really creating latent constructs. You kind of - kind of -- different ways of piecing together different variables to kind of create these, for lack of a better term, kind of these soft and fuzzy, you know, latent constructs or ideologies out there to see in fact how -- how certain groupings of variables affect other groupings of variables that affect other groupings of variables as well. So you can get into broader issues of mediation. Are the other groups of variables that mediate the relationship between two other sets of variables? You know, you can get into moderated relationships as well. Lots of different applications, missions, etcetera. And so I hope that answers your question.

**MEDS:** Yeah, that's great! And that's really interesting that you have fifteen years of longitudinal data, so some of those children have grown up, right?

**WM:** They have. Yeah.

**MEDS:** And that's amazing that you’ve able to follow.

**WM:** Yeah, they – yeah. I mean, the youngest from - the youngest when the when the series of studies was was started, the youngest I believe was five years of age. So by the time, fifteen years later, assuming we didn't have attrition, meaning subjects had to leave the study for whatever reason. Say participants had to leave this study - so that that that child would be twenty years of age. So in many instances we’re able to not only interview the mother over that 15-year period, but also interview the the child. So that child who started at five is now the age 20. I think the oldest child we had was 12. And so – so, after 15 years you're looking at interviewing still somebody who's 27 years of age. And so you can get into these really interesting life changes that occur. Like what happens to some of these kids over a 15-year period? Now they are young adults. So How is – how is this -How high up with an hiv-infected parent? How has that affected, you know, the child in terms of picking a career? We just America published a paper dealing with career readiness and in looking at child outcomes based on this longitudinal 15-year look. So it's a - it's fascinating. It’s really if these more complex statistical approaches such as growth curve modeling, and there are other things out there as well, another technique called generalized estimating equations where we can go ahead and take a look at these large, you know cuts and time over and over and over again these big longitudinal studies and try to make sense out of out of, you know, these little clips of individual’s lives.

**MEDS:** Fascinating.

**MEDS:** You just heard a bonus clip from episode 91 of the Research in Action podcast with Dr. William Marelich discussing longitudinal statistical approaches. Thanks for listening!

# Bonus Clip #2:

**MEDS:** In this second bonus clip for episode 91 of the research and action podcast dr. William Merrill Edge explains P values and statistical testing take a listen:

**MEDS:** So you mentioned, you know, situations that we typically see in journal articles and research reports in which they did actually do statistical tests, and typically with statistical tests we have this thing called the p-value. So I'm wondering if maybe you could talk about that, because we get a lot of questions about, what I need to pay attention to with this P-value?

**WM:**  Sure. So once, you know, once—especially when I'm talking my students and trying to explain, “Okay, so these mean values have will have variability kind of behind the scenes,” or if we're looking at correlations between two variables well, okay, there's going to be some some variability that's mixed into that particular - the correlation coefficient is actually a test statistic, but there's going to be some things we need to be aware of their two with variability. So, what we end up doing, let's say, we compare means, we can, we might, you know, generate a test statistic or something. There's something referred to as a t-test and ‘T’ is in the word ‘Tall’, so it's a t-test. And it basically is evaluating, in a simple two group example, we go ahead and take a mean difference, mean one versus mean two, we standardized that difference and then we evaluate whether or not that difference is above and beyond what's expected by chance. And we can actually calculate, or computer will do it for us, an exact probability of getting that particular test statistic given that the null hypothesis is true. So these p-values, you know, p is less than 0.05; p is less than 0.01. It basically indicates that, hey, if we did this, if we went out and sampled data a hundred times. Uh you know, ninety-five times out of a hundred, we could be sure that that you whatever these differences are true differences. And five percent of the time, is that this difference that we're showing here, in fact is due to random chance. So basically we're in psychology. Where in many instances we’re okay with this 95% kind of cut off, if you will. And so you'll see that reported; p is less than 0.05 or p is equal to 0.05. And then with there's also, you can get more stringent, being more conservative and use 0.01 level so again will get the same results ninety-nine times out of 100 due to real true group differences, and one-time of a hundred it’s going to be due to random chance or things outside of our control. So, and again, we're willing to live with that. And that's based on, again, comparing two means standardized are basically, getting mean differences, standardizing that difference, and and then evaluating whether or not, you know, this difference is above and beyond what we would expect by chance. And we typically use a chance cut off of 0.05. For correlation, it’s a similar thing. We’ll calculate it, measure of covariance, we basically standardized that covariance, which is the correlation coefficient something; something that's just referred to as *R*, and then we evaluate whether or not that *R* value is above and beyond what's expected by chance. And we get it we can computer can calculate for us an exact probability of getting that *R* value getting a valued like that *R* value. You know, assuming that the null hypothesis is true. And typically in Psychology the null hypothesis is saying that there are no group differences or that there are, that two variables don't move together. You know, basically null effects. And it's kind of arguable to there, there’s kind of newer literature that's been coming out the last fifteen or twenty years about null hypothesis testing and, you know, how much should how much more of it should we do? Should we look at alternatives? What are other ways around this? But my opinion right now is kind of staying put, you know, more or less with latching on to this .05 and .01 ideas and it—because they've been around for decades upon decades; fifty to sixty years. So, that's it.

So for somebody who's reading a newspaper account of studies, etc., you'll see these words being thrown out there about, or reading something on the web, which in some cases is less vetted than good newspapers, but we're see, “Hey, yeah, there was a significant difference between this group and this group” and when you read that you know most of the time the reporters are basically trying to summarize this *p* is less than 0.05 type of cut off, and this idea of null hypothesis testing. So I hope that answers your question.

**MEDS:** Yeah, and I'm really glad that you mentioned, you know, some of these concepts like *p* values and correlation coefficients and what they are. And I'm really glad also that you mentioned the kind of debate out there, and that maybe another topic for another podcast episode - is some questions about whether we should even be using these p-values in these kinds of models of statistical testing, so very interesting.

**WM:** I tell my classes that—I also teach Health psychology—so in psychology course, I point out that you know, here and even in health psych, we use a .01 the .05 level significance for a cut off and I said that tends to work pretty well unless you're working with life-and-death outcomes, and then I think you want to be a little more stringent. You know, where you don't want to say “Hey, this drug is effective. *P* is less than .05” because in fact you, you'd like to see that it's—why take a chance and say “Hey, it's effective five times out of 100 by random chance.” You know, you don't. I think that's or, “This is going to save somebody's life. You know, p is less than .05” it's kind of like, yeah but you know, part of that is you know you're risking, you know you get five out of a hundred that are just you know these effects are going to happen randomly, maybe we need to get more stringent with that. So most other things and in, let's say social psychology, work really well with *p* is less than .05. I think things of huge importance, let's say, you’re trying to come up with some type of—you've developed some new way, something new to implement in the education system. You know, at the high school level or grammar school level. And maybe you want to be more stringent than p is less than 0.05, if then a school district is going to go ahead and spend millions and millions of dollars to implement something when p is less than 0.05 only. Maybe you'd like *P* is less than .001. Maybe that's, you know—then yes, the school district should spend lots of money. So there are going to be certain situations, circumstances where the .05 is going to be great. It's going to work, we've been using it for four decades and decades, but in in other situations, I would suggest actually getting more stringent.

**MEDS:** Great, and thank you for kind of explaining how that statistic can actually be applied to make a decision. I think that's a really great place to kind of end.

**MEDS:** You just heard a bonus clip from episode 91 of the Research in Action podcast with Dr. William Merrill Edge explaining P. Values and statistical testing. Thanks for listening.

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