00:09
So I'm a doctor, but I kind of slipped sideways into research, and now I'm an epidemiologist. And nobody really kno ws what epidemiology is. Epidemiology is the science of how we know in the real world if something is good for yo u or bad for you. And it's best understood through example as the science of those crazy, wacky newspaper headline s. And these are just some of the examples.

00:30
These are from the Daily Mail. Every country in the world has a newspaper like this. It has this bizarre, ongoing phil osophical project of dividing all the inanimate objects in the world into the ones that either cause or prevent cancer. Here are some of the things they said cause cancer: divorce, Wi-Fi, toiletries and coffee. Some things they say preve nt cancer: crusts, red pepper, licorice and coffee. So you can see there are contradictions. Coffee both causes and pre vents cancer. As you start to read on, you can see that maybe there's some political valence behind some of this. For women, housework prevents breast cancer, but for men, shopping could make you impotent.

01:04
(Laughter)

01:05
So we know that we need to start unpicking the science behind this. And what I hope to show is that unpicking the e vidence behind dodgy claims isn't a kind of nasty, carping activity; it's socially useful. But it's also an extremely valu able explanatory tool, because real science is about critically appraising the evidence for somebody else's position. T hat's what happens in academic journals, it's what happens at academic conferences -- the Q&A session after a postdoc presents data is often a bloodbath. And nobody minds that; we actively welcome it. It's like a consenting int ellectual S&M activity.

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(Laughter)

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So what I'm going to show you is all of the main things, all of the main features of my discipline, evidence-based me dicine. And I will talk you through all of these and demonstrate how they work, exclusively using examples of peopl e getting stuff wrong.

01:56
We'll start with the absolute weakest form of evidence known to man, and that is authority. In science, we don't care how many letters you have after your name -- we want to know what your reasons are for believing something. How do you know that something is good for us or bad for us? But we're also unimpressed by authority because it's so ea sy to contrive. This is somebody called Dr. Gillian McKeith, PhD, or, to give her full medical title, Gillian McKeith.

02:21
(Laughter)

02:24
Again, every country has somebody like this. She is our TV diet guru. She has five series of prime-time television, g iving out very lavish and exotic health advice. She, it turns out, has a non-accredited correspondence course PhD fro

m somewhere in America. She also boasts that she's a certified professional member of the American Association of Nutritional Consultants, which sounds very glamorous; you get a certificate. This one belongs to my dead cat, Hettie. She was a horrible cat. You go to the website, fill out the form, give them $60, it arrives in the post. That's not the only reason we think this person is an idiot. She also says things like eat lots of dark green leaves, they contain chlorophyll and really oxygenate your blood. And anybody who's done school biology remembers that chlorophyll and chloroplasts only make oxygen in sunlight, and it's quite dark in your bowels after you've eaten spinach.

03:10
Next, we need proper science, proper evidence. So: "Red wine can help prevent breast cancer." This is a headline from The Daily Telegraph in the UK. "A glass of red wine a day could help prevent breast cancer." So you find this paper, and find that it is a real piece of science. It's a description of the changes in the behavior of one enzyme when you drip a chemical extracted from some red grape skin onto some cancer cells in a dish on a bench in a laboratory somewhere. And that's a really useful thing to describe in a scientific paper. But on the question of your own personal risk of getting breast cancer if you drink red wine, it tells you absolutely bugger all. Actually, it turns out that your risk of breast cancer increases slightly with every amount of alcohol you drink. So what we want are studies in real human people.

03:54
And here's another example. This is from Britain's "leading" diet nutritionist in the Daily Mirror, our second-biggest selling newspaper. "An Australian study in 2001 found that olive oil, in combination with fruits, vegetables and pulses, offers measurable protection against skin wrinklings," and give the advice: "If you eat olive oil and vegetables, you'll have fewer wrinkles." They helpfully tell you how to find the paper, and what you find is an observational study. Obviously, nobody has been able to go back to 1930, get all the people born in one maternity unit, and half of them eat lots of fruit and veg and olive oil, half of them eat McDonald's, and then we see how many wrinkles you've got later.

04:30
You have to take a snapshot of how people are now. And what you find is, of course: people who eat veg and olive oil have fewer wrinkles. But that's because people who eat fruit and veg and olive oil are freaks -- they're not normal, they're like you; they come to events like this.

04:44
(Laughter)

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They're posh, they're wealthy, less likely to have outdoor jobs, less likely to do manual labor, they have better social support, are less likely to smoke; for a host of fascinating, interlocking social, political and cultural reasons, they're less likely to have wrinkles. That doesn't mean it's the vegetables or olive oil.

05:01
(Laughter)

05:02
So ideally, what you want to do is a trial. People think they're familiar with the idea of a trial. Trials are old; the first one was in the Bible, Daniel 1:12. It's straightforward: take a bunch of people, split them in half, treat one group one way, the other group, the other way. A while later, you see what happened to each of them. I'm going to tell you about one trial, which is probably the most well-reported trial in the UK news media over the past decade. This is the tri

al of fish oil pills. The claim: fish oil pills improve school performance and behavior in mainstream children. They said, "We did a trial. All the previous ones were positive, this one will be too." That should ring alarm bells: if you know the answer to your trial, you shouldn't be doing one. Either you've rigged it by design, or you've got enough data so there's no need to randomize people anymore.

05:44
So this is what they were going to do in their trial: They were taking 3,000 children, they were going to give them these huge fish oil pills, six of them a day, and then, a year later, measure their school exam performance and compare their performance against what they predicted their exam performance would have been if they hadn't had the pills. Now, can anybody spot a flaw in this design?

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(Laughter)

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And no professors of clinical trial methodology are allowed to answer this question. So there's no control group. But that sounds really techie, right? That's a technical term. The kids got the pills, and their performance improved.

06:18
What else could it possibly be if it wasn't the pills? They got older; we all develop over time. And of course, there's the placebo effect, one of the most fascinating things in the whole of medicine. It's not just taking a pill and performance or pain improving; it's about our beliefs and expectations, the cultural meaning of a treatment. And this has been demonstrated in a whole raft of fascinating studies comparing one kind of placebo against another. So we know, for example, that two sugar pills a day are a more effective treatment for gastric ulcers than one sugar pill. Two sugar pills a day beats one a day. That's an outrageous and ridiculous finding, but it's true. We know from three different studies on three different types of pain that a saltwater injection is a more effective treatment than a sugar pill, a dummy pill with no medicine in it, not because the injection or pills do anything physically to the body, but because an injection feels like a much more dramatic intervention. So we know that our beliefs and expectations can be manipulated, which is why we do trials where we control against a placebo, where one half of the people get the real treatment, and the other half get placebo.

07:19
But that's not enough. What I've just shown you are examples of the very simple and straightforward ways that journalists and food supplement pill peddlers and naturopaths can distort evidence for their own purposes. What I find really fascinating is that the pharmaceutical industry uses exactly the same kinds of tricks and devices, but slightly more sophisticated versions of them, in order to distort the evidence they give to doctors and patients, and which we use to make vitally important decisions.

07:48
So firstly, trials against placebo: everybody thinks a trial should be a comparison of your new drug against placebo. But in a lot of situations that's wrong; often, we already have a good treatment currently available. So we don't want to know that your alternative new treatment is better than nothing, but that it's better than the best available treatment we have. And yet, repeatedly, you consistently see people doing trials still against placebo. And you can get licensed to bring your drug to market with only data showing that it's better than nothing, which is useless for a doctor like me trying to make a decision.

08:18

But that's not the only way you can rig your data. You can also rig your data by making the thing you compare your new drug against really rubbish. You can give the competing drug in too low a dose, so people aren't properly treate d. You can give the competing drug in too high a dose, so people get side effects. And this is exactly what happened with antipsychotic medication for schizophrenia. Twenty years ago, a new generation of antipsychotic drugs were br ought in; the promise was they would have fewer side effects. So people set about doing trials of the new drugs agai nst the old drugs. But they gave the old drugs in ridiculously high doses: 20 milligrams a day of haloperidol. And it's a foregone conclusion if you give a drug at that high a dose, it will have more side effects, and your new drug will l ook better.

08:59
Ten years ago, history repeated itself, when risperidone, the first of the new-generation antipsychotic drugs, came of f copyright, so anybody could make copies. Everybody wanted to show their drug was better than risperidone, so yo u see trials comparing new antipsychotic drugs against risperidone at eight milligrams a day. Again, not an insane do se, not an illegal dose, but very much at the high end of normal. So you're bound to make your new drug look better. And so it's no surprise that overall, industry-funded trials are four times more likely to give a positive result than ind ependently sponsored trials.

09:31
But -- and it's a big but --

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(Laughter)

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it turns out, when you look at the methods used by industry-funded trials, that they're actually better than independen tly sponsored trials. And yet, they always manage to get the result that they want. So how does this work?

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(Laughter)

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How can we explain this strange phenomenon? Well, it turns out that what happens is the negative data goes missing in action; it's withheld from doctors and patients. And this is the most important aspect of the whole story. It's at the top of the pyramid of evidence. We need to have all of the data on a particular treatment to know whether or not it r eally is effective. There are two different ways you can spot whether some data has gone missing. You can use statis tics or you can use stories. I prefer statistics, so that's what I'll do first.

10:17
This is a funnel plot. A funnel plot is a very clever way of spotting if small negative trials have disappeared, have go ne missing in action. This is a graph of all of the trials done on a particular treatment. As you go up towards the top of the graph, what you see is each dot is a trial. As you go up, those are bigger trials, so they've got less error; they're less likely to be randomly false positives or negatives. So they all cluster together. The big trials are closer to the tru e answer. Then as you go further down at the bottom, what you can see is, on this side, spurious false negatives, and over on this side, spurious false positives. If there is publication bias, if small negative trials have gone missing in ac tion, you can see it on one of these graphs. So you see here that the small negative trials that should be on the bottom left have disappeared. This is a graph demonstrating the presence of publication bias in studies of publication bias. And I think that's the funniest epidemiology joke you will ever hear.

11:08
(Laughter)

11:09
That's how you can prove it statistically. But what about stories? Well, they're heinous, they really are. This is a drug called reboxetine. This is a drug which I, myself, have prescribed to patients. And I'm a very nerdy doctor. I hope I go out of my way to try and read and understand all the literature. I read the trials on this. They were all positive, all well-conducted. I found no flaw. Unfortunately, it turned out, that many of these trials were withheld. In fact, 76 per cent of all of the trials that were done on this drug were withheld from doctors and patients. Now if you think about it, if I tossed a coin a hundred times, and I'm allowed to withhold from you the answers half the times, then I can convince you that I have a coin with two heads. If we remove half of the data, we can never know what the true effect size of these medicines is.

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And this is not an isolated story. Around half of all of the trial data on antidepressants has been withheld, but it goes way beyond that. The Nordic Cochrane Group were trying to get ahold of the data on that to bring it all together. The Cochrane Groups are an international nonprofit collaboration that produce systematic reviews of all of the data that has ever been shown. And they need to have access to all of the trial data. But the companies withheld that data from them. So did the European Medicines Agency -- for three years.

12:23
This is a problem that is currently lacking a solution. And to show how big it goes, this is a drug called Tamiflu, which governments around the world have spent billions and billions of dollars on. And they spend that money on the promise that this is a drug which will reduce the rate of complications with flu. We already have the data showing it reduces the duration of your flu by a few hours. But I don't care about that, governments don't care. I'm sorry if you have the flu, I know it's horrible, but we're not going to spend billions of dollars trying to reduce the duration of your flu symptoms by half a day. We prescribe these drugs. We stockpile them for emergencies on the understanding they'll reduce the number of complications, which means pneumonia and death. The infectious diseases Cochrane Group, which are based in Italy, has been trying to get the full data in a usable form out of the drug companies, so they can make a full decision about whether this drug is effective or not, and they've not been able to get that information. This is undoubtedly the single biggest ethical problem facing medicine today. We cannot make decisions in the absence of all of the information.

13:32
So it's a little bit difficult from there to spin in some kind of positive conclusion. But I would say this: I think that sunlight is the best disinfectant. All of these things are happening in plain sight, and they're all protected by a force field of tediousness. And I think, with all of the problems in science, one of the best things that we can do is to lift up the lid, finger around at the mechanics and peer in.

14:04
Thank you very much.

14:05
(Applause)