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Guide to interpreting research

All research varies in quality, and carrying out rigorous research is expensive and time consuming. When exploring autism research you'll find articles of varying quality, but how do you know what to make of the findings? This article will help explain how you know which research evidence can be trusted and when to be wary about the claims research makes.

1) Where is the research published?

Research can be published in a variety of places from journals to websites to books. Usually, the best research can be found in peer reviewed journals. This means that the methods used in the research have been checked and reviewed by professional researchers, and the article will only appear in the journal if it's been approved. You can see whether or not a journal is peer reviewed on the front page of the journal or the journal website's home page.

2) Who funded the research?

Sometimes people who are trying to promote a particular method will fund research into that method to show that it works. However, this will bias the research, because the researchers may be biased towards showing the method works (whether they're aware of it or not) because they're paid by the person who invented the approach. For example, even if the methods are good, findings from a study looking at *Glossy Teeth* toothpaste to reduce plaque might be biased if the research was funded by *Glossy Teeth*.

Research can be funded independently, for example, funding bodies include the Medical Research Council, National Institute for Health Research and the Welcome Trust. If research has been funded by these institutions or other funding bodies or charities, then it is unbiased. Research that's been privately funded by the company selling a particular intervention approach is likely to be biased.

3) How good are the methods?

This is the really important one, but hard to explain as the methods will depend on the type of research being done. A study looking at the genetic basis of autism will use very different methods to a study looking at the effectiveness of a particular intervention.

Autism intervention is my area, so I'll talk about the quality of methods used for intervention research. I'll leave it up to the geneticists/ statisticians out there to explain their methodology!

So, first things first, the study design is very important. In the perfectly designed intervention study, you should look for the following things: adequate control groups, adequate sample size, randomisation, meaningful outcome measures and long-term follow-up. I'll explain each of these below:

a) Adequate control groups

Imagine the *Glossy Teeth* example above. Perhaps we've been given funding to see whether *Glossy Teeth* toothpaste reduces plaque. We could just measure plaque levels before and after asking people to brush their teeth with *Glossy Teeth* for a month, but this wouldn't tell us much. If plaque is lower at the end of the month, this could be for many reasons. Perhaps the people ate less fruit over that month (and we know that fruit acid is bad for your teeth), or

perhaps fluoride was added to the water over that month, and so improving people's dental health. Or perhaps people just brushed their teeth more because they're part of a research study, and extra brushing could be reducing the plaque. The findings could have had nothing to do with the toothpaste at all!

What we need is a suitable control group, or comparison group. What about having one group of people who gets *Glossy Teeth* toothpaste, and one group who just brush their teeth with water, and compare their change in plaque levels? This would help, but again, it's not ideal. It won't tell us whether *Glossy Teeth* is better than any old toothpaste.

Three groups would be better: one group could get *Glossy Teeth* for a month, one group could get *Value Mint* toothpaste for a month, and one group could just brush with water for a month. If we compared the change in plaque levels over the course of the study with these three groups, and *Glossy Teeth* comes out on top, we'd be fairly sure that *Glossy Teeth* was better than any old toothpaste at reducing plaque and better than no toothpaste at all.

But that's not all there is to it....

b) Adequate sample size

You need to check if a study has a large enough sample size to be able to answer the questions they're asking. What if we had only 1 person brushing with *Glossy Teeth*, 1 person with *Value Mint* and 1 person with water? Would that be enough to say confidently whether *Glossy Teeth* was best? No! Perhaps the person who got *Glossy Teeth* is naturally a more vigorous brusher than the other two.

Would 5 people be enough, or 10? Probably not. The point here is that a study needs to have enough people in it to be able to make confident conclusions. Obviously it would be very expensive to research thousands of people in each group, so there's a balance somewhere, but in general, the larger the sample size (the number of people in a study) the better.

Statisticians can do something clever called a "power calculation". This calculation can tell you how many people you need in a study to show statistically significant group differences if they exist, given the size of the change in outcomes that you expect (based on previous research). So look out for large sample sizes and power calculations as signs of good research methods.

c) Random assignment to groups

If we have our three groups, Intervention 1 (*Glossy Teeth*), Intervention 2 (*Value Mint*) and Control (brush with water), you need to think about how people are assigned to those groups. If people could just choose, then they're more likely to go with the *Glossy Teeth* option, perhaps because it's more famous, or they think it's going to work better. This would then influence the outcomes (people are more likely to say something works better if they believe it's better).

If you found people who naturally choose *Glossy Teeth* or choose *Value Mint* toothpaste then your study would also be biased. People who choose a particular toothpaste might have other things in common, for example, people who buy *Glossy Teeth* might be wealthier than people who buy *Value Mint* toothpaste. This might mean they can afford better quality toothbrushes and therefore have better outcomes in the tooth-brushing research.

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There may be many factors that influence the success of an intervention (and toothpaste is a very simple example). In order to control for as many known and unknown sources of bias, participants in a research study should be randomly assigned to the different groups.

Very often, in intervention research, it's not possible to randomly assign people to groups. It wouldn't be ethical to randomly assign a child to a group that doesn't receive an intervention that you know will help that child. So while random assignment is methodologically ideal, in practice it's not always possible.

Other options include having a waiting list control group who would receive the intervention but at a later date, and you could compare the change during the waiting list with the change before and after the intervention. Or you could have different groups but not randomly assign. As long as you interpret the research bearing in mind any methodological flaws it's alright. You can read more about the different types of study used in autism research on the Research Autism website:
http://www.researchautism.net/pages/autism_research_journal_articles_publications_studies/autism_research_study_types

d) Are the researchers blind?

If researchers are checking the outcomes from a particular intervention it is important that they are blind to the group allocation. In the *Glossy Teeth* research example, this means that the person measuring the levels of plaque before and after doesn't know whether or not the person had been using *Glossy Teeth*, *Value Mint* or brushing with water. If the person measuring plaque knew which group the person was in, they might be biased. If they expect that *Glossy Teeth* is going to work best, then this might influence their measurements, whether they want to or not.

Some outcomes are very difficult to bias (for example, the number of people attending a group before and after it's advertised can be easily counted and checked by someone else), some are slightly open to bias and other outcomes are very easy to bias (for example, estimating the quality of social interaction before and after a social skills intervention).

This brings me on to meaningful outcome measures.

e) Meaningful outcome measures

If you're investigating whether or not *Glossy Teeth* toothpaste has superior performance in reducing plaque, then you need to measure something to do with plaque. It will be no good measuring the number of cups of tea a person drinks as that has nothing to do with the question you're trying to answer. It's not really any good measuring how sweet the person's breath smells either, as while that might have something to do with the amount of plaque on their teeth, it's not a direct measure of plaque, so you're making an assumption that plaque levels affect bad breath.

So when reviewing research, look at the quality of the outcome measures used. Are they measuring the right thing? For example, in a social skills intervention, are they measuring social skills ability?

Are the measures sensitive enough to pick up change? Or are they too broad and not likely to pick up any differences if they do occur?

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f) Clinical relevance of the findings

If the research is looking at the effectiveness of an intervention, and shows a statistically significant improvement in the intervention group, how clinically relevant is that? Will a change of 3 points on a questionnaire have an impact on the quality of a person's life? Statistically significant or not, the researchers should comment on the clinical relevance of the findings from their study.

g) Long-term follow-up

While it might be nice to say that using *Glossy Teeth* toothpaste for a month reduces more plaque than *Value Mint* toothpaste or brushing with water, it doesn't tell us about the long term outcomes of using *Glossy Teeth* (does it influence how many of your own teeth you have at aged 80yrs??). In intervention research, it's useful to know the long term outcomes of a particular approach. It's expensive and time consuming to do this, but it's something researchers should aim for, and something to look out for as a sign of a good quality study. It could be really useful to know what the long term outcomes are for a particular psychological intervention for autism in comparison to other approaches.

4) Is it replicated?

If the same findings come up more than once, then it's more likely that the findings are accurate. It's therefore important to repeat research to see if the same answer comes up. Even better is if someone else finds the same as you. This is known as independently replicating the research. Interventions that have independently replicated positive outcomes are few and far between as good intervention research is not easy to carry out. If you read an article that's got rigorous methods and backs up findings from other research, then you can likely trust the findings reported.

5) Can you be sure it's the intervention?

After all these considerations, it's important to have a think about any positive findings being down to the intervention, or whether the outcomes could be caused by something else. There's a nice example on Wikipedia of a study which found that children who slept with the lights on were more likely to be short sighted. This study was published in the prestigious journal "nature", but subsequent research could not replicate the findings. Instead, future studies found that parents of children who are short sighted are also short sighted themselves, and therefore more likely to leave the light on in the child's bedroom! So, it wasn't the light on in the room causing short sightedness at all.

When reading whether a child receiving a certain intervention is more likely to improve, think about what other factors might also be involved that the researchers may or may not have measured. In autism research there are many variables that play a part, and it's impossible to control for all of them. So be careful when interpreting findings.

Want to know more about research methods?

http://www.senseaboutscience.org/pages/about-us.html

Want to find high quality reviews about autism interventions?

http://www.cochrane.org/search/site/autism
http://www.researchautism.net/pages/autism_treatments_therapies_interventions/