

Understanding *Regression to the mean* in preparation for teaching EBM

Background

I am responsible for teaching medical students about Evidence Based Medicine. One of the challenges is to explain, early in the program, the several reasons that evidence for treatments (interventions) needs controlled studies. I deal with the need for randomisation in a separate occasion.

The problem

When I put up a slide showing the placebo arm of a trial (holding back data for the intervention arm, for the moment), which shows improvement with time, and ask the students to explain this, the notion of *placebo effect*, is quickly suggested: it seems to be well inured into our culture, and many students – even very early on – understand it well. However *regression-to-the-mean*¹ seems to be very non-intuitive in comparison.² It has been defined as the tendency for extreme measurements to be closer to the mean when repeated.³ It may be a greater effect than the placebo effect.³

The educational solution

In my session, which students are studying osteoarthritis (OA) as a weekly case in a problem-based learning (PBL) program, I discuss arthroscopy as a treatment option, widely practiced in our area. The example of a regression to the mean effect is from a randomised controlled trial of arthroscopic lavage and debridement for knee OA. To illustrate this effect, I hand out to the students a pair of dice to each PBL group (~8-9 students in each, ~12 groups), together with a laminated picture of an arthroscope. On a signal they throw the dice, and we record the score for each Group on the whiteboard. We had already set the pain level as 10 (dice score range 2-12), describing this pain as ‘unbearable – please do something, doctor’. Those scoring 10 are invited to ‘arthroscope their dice’, using the laminated sheet. This can be hilarious (I demonstrate how to do it with a grunt, and this is usually mimicked in each of the Groups). I then say “...it is now 3 months later, let’s see how the pain is measuring up. Those in the Groups that treated with arthroscopy, throw your dice again!”. These 3 or 4 groups usually find that most have regressed to the mean: their ‘patient’ is much improved. (I also now invite the *other* groups to also throw their dice to show how there is now a new set with increased pain).



Follow up

I test knowledge and understanding by means of multiple choice questions in the end of year exams to check there is some persistent understanding. I also revisit the teaching session the following year when we start to critically appraise randomised controlled trials, pausing to ask why we need a control group. This enables a spiral of learning re-enforcement.

Where the idea came from

I heard of the technique second hand from a teaching session in Oxford (related to the potentially spurious benefits of building traffic controls in accident-prone crossroads), but I am not sure who was responsible.

1. Bland JM, Altman DG. Regression towards the mean. *BMJ*. 1994;308(6942):1499.
2. Ernst E, Resch KL. Concept of true and perceived placebo effects. *BMJ*. 1995;311:551-553.
3. Hrobjartsson A, Gotzsche PC. Placebo interventions for all clinical conditions. *Cochrane Database Syst Rev*. 2010(1):Cd003974.