Cautions About the Regression Effect

Researchers often use nonexperimental data (aka “observational data”) to evaluate the efficacy of specific programs. Although graduate courses in methodology may alert researchers to a pitfall known as the regression effect, the topic can often fade from memory. A recent article by Weeks can help refresh those memories, helping researchers to improve their analyses.

In his article, Weeks includes the following points, among others:

1. “The regression effect is a universal statistical phenomenon in which an attribute that is extreme on an initial measurement will tend to be closer toward the mean of a group on a subsequent measurement…It is also known as statistical regression or regression toward the mean. Many health care studies select study groups on the basis of atypical or extreme pretest scores and are therefore extremely vulnerable to the regression effect…” [pp. 254-255]

2. “The regression effect should be considered as a rival explanation for change in nonrandomized intervention studies, such as case-control or cohort studies. Yet the regression effect continues to spoil many otherwise good research efforts when it is not considered as a substantive explanation for change across repeated measurements…” [p. 255]

3. “Except in the unlikely event that the two sets of scores [the baseline and follow-up scores] correlate at $r = 1.0$, there will be a tendency for the follow-up scores of the top half of the group to decrease (be closer to the mean) and an opposite tendency for the follow-up scores in the bottom half of the group to increase relative to the baseline scores…the regression effect will occur apart from the influence of an intervention…” [p. 255] [Comment: So changes in individuals’ scores can occur sans any intervention.]

4. “The magnitude of the regression effect is proportional to how far the scores on a baseline test deviate from a group or population mean. On the average, baseline scores that are more distant from the mean will tend to regress more on retest than baseline scores that deviate less from the mean…” [p. 255]

5. “The amount of regression expected to occur in a group of scores can be estimated numerically by the pretest-posttest correlation…” [p. 256]

6. “Calculating change due to regression for each pretest score and averaging these values will reveal whether posttest differences following an intervention exceed the average change expected from regression to the mean…” [p. 258] [Comment: This will help the researcher to isolate the change that is truly a result of some intervention.]

7. “Binary outcomes derived from continuous measures (e.g., the presence or absence of a condition on the basis of subject performance on a diagnostic test relative to a cutoff score) are also subject to the regression effect…” [p. 258]
8. “The type of intervention study most vulnerable to a threat from regression [effect] is a single-
group cohort study...in single-group cohort studies, the omission of a randomly assigned control
group leaves the ability to assess change due to regression indeterminate...” [p. 260]

9. Although control groups are used in multigroup cohort and case-control studies, outcomes from
such studies will typically be influenced by regression to the mean...The principal risk arises
when naturally occurring groups (e.g., cases and controls or exposed and unexposed cohorts) who
differ prognostically at baseline regress toward their respective posttest means by different
amounts. Typically, this prognostic dissimilarity is revealed by statistical tests showing
significant differences among groups at baseline. The use of gain or change scores (e.g., the
difference between posttest and pretest scores per subject) as the unit of analysis does not
eliminate the confounding effects of regression in multigroup cohort or case-control studies in
which groups differ at baseline...” [p. 260]

10. “The only generally satisfactory method to control for the regression effect is random assignment
to experimental and control groups, such that subjects with extreme scores (who therefore will
experience more regression) will be randomly allocated among the groups. In all types of
experimental designs, the use of a highly reliable measurement procedure can minimize the
amount of measurement error within a measurement occasion that will contribute to the
regression effect...It is important in all types of studies using subjects with extreme scores at
baseline to perform at least two baseline measures, at a minimum, within a day, and ideally across
different days...” [pp. 261-262]

Although this article appears in a journal that targets health researchers, institutional researchers should
benefit from it as well. The regression effect poses a subtle and often overlooked threat to the validity of
nonexperimental evaluation studies so this piece may help institutional researchers to avoid this pitfall.

The author, Douglas L. Weeks, works for Inland Northwest Health Services of the Washington State
University—Spokane. Interested parties can follow up by browsing his article (“The Regression Effect as
a Neglected Source of Bias in Nonrandomized Intervention Trials and Systematic Reviews of
Observational Studies”) in the peer-reviewed journal Evaluation & the Health Professions (September

[Abstract by Willard Hom, Director of Research & Planning, Chancellor’s Office, California Community Colleges, 11/26/07]

Additional abstracts of research can be viewed at our website at: