Abstract

Linear regression is a fundamental of statistical analysis typically taught in the last required statistics course for most public health and medical students. Research describes students’ attitudes toward basic regression, but there is a gap in validated tools for assessment of students’ understanding of critical topics. This study is the first external validation of the REGRESS (Research on Global Regression Expectations in Statistics) quiz outside of the creator’s, Felicity Enders, institution (Mayo Clinic). The quiz assesses students’ knowledge of simple and multiple linear regression topics. Our results support validation of REGRESS as a learning tool for students and an evaluation tool to identify topics for curricular improvement.

Implications for Teaching

Our results support the initial external validation of REGRESS as a tool for measuring students’ knowledge of linear regression. Specifically REGRESS can be used as a useful:

- Tool for course assignment.
- Diagnostic for students and instructors.
- Outcome measure for inter-institutional studies designed to assess interventions.

Future Directions

- We hope to understand if some of the differences in the Michigan and Mayo cohorts were due to teaching and course differences or to issues with the REGRESS instrument.
- Clickers were incorporated in the 2014 U-M biostatistics classroom emphasizing graphical displays. We plan to compare 2013 and 2014 scores to check for sensitivity to implementing interventions.
- We added the option for students to comment on each question in the 2014 Michigan cohort to better understand if particular REGRESS questions are confusing and why.
- Combining qualitative and quantitative results of the 2014 Michigan cohort, we will investigate whether further changes to REGRESS or the curriculum may be necessary to strengthen external validity.
- We will implement REGRESS in a larger external audience through additional CTSA and compare results.

Methods

1. Development of the REGRESS Instrument

- Developed for Clinical and Translational Science and Public Health students by Enders (2013), reviewed by 11 researchers, tested on Mayo Clinic students.
- REGRESS consists of 27 questions organized into six domains to assess understanding of simple and multiple linear regression. (See sample questions in Figure 1 below.)

Which regression model could have produced this graph?

- Age is continuous
- Marital status (married, single, or widowed)
- Ethnicity (Caucasian, African American, Hispanic, or Asian)
- Gender (male or female)

2. University of Michigan Validation

- REGRESS was implemented as part of the first regression course offered to public health students during winter semester 2013 (58 enrolled for credit).
- Students took REGRESS at the beginning and end of the term. 52 students completed the pre- and post-quiz.
  * 87% MPH or MS students, 6% MD/MPH, and 8% sought a PhD.
  * 92% reported taking at least one previous statistics course where regression was introduced.
- Post-course REGRESS scores were compared to student performance on other linear regression-related assessments
- U-M post-course REGRESS scores were compared with those of 52 students by Enders (2013), reviewed by 11 researchers, tested on Mayo Clinic students.

Results

- The REGRESS tool demonstrated a good level of internal consistency (Cronbach’s alpha=0.68) in total, but internal consistency was lacking for the domains of assumptions and interaction. Post-course REGRESS scores were significantly and positively correlated to grades on linear regression-related assignments (r=0.43, p=0.002).

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References


Enders, F. (2013). “The REGRESS (Research on Global Regression Expectations in Statistics) quiz outside of the creator’s, Felicity Enders, institution (Mayo Clinic).”


Figure 1: Sample questions from REGRESS

Figure 2: Distribution in pre-course and post-course scores

Table 1: Comparison of Mean Scores Between UM Students and Mayo Results*