10. *The "Goldilocks Problem" in Multivariate Regression*

SOLUTIONS

1. State whether a one-unit increase is a useful contrast for the specified topics and if not, give alternatives.

   a. Too low to be of substantive interest. Use increments of $1,000 instead.
   b. Reasonable.
   c. Too low to be clinically meaningful or measured precisely. Use an increment of 10 mg/dL.
   d. Too high. An increase of one unit would span the entire theoretically possible range. Use an increase of 0.05 or 0.10.
   e. Reasonable.

3. Answer the following questions based on table 10A from Laditka et al. (2005):

   a. The unit of analysis is the county, as shown in the title and row labels for the outcome and independent variables.
   b. For each of the following variables, report the requested mean value and explain how you calculated it from the information in the table. Hint: What transformation was needed to get from the scale shown in the table to the scale requested in this question? Rephrase it to show the rate or value per person.
      i. Mean primary care MDs per person = 0.000711. Divide the number shown in the table (scaled per 100,000 population) by 100,000. By taking the reciprocal of that number, we calculate that there was roughly one primary care MD for every 1,406 people in the counties studied in the year 2000—an alternative way to express the concept, e.g., in a discussion section.
      ii. Mean short-term general hospital beds per person = 0.00275. Divide the number shown in the table (scaled per 1,000 population) by 1,000. By taking the reciprocal of that number, we calculate that there was one hospital bed for every 363 people, on average, in the counties studied.
      iii. Mean Medicaid generosity in dollars = $1,310 per person under aged 65 below 200% of the poverty threshold. Multiply the number shown in the table (which is in multiples of $1,000s) by 1,000.

iv. Mean emergency room visits per person = 0.38151, which rounds to 0.38. Divide the number shown in the table (scaled per 1,000 population) by 1,000. By taking the reciprocal of that number we calculate that on average about one out of every three people visited the ER in the year 2000 in the urban counties studied.

c. Of these four continuous measures of health system capacity and use, the values per *person* range from well below zero to several thousand. For example, with means of 0.0007 and 0.002 for primary doctors per person and general hospital beds per person, respectively, a change of one unit in that original scale would be far too large, because the observed variation is detectable only in the third or fourth decimal place. When planning for health system capacity, these are the scales in which those concepts are conventionally discussed and analyzed using the scales shown in the table.

For Medicaid generosity per person with a mean value over $1,000, a $1 increase would be too small to be of interest, so it is conventionally analyzed in $1,000's or perhaps $100's. These changes were thus made to accommodate a combination of theoretical and empirical considerations and common usage.

5. Write sentences interpreting each of the following coefficients from the model for persons aged 18–39. Be sure to include direction, magnitude, statistical significance, and units for both independent and dependent variables *as specified in the model*:

   a. A one standard deviation unit increase in the number of community health centers per county was associated with a 4.4 percent higher rate of ambulatory care sensitive hospitalization (ACSH) among persons ages 18 to 39 years, but the difference was not statistically significant. (Reminder: 0.044 of a standard deviation is equal to 4.4%. Multiply the standardized coefficient by 100 to convert it from multiples of a standard deviation into percentage points.)

   b. For the same age group ASCH rates were approximately 23% lower for each one standard deviation unit increase in the number of short-stay general hospital beds per 1,000 county residents ($p < 0.001$).

   c. A one standard deviation unit increase in the number of primary care MDs per 100,000 county residents was associated with a 16% lower rate of ACSH ($p < 0.001$).

   d. Number of short-stay general hospital beds had the largest effect of those three variables, as gauged by effects of a one standard deviation unit increase in each variable on the ASCH rate in the model for 18 to 39 year olds.

7. For CHCs (community health centers), a one-unit increase is two standard deviations (1 SD = 0.50, as shown in table 10A). Multiplying the estimated standardized coefficient for CHCs by two, we have

0.044 × 2 = 0.088. Based on the results of the model, the addition of one CHC per county would be expected to be associated with nearly a 9% increase in the ACSH, although that effect is not statistically significant.

9. Write sentences to interpret each of the following coefficients from the model of waiting time to remarry. The model is specified with logged income, so the percentage change in waiting time to remarry for each one unit increase in the independent variable is calculated $(e^B - 1) \times 100$:

a. Taking into account a range of socioeconomic and demographic factors, respondents who cohabited prior to their remarriage waited on average about 24% longer to remarry than those who did not cohabit before either marriage ($p < 0.001$). Note: By expo-nentiating the intercept from table 10C, we can calculate that the mean waiting time in the reference category for the overall model was 6.3 years. Multiplying that by 24% and converting to months, we can restate the finding for cohabitation as follows: "Taking into account a range of socioeconomic and demographic factors, respondents who cohabited prior to their first marriage waited on average about 18 months longer to remarry than those who did not cohabit before either marriage."

b. For each additional year that a respondent's first marriage had lasted, waiting time to remarry was reduced by about 1.7%, or about 1.3 months ($p < 0.10$). For example, persons whose first marriage lasted for 20 years would be predicted to remarry just over a year faster than those whose first marriage lasted for 10 years, all else equal.

c. Presence of minor children at the time of the respondent's first di-vorce was associated with a 3.5% shorter waiting time to remarry, or about 2.5 months less than those without residential children at the time of divorce, but the difference was not statistically significant.