

9. Quantitative Comparisons for Multivariate Models

SOLUTIONS

1. Correct the given statements, if they are not already correct. Corrections are shown in bold.
 - a. “The odds ratio of passing the test was 0.60 for students in School A compared to School B, meaning that students in School A were **only 60% as likely to pass** as those in School B.” (Or “. . . , meaning that students in School A were 40% **less likely** to pass than those in School B.”)
 - b. Correct as written.
 - c. “Relative odds of migration for ever-married men were 0.91, reflecting **lower** chances of migration for ever-married than never-married men.”
 - d. Correct as written.
 - e. “The relative risk dropped from 2.50 to 2.00 between the unadjusted and adjusted models, corresponding to a **33%** reduction in excess risk.”

3. Answer these questions using the information in table 9A (Zimmerman 2003).
 - a. The dependent variable is cumulative GPA, a continuous variable measured in points, with a theoretical range from 0.0 to 4.0.
 - b. An OLS model is suitable because the dependent variable is continuous.
 - c. The continuous independent variables are own and roommate’s verbal and math SAT scores, each divided by 100 (see row labels) in the model specification shown in table 9A. Because SAT scores can range from 200 to 800 points, this transformation (change of scale) means that each of these variables could range from 2.0 to 8.0.
 - d. The categorical independent variables in the model are gender (ref. = male) and race (ref. = white American citizens, with five dummy variables, one for each of the other racial/citizenship groups [black, Hispanic, Native American, not a US citizen, Asian]).

5. The difference in GPA would be roughly 0.08 points if the student had a verbal SAT score of 720 instead of 680. Calculate this change by

multiplying the coefficient for own verbal SAT (0.195) by the requested difference in SAT score (40 points, divided by 100 in accordance with the model specification). $0.195 \times 0.40 = 0.078$.

7. His predicted GPA would be $2.906 = 0.780 + [(720/100) \times 0.195] + [(700/100) \times 0.092] + [(680/100) \times 0.027] + [(650/100) \times -0.016]$. No terms are needed for race or gender because they are the reference categories, which are captured in the intercept term.
9. Calculate the relative odds of first migration for the given situations using the results in table 9B (Fussell and Massey 2004).
 - a. The relative odds of migrating for an ever-married man compared to a never-married man = 0.91. (Exponentiate the coefficient on ever-married; $\exp[-0.09] = 0.91$.)
 - b. The relative odds of migrating for a 30-year-old man compared to a 20-year-old man = 0.59. Use the following expression, which plugs a ten-year age difference into the linear and square terms on age: $\exp[(30 \times [-.003]) + (30^2 \times [-0.001])]/\exp[(20 \times [-.003]) + (20^2 \times [-0.001])] = 0.59$.
 - c. The relative odds of migrating for a man with a parent who is a prior US migrant compared to a man without parents who migrated there = 1.67. (Exponentiate the coefficient on “parent is a prior US migrant”; $\exp[0.51] = 1.67$.)
 - d. The relative odds of migrating man from a community with a migration prevalence ratio (MPR) of 0–4 compared to a man from a community with an MPR of 10–14 = 0.37. (Exponentiate the coefficient on MPR = 0–4; MPR = 10–14 is the reference category; $\exp[-0.99] = 0.37$.)
 - e. The relative odds of migrating for a man from a community with a migration prevalence ratio (MPR) of 0–4 compared to one from a community with an MPR of 60 or more = 0.26. (Divide the relative odds for an MPR of 0–4 by the relative odds for an MPR of 60+ to “cancel” the 10–14 MPR reference group; $0.37/1.40 = 0.26$.)
11. The odds of first migration for a 20-year-old never-married man with no children, eight years of education, 24 months of labor force participation, neither parents nor siblings who are prior migrants, from a community with an MPR of 10–14 are calculated $\exp[-3.31 + (20 \times [-0.003]) + (20^2 \times [-0.0001]) + (8 \times [-0.04]) + (24 \times [-0.002])] = 0.016$ or 1.6%. No terms are needed for MPR, marital status, children, or parent or sibling migrants, as those values are all in the reference category.
13. Calculate the odds ratio and relative risk with the following information.
 - a. Assuming an odds ratio of 3.0 and a prevalence of the outcome (hospital admission) among the unexposed (nondiabetics)

of 0.20, the corresponding relative risk of hospital admission for diabetics = $3.0 / [(1.0 - .20) + (3.0 \times .20)] = 3.0 / [0.8 + 0.6] = 3.0 / 1.4 = 2.14$

- b. With an estimated odds ratio of 3.0 and a corresponding relative risk of 2.14, the percentage difference is calculated $[3.00 - 2.14] / 2.14 \times 100 = 40\%$. In other words, the estimated odds ratio overstates the relative risk by 40%.
- c. "Diabetics are more than twice as likely as nondiabetics to be admitted to the hospital."