MINDING YOUR P’S AND Q’S

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The two mortality studies reported in this issue are interesting contrasts. One (single-lung transplants) reports a small experience (16 subjects, 6 deaths, < 1 expected death), but represents the earliest long-term FU on a new procedure. The other (ethylene oxide exposure) is quite large (18,254 subjects, 1177 deaths, > 1000 expected deaths) and has an unusually long average duration of FU (16.1 years). Both are noteworthy in terms of the size of the experience relative to existing mortality sources (Ref. 4, pp. 25-27), or having to estimate progression of q’ for successive durations (Ref. 1, pp. 25-26).

Dr. Singer chose to use as the basis of expected mortality the age- and sex-specific mortality rates of the 1975-79 Group Life Insurance Tables. (Tables such as these are available to medical directors, for producing mortality abstracts or developing comparative mortality skills, from their corporate actuaries or by contacting Dr. Singer.) In his unpublished worksheets, Dr. Singer constructed a table in which he took the mortality rate applicable for each individual (for their age and sex) and averaged it with the others to obtain the mortality rate “expected” for that interval. He repeated the process for each successive interval, after aging the new list of contributing survivors by one year. The q’ for durations 1-6, reported in Table 1A of his abstract, is the grand average of the tabular q’s from his worksheet.

The transplant study was conducted over the time period 1983-90. Dr. Singer chose Group Life tables as his basis for expected mortality, reasoning that the degree of selection used in qualifying transplant recipients made them more select than a general population. Had he chosen to use a general population (say, U.S. population, e.g., the 1979-81 U.S. Decennial Table), what difference would it have made? The “expected” q’s would have been about 40-45% larger. The MR’s would have been 2700% and 625% instead of 5700% and 735%, and the EDR’s would have been 269 and 45 instead of 287 and 42. The Group Life expected rates—for persons of these ages and this male-female proportion—are about 70% of that expected for comparable U.S. population mortality.

Neither 1975-79 nor 1979-81 coincides with 1983-90. Is this a concern? The 1975-79 Group Life tables are the group tables nearest in time to the study period, and, therefore, represent the best available group tables to use. They were not adjusted for any secular trend in group life mortality because they were relatively close in time to the study period. Likewise, the 1979-81 U.S. tables are the nearest complete life tables for U.S. population, and are acceptably close in time.

Suppose other comparisons were desired—say, for example, comparing the transplant group’s mortality to that of a medically treated group. “Expected” mortality for medically treated lung-diseased controls could be sought (e.g., Ref. 5, chap. 8; Ref. 6, chap. 12, and elsewhere), and comparison made to a group with similar disease, comparable severity, etc. (See Table 1 for a partial list of possible mortality comparisons for which one might be interested in using the data.)

Dr. Singer did make a comparison of the single-lung transplant group to a kidney-transplant group, and describes some of the ways in which this newer procedure compares with a more established one.
Some other “program notes” are worth mentioning. Look again at his Table 1A. He describes adjusting exposure (E) for acute perioperative mortality. How was this done? He assumed a perioperative period of three weeks and multiplied the full-year exposure (number exposed to risk of dying = $I_0 - (w/2) = 14.5$) by 49/52 of a year.

Now look at the column of expected mean annual mortality rates/1000. ($q'$). Notice that the mean $q'$ for year-one is 5.1. If one did not already know the answer from familiarity with Group Life tables, or from reading the accompanying text, what mean age would one infer for the study group? For insured-lives, one might use 5-year-average select rates (e.g., 1979-81) and guess 45 (e.g., male) or 50 (i.e., mixed male and female population). As it turns out, the actual mean age is 47.6, and the rate of 5.1 corresponds to the expected Group Life mean-average mortality rate for a group of 16 people of given ages and sex.

Look again at the rates in the $q'$ column. Notice how, instead of steadily increasing over successive durations, the rate jumps to 7.1 in interval 2-3 and then falls back to 6.6 in the next interval. Is there some mistake here? No, this result is a consequence of the given ages and sex.

This is because aging, older survivors are contributing more heavily to mean $q'$, and fewer females are contributing their lesser mortality risk to the average. That is also why the mean age for intervals 1-2 and 4-5 are the same (51), but the associated $q'$ is not the same.

### REFERENCES