The statistical reanalysis and synthesis of data from multiple studies is known as meta-analysis. Procedures for implementing meta-analysis were first introduced in the 1930s and were extensively applied in the social sciences. The application of meta-analysis to biomedical research is considered more recent, the first examples dating from the late 1970s and early 1980s (1). However, an early application of meta-analysis can be found in an article by Joseph Goldberger (2) that was published in 1907 in Bulletin No. 35 of the Hygienic Laboratory (predecessor of the National Institutes of Health). In that review article, Goldberger addressed the frequency of urinary infection in cases of typhoid fever.

Goldberger noted the extreme heterogeneity of published data on typhoid bacteriuria. In reports of 44 studies published between 1881 and 1907, numbers of cases varied from 1 to 546, and the rate of infection varied from zero to 100 percent. This was demonstrated in the only table included in the article. In order to derive an overall estimate of the frequency of bacteriuria, Goldberger selected data from 26 of the studies, pooled the findings, and calculated a mean of 16 percent. The basis for selection was use of a "serum agglutination test" to definitively establish the diagnosis of typhoid fever.

Four criteria characterize a meta-analysis (1). First, a review of the literature identifies pertinent studies. Goldberger identified 44 studies and provided comprehensive references in a bibliography. Second, specific criteria are used to select studies for analysis. Goldberger used a newly developed serum agglutination test to separate reliable studies from those he considered unreliable. Third, data from the selected studies are abstracted. Goldberger tabulated the raw data from 26 selected studies. Fourth, statistical analysis of the abstracted data is implemented. Goldberger calculated the mean rate of bacteriuria from the pooled data. Thus, it may be concluded that Goldberger’s investigation of typhoid bacteriuria in 1907 anticipated the modern technique of meta-analysis and may represent its first comprehensive implementation.

Modern epidemiologists recognize, revere, and study Joseph Goldberger because of his pioneering studies of pellagra. This brief review (2), written early in his career at the Hygienic Laboratory, foreshadows the analytic brilliance of the young epidemiologist.

REFERENCES