6. AGE-PERIOD-COHORT ANALYSIS AND THE STUDY OF DEATHS FROM PULMONARY TUBERCULOSIS*

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Our purpose is both substantive and methodological. Substantively, we crystallize the results of prior research and expectations into an extended rationale for the application of the age-period-cohort accounting framework to the problem of understanding historical variability in the rate of tuberculosis mortality. This framework is then used to analyze a ninety year data series of tuberculosis mortality rates for the state of Massachusetts and a similar forty year series for the United States. The age-period-cohort accounting framework yields age effects with an expected pattern not well understood, period effects consistent with the advent of successful chemotherapeutic regimes after World War II, and steadily declining cohort effects whose interpretation has yet to be verified. In an attempt to pin down a possible interpretation, we show that cohort nativity composition affects the trend of cohort mortality in the Massachusetts series, and both level and trend in the United States series. Our findings consolidate the results and anticipations of past research on TB mortality based in part on two-effect models and graphic display of rates, and to some extent clarify various proposed interpretations of the historical trend; they leave open the ultimate

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question of why tuberculosis mortality declined in the industrializing countries. Methodologically, we show that the age-period-cohort accounting framework is helpful in organizing otherwise disparate theoretical and empirical material. Its usefulness appears to depend, however, on strong priors about the patterns in the coefficients as well as specific historical knowledge. Data analysis with unarticulated expectations and meager knowledge may be a recipe for error. A conventional exploratory stance, which works well for models of the additive analysis of variance type, is less suited to the age-period-cohort context, because of the need for identifying restrictions engendered by the inherent interaction among the three accounting categories.

1. INTRODUCTION

In the United States, United Kingdom, Australia and Scandinavia tuberculosis (TB) is no longer a leading cause of death. For these countries TB death rates have fallen steadily since the beginning of the twentieth century and, where records for earlier times exist, it is known that TB death rates have fallen steadily since at least the mid-nineteenth century.¹ This decline in TB mortality predates effective medical treatment of the disease in any of its manifestations, and even the acceptance of the germ theory of disease (Dubos and Dubos, 1952).

The demonstration in 1940 that the application of sulfonamides to guinea-pigs arrested the progress of tuberculosis led within a few years to the modern era of effective treatment of the disease (Toman, 1979). It is thought by some (Comstock, 1975) that prior to the existence of modern medication, physical segregation of active cases of tuberculosis from the rest of the population was helpful in the aggregate—if not to the individuals affected. As for the factors initiating and sustaining the secular decline prior to effective public health measures, few explanations

¹ We believe this characterization to hold for the industrialized countries more generally, but our sampling of the literature has been limited to English language articles concerning data obtained from a relatively limited number of countries. It is clear that there is currently a negative association cross-nationally between tuberculosis mortality or morbidity and level of economic development (Lowell, 1976).