USES OF STOCHASTIC MODELS IN THE EVALUATION OF POPULATION POLICIES. I. THEORY AND APPROACHES TO DATA ANALYSIS

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1. Introduction

During the past few decades, a number of workers have considered mathematical formulations for the reproductive performance of a group of women, or for some aspect of this performance (see [1] to [20] and reviews in [21], [22], [23]). These formulations have been intended to help in the appraisal of observed data, to yield estimators of some of the biological determinants of reproduction, or to predict effects of defined contraceptive practices, sterilization programs, and so forth. To date, explicit analytic results have been obtained only with considerable simplification of the underlying concepts, different workers resorting to different kinds of simplification. Alternatively, for greater realism, computer models are being developed, as discussed in the paper by E. B. Perrin in these *Proceedings* [56].

Sections 2 to 4 of this present paper will summarize work, done in collaboration with E. B. Perrin, on a class of mathematical models based on a relatively simple scheme for the process of human reproduction [9], [12] and will illustrate applications pertinent to efforts to reduce birth rates. Section 5 will illustrate issues arising in efforts to apply the results to empirical data, by using data from a simpler organism, the laboratory mouse, obtained in collaboration with D. P. Doolittle and M. New. Section 6 will present data on conception delays of a group of women, and an extension of a model previously presented for this phenomenon in a heterogeneous population [14].

Among the implications of such work, the greatest current interest probably lies in potential contributions to the evaluation of efforts to reduce birth rates—