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Working with positive real-numbers brings several advantages: If the estimator of a single parameter has a positive variance, then the variance and the Fisher information are both positive real numbers; hence they are members of the convex cone of nonnegative real numbers whose nonzero members have reciprocals in this same cone. This cone is closed under matrix-matrix addition, under matrix-inversion, and under the multiplication of positive real-numbers and matrices. An exposition of matrix theory and the Loewner-order appears in Pukelsheim. See an on-line textbook for practitioners, which has many illustrations and statistical applications: Retrieved October 15, Model - robust designs including "Bayesian" designs are surveyed by Chang and Notz. Designs, Models, and the Analysis of Mixture Data third ed. More detailed expositions occur in the advanced textbook of Pukelsheim and the papers of Kiefer. More advanced discussions occur in the monograph by Fedorov and Hackl, and the articles by Chaloner and Verdinelli and by DasGupta. Bayesian designs and other aspects of "model-robust" designs are discussed by Chang and Notz. The Annals of Mathematical Statistics. Wynn wrote, "the modern theory of optimum design has its roots in the decision theory school of U. Springer-Verlag and the Institute of Mathematical Statistics. Planning, Analysis, and Parameter Design Optimization. Optimal designs for "follow-up" experiments are discussed by Wu and Hamada. Experiment Design and Data Analysis. Identification of Parametric Models from Experimental Data. Mathematically, such results are associated with Chebyshev polynomials , "Markov systems", and "moment spaces": See Karlin, Samuel and Shapley, Lloyd With applications in analysis and statistics. The Theory of canonical moments with applications in statistics, probability, and analysis. Reprinted in Collected Papers v. Optimum experimental designs, with SAS. Sequential analysis and optimal design. Society for Industrial and Applied Mathematics. Theory of Optimal Experiments. Model-Oriented Design of Experiments. Lecture Notes in Statistics. Brown ; Olkin, Ingram ; Sacks, Jerome ; et al. Optimal design of experiments. Classics in Applied Mathematics. Theory of Optimal Designs. Textbooks for practitioners and students[edit] Textbooks emphasizing regression and response-surface methodology[edit] Atkinson, A. Textbooks emphasizing block designs[edit] Optimal block designs are discussed by Bailey and by Bapat.

Chapter 2 : Preferences, Uncertainty, And Optimality : Daniel McFadden :

This book deals with different modern topics in probability, statistics and operations research. It has been written lucidly in a novel way. Wherever necessary, the theory is explained in great detail, with suitable illustrations.

Using a landmark article published in by Nobel Prize winning economist Kenneth J. Arrow as a launching point, the analysis of medical economics is presented from the perspective of medical care in a competitive market. The essay concludes with a brief look at work in the area of market forces in the medical care market and a consideration of the role of the Internet in providing information on quality and price to medical providers and consumers. The Economics of Medical Care Overview Is the medical care market a "competitive" market as defined by the discipline of economics? Can the general norms and theories of economics be applied to medical care? These are the questions that are discussed in this article. First, it is important to note that the language used here is "medical" economics and not "health" economics. Medical economics refers to the study of the medical industry as represented by goods and services produced and provided by physicians, ancillary providers, clinics, and hospitals. Health economics implies a state of being that includes factors such as diet, exercise, and individual risk behaviors such as smoking, drinking, non-seat belt use, etc. The exploration of health economics is not considered in the scope of this article and best left for a separate discussion. First, to put his article in context, Arrow was writing before the era of health maintenance organizations HMOs , managed care, and many of the major technological advances in medicine that are commonplace today. These would include advanced imaging such as magnetic resonance imaging MRI , and major new classes of drugs used in infection control, cancer treatment, mental health, and other conditions. The concept of moral hazard is defined as the effect of insurance on the behavior of the insured Nicholson, In general, the availability of insurance creates the potential for increased demand. This is clearly seen in the medical care market where the spread of insurance, in particular Medicaid and Medicare, has created an increased demand for medical services Millenson, ; Arrow, Arrow and others argue that medical care markets fail to address increased demand through increased prices because medical care is a non-competitive market. Pareto Optimality The concept of Pareto optimality, as first described by Vilfredo Pareto in , states that competitive equilibrium exists in a market when an allocation of resources is such that giving one additional allocation to one person results in making another person worse off. Stated another way, a condition of Pareto optimality resource allocation is such that all participants in a market are in equilibrium and a change to make one better off makes another one worse off. Pareto optimality can be further understood by examining the First and Second Theorems of Optimality. There is no other allocation of resources to services which will make all participants in the market better off" Arrow, , p. Reinhardt further states that the assumptions underlying the First Theorem are: Both buyers and sellers understand fully the good and services available in the market Both buyers and sellers are price takers because neither has influence over prices in the market All relevant prices are known to all participants before a purchase transaction takes place. To apply this theorem to the reality of the medical care market one assumes that an equal distribution of purchasing power exists to insure a state of equilibrium. In its most practical sense, an equal distribution of purchasing powers is achieved through taxes and subsidies. Thus, the question of how the purchasing power gets re-distributed becomes a question of politics and social justice and not necessarily economics. If you argue that the medical market operates in such a manner as to efficiently meet the needs of both patients and providers, e. The significance of the Arrow article is that he was the first to systematically apply the standard norms and assumptions of economics to the medical market especially with respect to competitive equilibrium and Pareto optimality. His work opened the door for subsequent important research and theoretical discourse that continues in the literature to this day. Asymmetrical Information Arrow and subsequent researchers theorize that it is the asymmetry of information between patients and providers, mainly physicians that cause the medical market to be characterized as a noncompetitive equilibrium. Researchers, economic and non-economic alike, contend that medical economics are "different" because of the role of information Robinson, Asymmetrical information means that the distribution of information between buyers or sellers is

skewed, i. In the case of the medical market, the distribution of information is not equal. The health care delivery system is built on the assumption that doctors are more knowledgeable about medical diagnosis and treatments than their patients. Because of that knowledge, as a society we give doctors the medical, legal, and political authority to not only provide medical care but also to set policy and determine the pricing structure of medical care. Uncertainty in Medical Care This imbalance, or asymmetry, of information is manifest along several dimensions. First is the role of uncertainty in medical care. According to Arrow, uncertainty occurs in two ways. When a patient sees a doctor he is uncertain about the consequences of his decision to purchase treatment in the first place and uncertain about the effectiveness of that treatment in the second place. At the time that Arrow was writing, there was almost no way for a patient to obtain information about his own condition prior to seeing the doctor, no way to determine which doctor was best suited to treating the condition, and no way to evaluate treatment options or outcomes of the treatment Haas-Wilson, The internet has provided an avenue for patients to gain a great deal more information about diagnosis and treatment options but by and large, physicians still hold a monopoly on medical information. This information monopoly on the part of physicians is an outcome of the growth and development of medicine as a profession. As scientific treatments evolved and medical education became more sophisticated, physicians sought to withhold this specialized knowledge from anyone other than a trained physician. This was accomplished by strict licensure requirements and by increasing levels of The entire section is 4, words. Unlock This Study Guide Now Start your hour free trial to unlock this page Economics of Medical Care study guide and get instant access to the following:

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