Demography and Disease


THE SPREAD OF AIDS ACROSS THE MIDDLE of Africa in recent decades has obliged the United Nations Population Division to revise downward its projections of African population growth. The reduction in deaths from malaria and other insect-borne diseases after World War II forced earlier demographers to revise upward their projections of population growth in developing countries. Few demographers and epidemiologists today doubt the intimate interaction between human demography and infectious diseases. The demographic roles of famine, undernutrition, malnutrition, temperature, and rainfall are much more controversial.

Until recently, few analytical tools have been available to treat infectious diseases, food scarcity, environmental factors, and population growth in combination. Classical epidemic models often assume a population of constant size. Classical demographic models take no explicit account of the effects of infectious diseases or nutritional status on mortality, fertility, or migration. Epidemic and demographic models conventionally ignore environmental factors altogether.

In Human Demography and Disease, Susan Scott and Christopher J. Duncan weave together four strands that now make possible a more integrated understanding of human population dynamics, nutrition, climatic variables, and infectious diseases. These four strands are: the cohort-component (or Leslie matrix) method of population projection; the SEIR (susceptible-exposed-infectious-recovered) model for human infectious diseases; time series analysis (including Fourier analysis, multiple regression, filtering, and cross-correlation); and abundant data on births, deaths (sometimes by age group and by specific cause), commodity prices (food grains and wool), temperature, and precipitation. The hidden hero of the story is the software called MATLAB, which offers convenient facilities for time-series analysis and exploration of dynamic models.

Although the data are restricted to Britain from the middle of the 16th century to the end of the 19th century, and although the only identified causes of death are infectious diseases, the ideas and methods promise to be widely applicable to other historical populations and to other causes of death. Scott and Duncan’s results give insight into the interactions of nutrition, infectious disease, climatic factors, and demography among the undernourished poor in some developing countries today.

The first half of the book focuses on Penrith, a village of around 1200 people in Cumbria, northwestern England, who lived at the edge of survival from 1550 to 1750. Scott and Duncan have developed an age-structured demographic model to distinguish the cycles in births and deaths that were endogenous (resulting from internal demographic dynamics) from cycles that were exogenous (resulting from fluctuations in weather and the prices of wheat and wool). They show how Fourier analysis of demographic time series leads to inferences about the microstructure of fertility, nuptiality, and mortality. They have verified these inferences by laborious family reconstitution from parish records. Turning to exogenously driven cycles, they find that high wheat prices drove up death rates and lowered birth rates. High wheat prices in combination with low prices for wool caused catastrophic crises in mortality because the sheep holders had inadequate income to buy even minimal food.

The second half of the book deals with infectious diseases in England and Wales from the 16th through the 19th century. Scott and Duncan first use a simple mathematical model to illuminate smallpox mortality in London. This mathematical model would display damped oscillations if infection were introduced into a susceptible population; epidemic waves should gradually decay to a steady level of endemic infection. It is then necessary to explain why major smallpox epidemics persisted in London from 1659 to 1800, albeit with gradually decreasing interepidemic intervals (four or three years between epidemics in the 17th century, two years between epidemics in the late 18th century). According to Scott and Duncan, these continuing epidemics were driven by a periodic variation in susceptibility to smallpox. Susceptibility was driven by climatic variables, notably low temperatures in winter and low autumn rainfall. The gradual decrease in the interepidemic interval could be explained by the long-term growth in the population size and density of London up to 1750, and by increasing malnutrition (resulting from high food prices) from 1750 to 1800.

Scott and Duncan compare smallpox with measles and whooping cough. All three diseases became lethal in London in the second half of the 17th century or slightly later. Smallpox mortality was at least four times that of whooping cough and measles. The endemic level of all three diseases rose during the 18th century. A sharp rise in the endemic level after 1750 was associated with a concurrent rise in wheat prices. Continuing epidemics were driven at the resonant frequency of the epidemic models by oscillations in susceptibility. Between 1750 and 1812, epidemics of whooping cough synchronized with epidemics of smallpox because both were driven by similar conditions.
fluctuations in rainfall, but epidemics of smallpox alternated with epidemics of measles. Thus the patterns of these infectious diseases (their endemic levels, susceptibility, and frequency of epidemic outbreaks) were driven by demographic change, economic conditions (food prices), and environmental variables.

“a new kind of telescope for looking into the past, and perhaps understanding the future”

Causation also ran in the reverse direction from the infectious diseases to demography. Smallpox contributed substantially to mortality in London in the 18th century, driving population oscillations and slowing population growth. As the growth in population shortened the interval between epidemic outbreaks, there was a mutual feedback between infectious disease outbreaks and population growth. Without explicit mathematical models and careful quantitative analysis of historical time series, Scott and Duncan could not have measured the components of this feedback process.

Scott and Duncan identify three effects of levels of nutrition on the dynamics and lethality of infectious diseases. First, malnutrition increased susceptibility to infection at that time, holding all other conditions constant. Second, short wavelength fluctuations in nutrition driven by wheat prices generate oscillations in susceptibility that drive epidemics. Third, children who are malnourished during pregnancy, lactation, or at weaning are more susceptible to infection even if later their food supplies appear to be adequate; the proof that this effect exists is the cross-correlation of epidemics with short-wavelength oscillations in wheat prices at a lag of two to three years. The enhanced susceptibility to infection of children who suffered perinatal malnutrition makes an extra contribution to the cyclical mortality of epidemics.

Scott and Duncan have invented a new kind of telescope for looking into the past, and perhaps understanding the future. The eyepiece of the telescope is modeling. The objective lens is data analysis. To the best of my knowledge, much of what they see with this telescope has not been seen before, with this clarity or at all. There may well be justice to their claim, “We believe that this is the first fully integrated, quantitative study of population dynamics in a human community.”

This excellent and important book could have been even stronger if a few changes had been made in the presentation. Most of the book seems to be based on material previously published in research papers, and there is considerable unnecessary repetition. One example is that the claim I just quoted from page 114 is repeated almost verbatim on page 142. Second, attention to statistical significance occasionally dominates attention to scientific significance. Some tables give only P values without the coefficients, which are the real subject of interest. Third, it is not clear to me whether the authors think that the excess mortality caused by infectious diseases is, or is not, an important factor in the ability of the epidemic models to describe observations. At one point (page 175), the authors assure us that including the mortality resulting from a disease does “not substantially alter the results,” but later (page 257) they write, “...we see that a change in the fraction of infectious dying from the disease profoundly alters the characteristics of the epidemics.” When does the excess mortality of infectious matter? Fourth, the book would be much more useful to other researchers if the data on which it is based were listed in annexed tables, available on diskette, or deposited in a public data archive. The authors have put tremendous effort into assembling the data analyzed here. The recognition due them would only be enhanced if they made their data easily available. Fifth, there are mistakes among the mathematical equations (12.4 to 12.16). Check the calculations yourself, if you plan to use this mathematical model.

In their introduction, Scott and Duncan express the hope that their book will interest readers from the fields of theoretical population biology; demographic, economic, social, medical, agricultural, and geographic history; behavior; and epidemiology. Because the book spans all these fields, it will be challenging but worthwhile reading for specialists in each of them. I commend it especially to graduate students who want an inspiring example of the use of fresh methods to stimulate fresh thoughts.

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Fiction


Bellevue is an entertaining novel. It is neither social criticism nor grand scale fiction of the Lloyd Douglas or A. J. Cronin ilk, but it falls closer to Richard Gordon’s Doctor in the House series.

The protagonist is an intern at Bellevue, and the story follows his adjustment—or maladjustment—through that first postgraduate year. His problems are interpersonal and not particularly with medicine.

The dust jacket blurb characterizes this as a “Medico-Gothic” novel, and for the nonphysician that is apt. Big city hospitals tend to labyrinthine corridors and murkiness. Siegel has populated those corridors with equally dark figures. Bellevue is a short novel about a long year, and the nonphysician public accustomed to medical teledrama along the lines of St. Elsewhere and ER may find Bellevue a bit thin in action and detail. But the black humor of the human relationships makes up for this lack, and there are several other ways to view the novel.

For those of us who can still remember our own internships and for physicians in teaching programs and in regular contact with PGY-1s, the char-
characters of Bellevue will seem realistic or at least a blend of familiar types. They include the chief of service, ward attending, chief resident, fellow residents and interns, and a medical student from hell. Occasionally while attending on a teaching service, I get the feeling that I have been trapped in a sitcom, as truths stranger than fiction unfold daily. Siegel has captured that feeling, and physicians should be entertained.

I suspect that if you trained at Bellevue, there might be another story hidden in these pages. Big, old city hospitals develop their own intrinsic culture and folklore, and one wonders about the reality behind the characters and setting.

The prose shows influences of film noir: "The day was hot; the sky and the river were both bluer than a chronic lunger's face." I found this style added to the enjoyment. Bellevue is not Cronin's The Citadel or a Perri Klass novel, but it was fun to read.

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Allergy

One cannot overstate the achievement of Drs Middleton, Reed, and Ellis in producing this update of their famous text Allergy: Principles and Practice. The continued requirement of the medical community for this textbook is not just for its encyclopedic compendium of allergic diseases, but also for its practical applications to ordinary allergy practice problems.

Now in the fifth edition, three more editors, Adkinson, Yunginger, and Busse, have been enlisted. Since the original publication in 1973, this text has continued to address the clinical manifestations of allergic diseases, including detailed descriptions of immunopathogenesis as currently understood and proper management of disorders due to altered immunologic response. The increased appreciation of the pathogenetic mechanisms involved in allergic diseases and newer approaches to their management have required significant revision in the fifth edition by the 150 authors, nearly one third of whom are new.

The organization is practical, consisting of two volumes with five sections. Section A, "Immunology," has 28 chapters, which review molecular biology of allergy, receptor structure, and signal transduction; included are genetics of allergy, complement systems, cellular adhesion, cytokine network, mast cell physiology, and pathophysiology of the allergic inflammatory response. The chapter "Control of IgE Synthesis" is superb. This lucid review of the molecular events in the induction of IgE synthesis presents locations for intervention that might provide future therapeutic strategies for control of allergic diseases.

Section B, "Allergens and Diagnosis of Allergy," consists of six chapters devoted to allergen structure, allergy diagnosis, and biology, including identification of allergens and various methods for in vivo assessment of allergic rhinitis and bronchial challenge. Section C, "Physiology," has seven chapters relating to physiology of the skin, lung, and airway smooth muscle. Section D, "Pharmacology," develops the structure and function of adrenergic agents, phosphodiesterase inhibitors, antihistamines, corticosteroids, mast cell stabilizers, anticholinergic agents, and leukotriene modifiers. Section E, "Clinical Science," has 88 chapters, including 10 devoted to asthma, which are outstanding. The chapters related to asthma epidemiology, natural history, and pathogenesis are particularly worth noting. "Mastocytosis Syndromes" is an excellent clinical review complemented by ample figures classifying mastocytosis in relation to clinical manifestations and pathogenesis.

The text flows easily and cogently with well integrated chapters. Each section is amply illustrated with easily understood professional diagrams, algorithms for diagnosis and management triage, clinical summaries, and photomicrographs. The appendices and the volumes' inside covers contain a glossary listing cytokine sources, stimuli, targets, and effects. Additional tables provide similar data concerning chemokines, adhesion molecules, and leukocyte cell surface proteins. Subheadings facilitate reading and recall, and extensive bibliographies reference the text in each chapter. Eighteen new chapters concern genetics, cell adhesion, cytokine generation, allergic inflammation, and the biology of endothelial cells. Websites are listed for professional organizations, relevant government agencies, and scientific resources such as the database for the Sixth Human Leukocyte Differentiation Antigen (HLDA) Workshop.

For the next edition several revisions may be appropriate. Expand and clarify the molecular biology section. Enlarge the drug allergy section to provide practical approaches to drug desensitization. Maintain anaphylaxis as the syndrome regardless of etiology. Add a chapter on lineage development of basophils, mast cells, and eosinophils. Consider classifying the excellent primary immunodeficiency chapter in relation to T-cell/B-cell/combined complement deficiency. Consider adding chapters related to autoimmunity.

The fifth edition of Allergy: Principles and Practice is excellent. It is required reading for anyone training or practicing as an allergy-immunology subspecialist. It provides practical information for the dermatologist, pediatrician, pulmonologist, internist, gynecologist, and any other primary care physician encountering medical disorders of allergic-immunologic origin.

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Pediatric Pearls


This is a delightful book of 600 pearls gleaned during 43 years of practice by William Wadlington, MD, clinical professor of pediatrics at Vanderbilt University School of Medicine, Nashville, Tenn. Clifton Meador, MD, clinical professor of medicine at Vanderbilt and author of The Little Book of Doctors’ Rules is editor. The two are friends and colleagues, dating back to their early days at Vanderbilt, when Meador was a junior medical student and Wadlington senior resident in pediatrics.

The pearls are pithy statements, almost proverbs, succinct and full of wisdom. Wadlington relates that they were learned from years of experience working with children, parents, and families, by direct observation and by listening to other physicians who also have been keen observers. He makes no claim that the pearls are his alone, and many have been absorbed from the published literature. The uniqueness of the book is in the selection and in Wadlington’s ability to organize, summarize, and transform teaching material into proverbial formats and mnemonics.

Wadlington has a holistic philosophy concerning the health of infants, children, and adolescents, which has emotional, mental, and spiritual, as well as physical, components. Disease may be associated not only with transmission of dysfunctional genes or organ dysfunction acquired through various pathological mechanisms but also with exposure to adverse environmental factors. These include poor parenting, extreme poverty, excessive television viewing, and exposure to violence. Early smoking leads in turn to a variety of problems, including abuse of other drugs. Inadequate diet and exercise lead to obesity, which results in physical and psychosocial adjustment problems.

The book is ideally for the younger or less experienced pediatrician or other healthcare professional who treats children. The details become relevant to the reader as the various problems and scenarios are experienced on a regular basis in the context of a pediatric practice. All the pearls are valuable for the pediatrician and in general may be categorized in several areas.

One area is how to get along with and best to relate to infants, children, adolescents, parents, resident physicians, partners in practice, office staff, nurses, other physicians in the community, pharmaceutical representatives, hospitalized patients, managed care organizations, and pharmacists. There is also advice on medical records and lawsuits, medical schools and the need for curriculum changes, telephone use in the office and after hours, and dealing with noncompliant families. In the realm of skills, personal problem solving, self exploration, and improvement, the author suggests that the pediatrician develop some subspecialty area of interest to keep up with preferentially, which will make office practice more interesting.

Sources of medical tips for the health professional are mentioned, including Pediatric Notes (monthly), Year Book of Pediatrics, and monthly tapes from the Audio-Digest Foundation. Sources are given for parents for help with behavior problems, child advocacy, parenting skills, and discipline; these include books, hotlines, and web sites. Other pearls cover the diagnosis and differential diagnosis of most common problems and a large number of less common problems that eventually are seen in most every practice.

There are no page numbers, but the 600 pearls are numbered and are listed on approximately 200 pages in a conveniently small book. An excellent 26-page index features on average three pearls per topic, from “abdomen, abscess of” to “zidovudine, perinatal, use of.” To give an idea of the detail, nine different pearls are indexed under the topic of abdominal pain: abscess, ultrasound evaluation of the acute surgical abdomen, black-widow spider bite-related, chronic, colicky, idiopathic hypercalcuiar-related, Crohn disease-related, hematocolpos-related, and “navel pointing in.” A fun exercise is to read the 600 pearls, then look up a topic in the index and try to recall the complete pearl—the pearls are much more inclusive than the index entries. The reader can learn much by performing this exercise, which can be completed in only a few hours, and the breadth and depth of the pearls will shine through. Dr Wadlington has a special interest in working with adolescents to improve lifestyles and in education in areas of drug, alcohol, and tobacco abuse, violence and gun-related deaths, and control of obesity. Under the topic of adolescents are about 30 indexed pearls, such as the excellent PACES for Teenagers mnemonic teaching tool (pot, alcohol, cigarettes, education and future goals, and sex).

Smoking has about 15 separate pearls, with some surprising associations. For example, there is an increased risk of attention deficit hyperactivity disorder (ADHD) among mothers who smoke during pregnancy, and there are more smokers among adolescents with ADHD than among those without ADHD. Useful information on other subjects is imparted. The top nutritional problems among children in the United States is obesity and not starvation. Eighty percent of children born to two obese parents will become obese compared with 14% of children born to normal-weight parents. Studies comparing weights of adoptees with weights of biological and adoptive parents indicate that genetic factors are responsible for only 33% of the variance in weight. By the time today’s child reaches age 70 years, he or she will have spent 7 years watching TV. By age two years, US kids spend an average of 27 hours per week in front of the television. The television is used too much as a baby-sitter. The American Academy of Pediatrics advises parents to limit television time to one to two hours per day (with care of what is watched).

I have been in the field of pediatrics for 33 years, and I agree with at least 95 percent of Pearls From a Pediatric Practice.
Practice I. It would be useful as a gift to all residents as they graduate from pediatric programs and of great benefit to pediatric nurse practitioners. Most pediatricians and family physicians who care for a significant number of children need to read it.

There are two ways to acquire the wisdom in this small book. The usual way is to assimilate it firsthand over a lifetime of practice. A much more reasonable way is to buy the book, meditate over the proverbs, and become wise ahead of your peers.

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RECEIVED

Alcohol and Drug Dependence


Cancer


Dermatology


Education


Genetics


Geriatrics


Health Systems


Immunology


Medicine


New Medicine


Ophthalmology


Pathology


Primary Care


Surgery


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