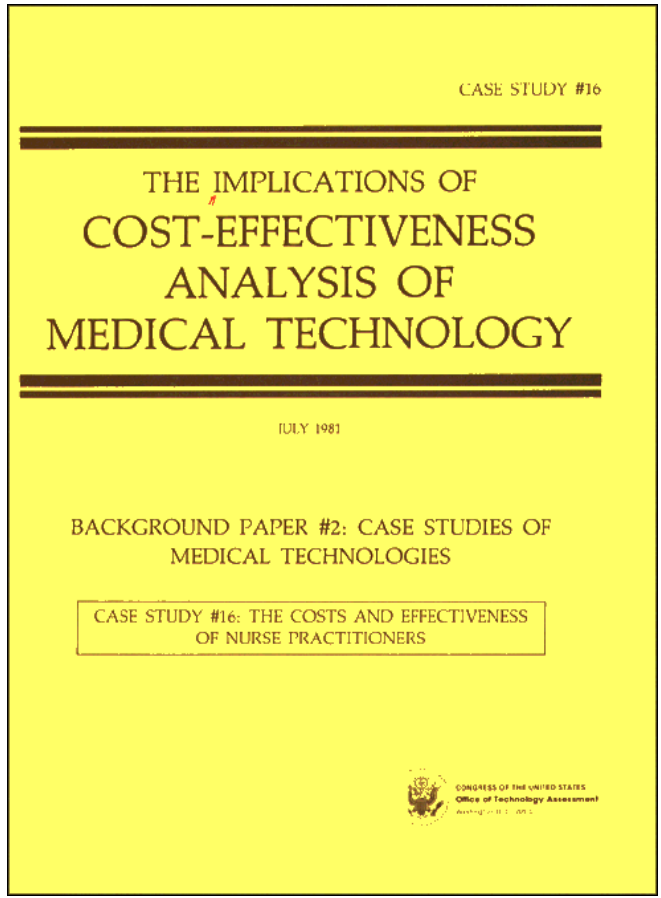
The Costs and Effectiveness of Nurse Practitioners

July 1981

NTIS order #PB82-101326





THE IMPLICATIONS OF COST-EFFECTIVENESS ANALYSIS OF MEDICAL TECHNOLOGY

JULY 1981

BACKGROUND PAPER #2: CASE STUDIES OF MEDICAL TECHNOLOGIES

CASE STUDY #16: THE COSTS AND EFFECTIVENESS OF NURSE PRACTITIONERS

Lauren LeRoy, C. Phil.
Senior Research Associate

With the assistance of:

Sharon Solkowitz, B.S.
Health Policy Intern

Health Policy Program, University of California, San Francisco

OTA Background Papers are documents that contain information believed to be useful to various parties. The information undergird formal OTA assessments or is an outcome of internal exploratory planning and evaluation. The material is usually not of immediate policy interest such as is contained in an OTA Report or Technical Memorandum, nor does it present options for Congress to consider.

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D.C. 20510

Library of Congress Catalog Card Number 80-600161

For sale by the Superintendent of Documents,
U.S. Government Printing Office, Washington, D.C. 20402

Foreword

This case study is one of 17 studies comprising Background Paper #2 for OTA's assessment, *The Implications of Cost-Effectiveness Analysis of Medical Technology.* That assessment analyzes the feasibility, implications, and value of using cost-effectiveness and cost-benefit analysis (CEA/CBA) in health care decsionmaking. The major, policy-oriented report of the assessment was published in August 1980. In addition to Background Paper #2, there are four other background papers being published in conjunction with the assessment: 1) a document which addresses methodological issues and reviews the CEA/CBA literature, published in September 1980; 2) a case study of the efficacy and cost-effectiveness of psychotherapy, published in October 1980; 3) a case study of four common diagnostic X-ray procedures, to be published in summer 1981; and 4) a review of international experience in managing medical technology, published in October 1980. Another related report was published in September of 1979: *A Review of Selected Federal Vaccine and Immunization Policies.*

The case studies in *Background Paper #2: Case Studies of Medical Technologies* are being published individually. They were commissioned by OTA both to provide information on the specific technologies and to gain lessons that could be applied to the broader policy aspects of the use of CEA/CBA. Several of the studies were specifically requested by the Senate Committee on Finance.

Drafts of each case study were reviewed by OTA staff; by members of the advisory panel to the overall assessment, chaired by Dr. John Hogness; by members of the Health Program Advisory Committee, chaired by Dr. Frederick Robbins; and by numerous other experts in clinical medicine, health policy, Government, and economics. We are grateful for their assistance. However, responsibility for the case studies remains with the authors.



JOHN H. GIBBONS
Director

Advisory Panel on The Implications of Cost-Effectiveness Analysis of Medical Technology

John R. Hogness, *Panel Chairman*
President, Association of Academic Health Centers

Stuart H. Altman
Dean
Florence Heller School
Brandeis University

James L. Bennington
Chairman
Department of Anatomic Pathology and Clinical Laboratories
Children Hospital of *San Francisco*

John D. Chase
Associate *Dean for Clinical Affairs*
University of Washington School *of* Medicine

Joseph Fletcher
Visiting Scholar
Medical Ethics
School of *Medicine*
University of Virginia

Clark C. Havighurst
Professor of Law
School of Law
Duke University

Sheldon Leonard
Manager
Regulatory Affairs
General Electric Co.

Barbara J. McNeil
Department of Radiology
Peter Bent Brigham Hospital

Robert H. Moser
Executive Vice President
American College of Physicians

Frederick Mosteller
Chairman
Department of Biostatistics
Harvard University

Robert M. Sigmond
Advisor on Hospital Affairs
Blue Cross and Blue Shield Associations

Jane Sisk Willems
VA Scholar
Veterans Administration

OTA Staff for Background Paper #2

Joyce C. Lashof, *Assistant Director, OTA*
Health and Life Sciences Division

H. David Banta, *Health Program Manager*

Clyde J. Behney, *Project Director*

Kerry Britten Kemp, * *Editor*
Virginia Cwalina, *Research Assistant*
Shirley Ann Gayheart, *Secretary*
Nancy L. Kenney, *Secretary*
Martha Finney, * *Assistant Editor*

Other Contributing Staff

Bryran R. Luce Lawrence Miike Michael A. Riddiough
Leonard Saxe Chester Strobe] *

OTA Publishing Staff

John C. Holmes, *Publishing Officer*

John Bergling Kathie S. Boss Debra M. Datcher Joe Henson

● OTA contract personnel

Preface

This case study is one of 17 that comprise Background Paper #2 to the OTA project on the *Implications of Cost-Effectiveness Analysis of Medical Technology.** The overall project was requested by the Senate Committee on Labor and Human Resources. In all, 19 case studies of technological applications were commissioned as part of that project. Three of the 19 were specifically requested by the Senate Committee on Finance: psychotherapy, which was issued separately as Background Paper #3; diagnostic X-ray, which will be issued as Background Paper #5; and respiratory therapies, which will be included as part of this series. The other 16 case studies were selected by OTA staff.

In order to select those 16 case studies, OTA, in consultation with the advisory panel to the overall project, developed a set of selection criteria. Those criteria were designed to ensure that as a group the case studies would provide:

- examples of types of technologies by function (preventive, diagnostic, therapeutic, and rehabilitative);
- examples of types of technologies by physical nature (drugs, devices, and procedures);
- examples of technologies in different stages of development and diffusion (new, emerging, and established);
- examples from different areas of medicine (such as general medical practice, pediatrics, radiology, and surgery);
- examples addressing medical problems that are important because of their high frequency or significant impacts (such as cost);
- examples of technologies with associated high costs either because of high volume (for low-cost technologies) or high individual costs;
- examples that could provide informative material relating to the broader policy and methodological issues of cost-effectiveness or cost-benefit analysis (CEA/CBA); and
- examples with sufficient evulable literature.

On the basis of these criteria and recommendations by panel members and other experts, OTA staff selected the other case studies. These 16 plus the respiratory therapy case study requested by the Finance Committee make up the 17 studies in this background paper.

All case studies were commissioned by OTA and performed under contract by experts in academia. They are authored studies. OTA subjected each case study to an extensive review process. Initial drafts of cases were reviewed by OTA staff and by members of the advisory panel to the project. Comments were provided to authors, along with OTA's suggestions for revisions. Subsequent drafts were sent by OTA to numerous experts for review and comment. Each case was seen by at least 20, and some by 40 or more, outside reviewers. These reviewers were from relevant Government agencies, professional societies, consumer and public interest groups, medical practice, and academic medicine. Academicians such as economists and decision analysts also reviewed the cases. In all, over 400 separate individuals or organizations reviewed one or more case studies. Although all these reviewers cannot be acknowledged individually, OTA is very grateful for their comments and advice. In addition, the authors of the case studies themselves often sent grafts to reviewers and incorporated their comments.

These case studies are authored works commissioned by OTA. The authors are responsible for the conclusions of their specific case study. These cases are not statements of official OTA position. OTA does not make recommendations or endorse particular technologies. During the various stages of the review and revision process, therefore, OTA encouraged the authors to present balanced information and to recognize divergent points of view. In two cases, OTA decided that in order to more fully present divergent views on particular technologies a commentary should be added to the case study. Thus, following the case

*Office of Technology Assessment, U.S. Congress, *The Implications of Cost-Effectiveness Analysis of Medical Technology*. GPO stock No. 052-003-00765-7 (Washington, D.C.: U.S. Government Printing Office, August 1980).

studies on gastrointestinal endoscopy and on the [illegible] for end-stage renal disease, commentaries from experts in the appropriate health care speciality have been included, followed by responses from the authors.

The case studies were selected and designed to fulfill two functions. The first, and primary, purpose was to provide OTA with specific information that could be used in formulating general conclusions regarding the feasibility and implications of applying CEA/CBA in health care. By examining the 19 cases as a group and looking for common problems or strengths in the techniques of CEA/CBA, OTA was able to better analyze the potential contribution that these techniques might make to the management of medical technologies and health care costs and quality. The second function of the cases was to provide useful information on the specific technologies covered. However, this was not the major intent of the cases, and they should not be regarded as complete and definitive studies of the individual technologies. In many instances, the case studies do represent excellent reviews of the literature pertaining to the specific technologies and as such can stand on their own as a useful contribution to the field. In general, though, the design and the funding levels of these case studies were such that they should be read primarily in the context of the overall OTA project on CEA/CBA in health care.

Some of the case studies are formal CEAS or CBAS; most are not, Some are primarily concerned with analysis of costs; others are more concerned with analysis of efficacy or effectiveness. Some, such as the study on end-stage renal disease, examine the role that forma] analysis of costs and benefits can play in policy formulation. Others, such as the one on breast cancer surgery, illustrate how influences other than costs can determine the patterns of use of a technology. In other words, each looks at evaluation of the costs and the benefits of medical technologies from a slightly different perspective. The reader is encouraged to read this study in the context of the overall assessment's objectives in order to gain a feeling for the potential role that CEA/CBA can or cannot play in health care and to better understand the difficulties and complexities involved in applying CEA/CBA to specific medical technologies.

The 17 case studies comprising *Background Paper #2* (short titles) and their authors are:

Artificial Heart: Deborah P. Lubeck and John P. Bunker
Automated Multichannel Chemistry Analyzers: Milton C. Weinstein and Laurie A. Pearlman
Bone Marrow Transplants: Stuart O. Schweitzer and C. C. Scalzi
Breast Cancer Surgery: Karen Schachter and Duncan Neuhauser
Cardiac Radionuclide Imaging: William B. Stason and Eric Fortess
Cervical Cancer Screening: Bryan R. Luce
Cimetidine and Peptic Ulcer Disease: Harvey V. Fineberg and Laurie A. Pearlman
Colon Cancer Screening: David M. Eddy
CT Scanning: Judith L. Wagner
Elective Hysterectomy: Carol Korenbrot, Ann B. Flood, Michael Higgins, Noralou Roos, and John P. Bunker
End-Stage Renal Disease: Richard A. Rettig
Gastrointestinal Endoscopy: Jonathan A. Showstack and Steven A. Schroeder
Neonatal Intensive Care: Peter Budetti, Peggy McManus, Nancy Barrand, and Lu Ann Heinen
Nurse Practitioners: Lauren LeRoy and Sharon Solkowitz
Orthopedic Joint Prosthetic Implants: Judith D. Bentkover and Philip G. Drew
Periodontal Disease Interventions: Richard M. Scheffler and Sheldon Rovin
Selected Respiratory Therapies: Richard M. Scheffler and Morgan Delaney

These studies will be available for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Call OTA's Publishing Office (224-8996) for availability and ordering information.

Case Study #16

The Costs and Effectiveness of Nurse Practitioners

Lauren LeRoy, C. Phil.
Senior Research Associate

with the assistance of:

Sharon Solkowitz, B.S.
Health Policy Intern

Health Policy Program
University of California, San Francisco

Contents

	Page
Introduction	3
Definition of Terms	3
Supply	4
Cost-Effectiveness Analysis	4
Limitations of a CEA of Physician Extenders	4
Services Provided by Physician Extenders	7
Performance Quality	8
Productivity	9
Employment Costs	12
Average Expenses per Patient Visit	15
Training Costs	16
Medical Care Prices	18
Medical Care Expenditures	20
Cost Effectiveness: Actual or Potential?	21
Appendix: Background Infomation Physician Extenders,	25
Training	25
Legislation Supporting Physician Extender Training.	25
Location Patterns	26
Physician and Consumer Acceptance	28
Legal Restrictions	29
Reimrsement	31
Practice With Physicians v. Independent Practice	32
p references	33

LIST OF TABLES

Table No.	*Page*
l. Mean Physician andI %actitioner Time With Patients	11
2. First ComparisonofPracticesWithand Without a PA When SupervisionIs Considered	12
3. Second Comparison of Practices With and With out a PA When Supervision Is Considered	13
4. Patient Care Time and Cost of Physician Extenders and physicians, 1975	14
5. Change in Average Expense per Patient Visit With Reduced physician Effort	16
6. Training Expenditures for physicians and Physician Extendes, Acadmic Year 1975-79	17
7. Federal Support for physiciaa and Physician Extender Training, Fiscal Year 1970	17
8. Average Charge per Patient Visit in Practices With andWith out a Physician Extender, 1977	18
9. Physician Time In put and Income With and Without Employment of a New Type of Health Manpower (NTM)	19
10. Impact of Physician Extenders on Prices, Patient Volume, and Expenditures.	21
11. Current and Projected Supply of Active Physician Extender, 1979 and 1990	21
12. Employed Graduates of NP ProRrams bv Role and Type of NP Program	22
A-l. NP Programs by Specialty and Type of Program	25
A-2. Average Length and Range in Months of NP Programs by Specialty and Type of Program	26
A-3. Practice Setting Location of NPs by Type of NP Program	27
A-4. NP Programs by Availability of Inner-City and/orRural Practice Setting and Type of Program	27
A-5. Practice Setting Location of NPs by Specialty and Type of Np Program	28
A-6. NPs by the one Employment Setting in Which They Spent Most of Their Time as NPs and Type of NP Program	30

Case Study #16:
The Costs and Effectiveness of Nurse Practitioners

Lauren LeRoy, C. Phil.
Senior Research Associate

with the assistance of:

Sharon Solkowitz, B.S.
Health Policy Intern

Health Policy Program
University of California, San Francisco

INTRODUCTION

Definition of Terms

The concept of using nonphysician health professionals to perform basic medical services traditionally provided by physicians emerged in the mid-1960's amidst widespread concern over a perceived physician shortage. Variously referred to as new health practitioners, mid-level practitioners, or physician extenders, they were seen as a way to increase the availability of health care services, particularly in primary care. Although no single term adequately represents the categories of professionals who comprise this group, the term physician extender is used in this case study when general reference is being made to them. This term encompasses nurse practitioners (NPs), physicians' assistants (PAs), and Medex, a group of former military corpsmen who apply their skills in civilian life.

The present analysis highlights data on NPs. However, the data that exist make it difficult to focus on NPs exclusively. For that reason, data on the various types of physician extenders are incorporated into the analysis where such data are relevant for comparative purposes or in cases where similarities in experience merit a broader discussion. The distinctions among NPs, PAs, and Medex derive from differences in legal requirements, training, and functions (see appendix). In the wide variation of experience documented for different practice settings, however, these distinctions often break down. As a result, attempts to distinguish between NPs and PAs understandably lead to broad definitions of roles such as those quoted by the Graduate Medical Education National Advisory Committee (32):

> [A physician's assistant is] a skilled person qualified by academic and practical on-the-job training to provide patient services under the supervision and direction of a licensed physician, who is responsible for the performance of that assistant.

> Today's nurse, operating in an expanding role as a professional nurse practitioner, provides direct patient care to individuals, families, and other groups in a variety of settings . . . . The nurse practitioner engages in independent decisionmaking about the nursing needs of clients, and collaborates with other health professionals, such as the physician, social worker, and nutritionist in making decisions about other health care needs. The nurse working in an expanded role practices in primary, acute, and chronic health care settings. As a member of the health

care team, the nurse practitioner plans and institutes health care programs.

The actual roles of PAs and NPs depend on their work settings. In some cases, the functions the two perform are virtually identical; in others, they are very different. PAs are intended to operate essentially as physician substitutes for routine primary care. NPs, while trained to assume medical tasks, come from a tradition based on fundamental nursing concepts stressing aspects of patient care not usually provided by physicians.

The scope of this analysis is limited by inadequacies in the available data. Although there is a rather extensive body of literature on physician extender practice in a variety of different practice settings—private physician practice, prepaid group practice (PPGP), hospitals, and other organized settings that operate on either a fixed budget or fee-for-service basis) —some general problems, as noted by Schweitzer (87), appear consistently in the available studies: narrowness of site coverage, incomprehensiveness of variables considered, and weakness of the research design. Studies often focus on a single site or small nonranciom groups of sites. A number of studies were conducted shortly after the physician extender entered practice and therefore leave issues regarding maturity unresolved. Many studies do not adequately identify potential biases influencing the research findings or later interpretation of those findings: In some of them, the impact on the research results of factors unique to the type of practice setting being examined is not specified; in others, the researchers conducting the study may be advocates for the physician extender concept. Finally, from the perspective of cost-effectiveness analysis (CEA), perhaps the most serious problem is a dearth of information specifically defining what medical care tasks physician extenders are qualified to perform. Without this information, comparative analysis between physician extenders and physicians is limited.

supply

Before 1970, there were fewer than 2,ooo formally trained physician extenders. Currently, there are roughly 22,ooo physician extenders in active practice: 13,000 NPs and 9,000 PAs (18). The Congressional Budget Office (CBO) estimates that 2,000 NPs and 1,500 PAs and Medex graduate annually. Assuming continuation of Federal funding at the present level, CBO estimates the supply of physician extenders by 1990 will exceed 56,000 (18). While budgetary constraints might preclude a decision to further increase training opportunities, the demand for training positions, as reflected currently by a high ratio of applicants to available positions, would not be an obstacle (25,101). Assuming continuation of current trends, however, physician extenders will continue to represent a very small group of health professionals. For purposes of comparison, it should be noted that the number of physicians is expected to rise from the present 400,000 to 594,000 by 1990 (18). This increase alone is several times more than the total number of physician extenders.

COST= EFFECTIVENESS ANALYSIS

Limitations of a CEA of Physician Extenders

Encouragement of NPs and PAs as an innovation in the delivery of primary care services is based on their potential to improve access and to lower costs without compromising quality. This promise derives from several basic assumptions (18):

- physician extenders can perform basic and routine medical care tasks traditionally performed by physicians;
- physicians working in concert with physician extenders will thus be free to focus on more serious and more complex medical care problems;
- training costs for physician extenders are cheaper than training costs for physicians;
- lower costs associated with physician ex-

tender services will result in lower prices for the services provided; and

- improved access resulting from the addition of physician extenders to the health care team will increase the frequency of early detection of disease and thus reduce medical care expenditures.

A number of issues concerning appropriate training, task delegation, performance quality, physician and consumer acceptance, costs, productivity, and barriers to practice have constrained the realization of physician extenders' potential. The importance of these concerns is illustrated by their dominance in published research. Only recently, with several exceptions, has cost effectiveness provided the framework for analysis of physician extender practice (69,71). The most recent contributions to CEA of physician extenders are a synthesis of related research and its application to cost-effectiveness questions published by CBO (18), and an exhaustive review of literature on task delegation, productivity, and cost by Jane Cassels Record (70).

The focus on literature review and synthesis in these studies reflects, in part, the data and methodological problems associated with conducting a pure CEA in this area. Data from existing studies are insufficient to meet the requirements of a thorough CEA. Moreover, while the findings of these more narrow studies may contribute to CEAS, the evidence they have provided to date is considered "limited but suggestive" and allowing for only "tentative" conclusions (18). CEA seeks to determine which approach accomplishes a given objective at minimum cost. Such a comparison between physicians and physician extenders is difficult, because the approaches being compared, while overlapping, cannot be substituted for each other in all instances. Moreover, there does not exist the same standardization with physician extenders as with more traditional technological innovations. Physician extenders differ in background, temperament, training, attitude, ability to make independent judgments, and desire for independence. They cannot be considered a neutral "technology" to be utilized and acted on, because they themselves exert an influence on their practice. Moreover, it is not known whether differences in productivity, quality, independence, cost, and provider acceptance exist among NPs in different types of specialty practice. These factors raise both data and methodological questions which have yet to be answered in published research.

Physician extenders have been found to be capable of providing high percentages of primary care services traditionally provided by physicians—but it is unclear which services are included in these percentages; which services are left out; whether those left out have more impact on the delivery of care, physician attitudes, productivity, and costs than those provided; and so on. One way to focus an analysis would be to select for comparison a set of tasks that have been noted in the literature to be performed by both physicians and physician extenders (e.g., well-baby care, history and physical, hypertension monitoring). Even then, however, the results of the analysis would be limited, because they would not provide a way to determine what medical care tasks physician extenders do not perform and the value of those services. It would be difficult to determine whether a "patient visit" (the usual standard of measurement) were the same in both instances in terms of content and outcome. The results would not provide adequate information for developing staffing configurations that are cost effective in terms of services for which physician extenders can substitute for physicians, services for which physicians are the only providers, and services provided by physician extenders that physicians traditionally have not provided.

The objectives of a CEA of physician extenders will depend on the perspective of those for whom the study is undertaken (e.g., a physician in fee-for-service private practice, a health maintenance organization (HMO) with a fixed budget, or Federal policy makers concerned with reimbursement under Federal health insurance programs). Consideration of the type of practice setting, with its different budget and staffing constraints, will alter the study design. The context within which the analysis is conducted is

crucial. Different factors are taken as given; different assumptions underlie the analysis.

Moreover, structural characteristics of the health care system have a profound impact on the way an innovation is used. This is clearly evident in the case of physician extenders and raises questions as to whether a CEA should restrict its focus to current conditions or whether its assessment should consider changes in relation to a variety of policy alternatives to modify the existing structure. This is a key question in the case of physician extenders. Unlike the introduction of most new technologies, the introduction of physician extenders into health services delivery was not accompanied by reimbursement. Unlike many new technologies which enhance the position of the physician, the physician extender is potential competition. Physicians legally maintain a substantial amount of control over physician extender practice; however, the structure of reimbursement reinforces that control by making it virtually impossible for a physician extender to practice independently, Any analysis that is based on what physician extenders *can* do by virtue of their training, rather than what they *actually* do by virtue of the structural characteristics of the health care system, therefore has serious methodological limitations.

Yet developing a broad study based on actual experience to make up for those limitations is much more difficult. The data base specifying what physician extenders do and costs associated with their practice is incomplete. Most existing studies confine themselves to very small samples. The emphasis has been on ambulatory care, leaving a dearth of information on the roles of physician extenders in hospital settings, including their potential substitution for house staff. Expanding the sample size and composition would entail the identification and survey of physician extenders in a variety of practice settings, itself a lengthy and expensive task. Moreover, it is difficult to disentangle physician extender performance and cost characteristics from the characteristics of the practice setting. In a CEA, which should be the focus? Is it possible to control for those factors associated with the practice setting that determine utilization of health personnel?

Given the data that are available, it is not possible to conduct a CEA of sufficient precision to calculate cost-effectiveness ratios. To reiterate key constraints on such an analysis, it is not known exactly what medical tasks physician extenders perform, nor what tasks they cannot perform, nor the importance of either to those employing physician extenders (i. e., do employers seek to cover the average case or the variance: routine versus emergency care?). It is unclear what occurs during the "patient visits" reported throughout the literature. Are there qualitative differences in the services provided by a physician extender and those provided by a physician? The relationship between practice setting characteristics and physician extender cost and performance factors is not fully understood or described in available research. Cost information, when available, is not sufficiently broken down to compare the full costs of a given service provided by a physician extender to the service provided by a physician. Costs of physician extenders are generally presented as an add-on to an existing physician practice. While calculations often account for overhead, they also reflect a fully operational practice, thus minimizing startup costs and assuming different degrees of practice independence for physicians and physician extenders. Moreover, charges cannot be used to determine costs, because existing evidence indicates little relation between the two.

Because the methodological problems and lack of data preclude a full CEA of physician extenders at this time, no effort is made in the analysis presented in this case study to develop cost-effectiveness ratios. The purpose of the analysis is to elaborate on the factors essential to determining cost effectiveness and to testing assumptions regarding the cost-effectiveness potential of NPs against existing data and research findings. Even without data of sufficient precision, quality, and quantity for a full CEA, one can see trends and draw conclusions. From a policy perspective, there emerge in this case clear indications of areas in which alternative

policies would have significant impact. Given the expense in time and dollars of going beyond synthesis and analysis of available information within a cost-effectiveness framework, it is questionable how much more could be gained that would significantly alter the findings and conclusions suggested by existing studies through fulfilling the requirements of a more elaborate cost-effectiveness methodology.

Studies focusing on the removal of serious deficiencies in the data base most likely would be more useful in clarifying still outstanding issues. Assessment of the cost effectiveness of NPs must at a minimum consider the specific services NPs are qualified to provide, performance quality, productivity, task delegation experience, changes in physician practice behavior after the introduction of NPs, employment costs, impact on average expenses per patient visit, training costs, price effects, and revenue generation ability. The discussion that follows examines each of these factors. The difficulty in reaching definitive conclusions in this area results in part from the sensitivity of the analysis to modest changes in many of the variables and from the need to consider the combinations in which these variables are found as additional factors influencing the outcome.

On the basis of available data, it appears that NPs do alter the production of medical services in a manner that can improve access to such services and reduce production costs. That the introduction of NPs will result in a reduction in the price of medical care services or in overall medical expenditures appears less likely. Without a reduction in price that reflects lower costs, the financial benefits derived from the cost-effective attributes of NPs accrue primarily to the physician or to the employing institution. This situation with NPs is similar to the experience with many new medical technologies that are cost saving. Benefits to consumers come when the introduction of NPs results in improved access.

Services Provided by Physician Extenders

In order to determine the cost effectiveness of physician extenders, it is necessary to know what services they are qualified to provide and whether those services are substitutive or complementary to those provided by physicians. This key question is one on which available data are clearly inadequate. Most studies refer to services provided by or delegated to physician extenders in terms of office visits rather than definitive tasks. They describe services physician extenders are producing rather than those they are qualified to produce (70). Instead of categorizing services by specific tasks, studies are more likely to categorize services generally into those physician services that physician extenders either can or cannot safely provide.

There are some studies that have attempted to define areas of medical practice or diagnoses managed by physician extenders. Although the study samples are often very small, the findings of these studies, accompanied by more general conclusions drawn from the bulk of available research, suggest several patterns:

- physicians and physician extenders have both a complementary and substitutive relationship. NPs provide additive services and PAs serve as an extension of the physician (70);
- physician extenders are capable of safely providing a high percentage of primary medical care services (70); and
- studies that document current performance reveal that the practice setting is the *major* determinant of services provided by physician extenders (29,50).

In general, PAs work more closely with physicians than do NPs and also provide care which is more oriented toward acute or emergency situations. NPs often assume a large degree of independence and responsibility and tend to be involved in a broader spectrum of patient care, including counseling, education, and general consultation on a continuing basis.

Among the studies that begin to define services performed by NPs is that of Coulehan and Sheedy (20). The medical practice of an NP trained in diagnosis and treatment of general medical conditions included the following: wellness care; stable chronic disease (hyperten-

sion, diabetes, obesity, arteriosclerotic heart disease, arthritis, chronic depression, psychophysiologic reactions); and acute self-limited conditions (colds, sore throats, acute viral syndrome, minor trauma, rashes, skin infection). Of the 15 most common diagnoses for the Coulehan and Sheedy study sample, the NP handled so percent or more of the following conditions: upper respiratory infections, otitis media, otitis externa, soft tissue trauma, and gonorrhea. The NP managed one-third to one-half of patients presenting the following: muscle or back strain, dermatitis or eczema, hypertension, diabetes, obesity, and urinary tract infection. Again, it must be noted that these services reflect services the NP provided within the constraints of the practice setting, not necessarily the range of services the NP was qualified to provide. Moreover, it should be noted that the Coulehan and Sheedy study was conducted in 1973, and therefore reflects early experience with NPs, Subsequent studies reveal even higher percentages of patients presenting the same conditions being treated by NPs.

In terms of specific tasks, the limited data that are available indicate that physician extenders can perform medical functions basic to primary care such as taking medical histories, performing routine physical examinations, carrying out simple diagnostic procedures, ordering routine lab tests and interpreting their results. Physician extenders commonly administer injections, apply dressings, casts and splints, and can perform life-preserving measures in emergency situations. Some are qualified to perform minor surgical procedures such as removing a foreign object from the eye 01 routine suturing (10).

Physician extenders generally are restricted from prescribing drugs except under certain conditions (e. g., having prescriptions countersigned by a supervising physician or prescribing within a limited "scope of practice"). Eight States prohibit physician extenders from writing drug prescriptions. The issue of whether or not physician extenders are qualified to prescribe drugs is one that a number of States are currently reviewing. Some States are experimenting with the extension of prescribing privileges (e.g., California has a project which allows prescribing by NPs, PAs, and pharmacists in five geographic areas of the State). The constraints on drug prescription represent the most sensitive unresolved issue in terms of tasks allowed to be performed by physician extenders, both because of the integral role of prescribing in medical care and because of the implications of such constraints for professional independence (18).

Performance Quality

The quality of services provided by NPs is crucial to their acceptance by both physicians and patients. Indeed, this issue has been studied more than any other. Like most research in this area, the studies on quality generally use small samples, assess quality from a variety of different perspectives and focus more on short-term results than on long-term outcomes of patient care. These evaluations of physician extender services repeatedly confirm their high quality (10,14,24,41,42,44,51,52,79). The quality of medical care services provided by physician extenders is at least comparable to the quality of services provided by physicians themselves. Furthermore, in some cases, physician extenders have shown performance superior to physicians in symptom relief, diagnostic accuracy, and patient satisfaction (33,70). Summarizing the findings of the numerous studies of physician extender performance in a variety of practice settings, CBO concludes: "Physician extenders have performed as well as physicians, with respect to patient outcomes, proper diagnoses, management of 'indicator'[1] medical conditions, frequency of patient hospitalization, manner of drug prescription, documentation of medical findings and patient satisfaction" (18).

In its study of the Federal physician extender reimbursement experiment (102), System Sciences, Inc., used nationally recognized disease treatment protocols to evaluate the quality of care provided to patients by physician/physician extender teams and by physicians only. The results favored physician/physician ex-

[1]According to Spitzer, et al. (93), "An indicator condition is a distinct clinical entity (such as a disease, symptom, state, or injury) occurring frequently in primary care, with an outcome that can be affected favorably or adversely by choice of treatment."

tender teams and revealed higher quality ratings for physician/NP teams than for any other group.

Productivity

It is difficult to measure productivity in strict economic terms when applied to health manpower. The inputs and outputs of the medical care production process are difficult to define and measure. Some people define the output of the medical care industry as an intermediate good to be combined with other inputs in the production of good health. However, most focus on this intermediate product and try to develop proxy measures for what actually occurs when patient and health professional come together.

The output most commonly associated with health professional services is defined in terms of patient visits. Productivity of physicians and physician extenders usually is measured by the number of patient visits per unit of time. Holmes, et al. (39) noted the inability of this measure to reflect either the complexity or the volume of services provided during a patient visit. These investigators also noted the difficulty of determining the relative contributions made to patient care when more than one professional is involved. To overcome these inadequacies, they suggested the *use* of a relative value scale to assign values to the specific activities performed by physicians, NPs, and nurses. This and other attempts are being made to develop more refined measures of productivity, but the use of patient visits is most prevalent in the literature.

Although there is little doubt that the efficient use of NPs can improve the productivity of the delivery of medical services, it is essential to distinguish between potential impact and actual experience. As Reinhardt (74) points out, determination of physician productivity must account for both technical feasibility in the production process and the probable economic behavior of the physician. One needs to know not only what is technically feasible but also what configuration of inputs physicians are likely to choose and to what extent physicians will attempt to maximize the output that is technically attainable with that combination of inputs (75). The physician, perhaps in collaboration with the administrator in an organized setting, determines how the physician extender will be used as an input in the production of medical services. While the debate continues regarding the independence of NPs, reality shows them to be functionally dependent on the physician. Berki (37) defines this relationship as one of "constrained substitutability" with the physician determining most of the constraints.

The extent to which tasks are delegated from physician to NP, the amount of time it takes a physician or NP to perform the same task, and the impact of the introduction of NPs on physician behavior are key productivity-related variables in the cost-effectiveness calculation. In a review of 15 studies that used physician office visits as a measure of delegability, Record (70) concluded that between 75 and 80 percent of adult primary care services and up to 90 percent of pediatric primary care services could be delegated to physician extenders. The purpose of the Record study was to estimate different combinations of physicians and physician extenders that could produce given levels of primary care services. Cost estimates associated with the various configurations revealed potential cost savings of $0.5 billion to over $1 billion in cases with higher physician extender participation. This amounted to 19 to 49 percent of total primary care provider costs.

Steinwachs, et al. (94) reported on the experience of the Columbia Medical Plan, an HMO, in expanding the use of physician extenders over a 3-year period. As the involvement of physician extenders increased, dramatic changes occurred in the distribution of patient encounters between physician extenders and physicians. In 1971-72, 79 percent of patient encounters in adult medicine were managed initially by physicians. By 1973 -74, that figure had dropped to 38 percent. In 1971-72, physician extenders managed 10 percent of initial encounters for illness and injury and conducted no health reviews. By 1973-74, physician extenders managed 50 percent of illness and 75 percent of in-

jury initial encounters and conducted 50 percent of adult health reviews. The delegation of responsibility for initial encounters in pediatrics was even higher, with all but 16 percent of pediatric health reviews being conducted by physician extenders.

The changes in distribution of patient encounters among physician extenders and physicians resulted in a major change in staffing patterns as the Columbia Medical Plan evolved (94). During the study period, enrollment nearly doubled. In response to this growth, the number of full-time equivalent (FTE) internists increased less than 10 percent, while the number of physician extender FTEs increased 260 percent. The result was a change in staffing patterns from the early study period when physicians represented 60 percent of the total number of FTE providers to the final months of the study when their representation decreased to 38 percent of total FTE providers. Pediatrics experienced a similar but less pronounced staffing change, with physician FTEs increasing by one-third and physician extender FTEs nearly doubling.

In the Northern California Kaiser-Permanente Medical Care Program, also an HMO, NPs conducted a Health Evaluation Service (HES) consisting of automated multiphasic health testing followed by a physical examination and health appraisal (22). Of the patients who entered the Kaiser system through HES, 74 percent were managed without physician referral. Of those referred to a physician, two-thirds went to a specialty clinic, thus having the NPs' HES visit substitute for an initial primary care physician visit. Moreover, pelvic exams conducted through HES replaced 5,207 visits to the gynecology clinic during the study period.

Similar experience is reported for two NPs working in the offices of two family physicians in the Burlington Randomized Trial (79,93). Patients were divided randomly into two groups: one receiving first-contact, primary care services from a family physician working with a nurse ("conventional" care); and the other receiving such care services from NPs. The study found that NPs were able to provide primary care services as safely and effectively as physicians. In 67 percent of patient visits, care was provided with no physician consultation.

More specifically, in settings with both NPs and physicians, NPs assume primary responsibility for the diagnosis and treatment of acute self-limited conditions and acute conditions with limited uncertainty in the diagnosis and responsiveness to a defined therapy. Adult health reviews are shared by physicians and NPs, while the majority of well-baby care can be provided by pediatric NPs, Physicians retain primary responsibility for diagnosis and treatment of more complex and serious acute conditions and for chronic conditions (89,94,109).

It is obvious from the aforementioned and other studies (19,85, 105) that NPs can assume a high proportion of primary medical care tasks. Existing studies also reveal substantial variation among practices, making more difficult the translation of specific expectations for task delegation to widespread experience. Record (70) outlines a number of factors accounting for that variation, including type of practice setting, structure and age of practice, provider role strain, legal and reimbursement constraints, and level of demand.

The time spent by NPs in managing a patient visit is significantly higher than that spent by physicians. Table 1 shows the experience of physician extenders in the Southern California Kaiser-Permanente Health Facility.

For given presenting complaints, physician extenders averaged 4 to 9 minutes longer than physicians. Recent research has shown that NPs spend up to 65 percent more time per patient visit and see 60 percent as many patients per hour as do physicians (18,103). NPs see fewer patients per day because of their longer time per visit, a shorter workday, and more time devoted to patient telephone consultation and administrative activities. The number of patient visits reported for NPs ranges from 5 to 14 per day (101). Consideration of the number and duration of patient visits to NPs must account for the possibility that the content of the NP patient visit differs from that of a physician visit. If NPs do, in fact, provide more patient education and counseling than physicians, they

Table 1.—Mean Physician and Practitioner Time With Patients

	Physician group		New health practitioner (NHP) group		
Subgroup[a]	Number of visits	Physician time (min)	Number of visits	NHP time (min)	Physician consult time (min)
URI	60	11.4 ± 7.2	156	15.7 ± 6.1	0.8 ± 1.5
UTI	53	11.4 ± 6.2	34	17.4 ± 5.8	0.9 ± 1.2
Headache	32	13.7 ± 8.4	34	19.5 ± 8.3	0.8 ± 1.2
Abdominal pain	60	12.4 ± 7.4	43	21.1 ± 8.3	1.3 ± 2.3
Average visit[b]		11.8		17.1	0.9

[a]URI denotes upper respiratory infection; UTI donates urinary tract infection.
[b]Weighted average calculated and tested for significance. All differences between mean physician time and mean NHP time significant at $p > 0.005$ (by 2-tailed t-test).

SOURCE: S. Greenfield, et al., "Efficiency and Cost of Primary Care by Nurses and Physician Assistants," *N. Eng. J. Med.* 298307, 1978

may be improving access and the patient's experience during the encounter. Since such services generally are not reimbursable, and reimbursement is used as a measure of value, it is difficult to determine the value of these services.

An NP who substitutes for a physician in providing specified medical services allows the physician to increase productivity. As Reinhardt points out, this is true even if the NP spends more time providing the same service (75s):

> Because of the need for supervision of physician extenders, the delegation of a task normally requiring 10 minutes of physician time to a physician extender may actually free only 8 minutes of physician time (and may require 20 minutes of the physician extender's time). Even so, as long as some physician time is freed at all, task delegation will enable the physician to treat more cases per unit of time and hence increase . . . hourly productivity.

Physicians working with NPs noted an additional increase in their efficiency due to the need to be more rigorous and clear in communicating their thoughts to the NPs (93).

Estimates of increases in the productivity of physician practices that include NPs range from 20 to 90 percent (31,36,38,39,43,70,82,104). In some cases, these estimates reflect actual experiences; in others, they are the resuIt of computer simulation models that determine productivity increases based on optimal staffing configurations for performing medical care tasks. Given that the computer simulation models measure potential rather than actual experience, these generally yield higher estimates. The greatest productivity increases come when the NP has primary responsibility for a subset of patients and when triage is performed by the NPs' referring complicated cases "up" to the physician rather than by the physician's delegating routine medical problems "down" to the NP (90).

The amount of physician time freed by NPs is reflected in physician/NP substitution rates. In a mathematical model for HMO staffing patterns, Schneider and Foley (82) estimated that the substitution of one physician extender would decrease physician requirements by 53 to 60 percent depending on departments. After the expanded use of physician extenders in the Columbia Medical Plan, the workload (number of encounters per FTE) remained constant for the physician extenders but declined for physicians, in part because physicians were freed from routine medical procedures to concentrate on patients with more time-consuming complex problems (94). Although physicians still must be available for consultation with the NP, Greenfield, et al. (33) found that the physician time required for consultation was 92 percent less than the time that physicians would spend treating the same clinical problem.

In addition to the numerous studies that define productivity in terms of patient visits, Holmes, et al. (39) used a relative value scale to determine productivity differences between tra-

ditional physician/nurse practices and physician/NP practices. They found productivity levels in practices incorporating NPs to be an average of 25.8 percent higher (39).

Productivity increases that result from the use of NPs vary widely, depending on the practice setting, the responsibilities delegated to the NP, the severity and stability of illness in the patients served by the practice, and how the physician chooses to use the free time resulting from task delegation. As will be discussed below, the potential for productivity increases is not necessarily realized. Moreover, Hershey and Kropp (36) point out the negative impact that maximum task delegation and resulting productivity increases can have on the practice environment. Considering such factors as office hours, waiting room congestion, and supervision time, they conclude that an operating environment resembling that of a conventional physician practice cannot be achieved with more than a 50-percent increase in procductivity. If physician hours remain constant, supervision time has a marked impact on how much of an increase in productivity a practice environment can absorb. Tables 2 and 3 compare practice environments with and without PAs under varying supervision times.

Employment Costs

To determine the cost effectiveness of NPs, both the amount of time they spend to perform a given service and the cost per unit of time for NPs must be compared with the figures for physicians. However, available cost data are limited, and what data exist often come from studies of small samples that are not comparable. An additional difficulty in comparing costs arises because most physicians are self-employed and compensated for their services on a fee-for-service basis, while virtually all NPs are salaried.

The basic costs of employing an NP include salary, fringe benefits, and physician supervision. The average salary of NPs was estimated in 1978 to be about $13,800 (105). Using 1975 data, CBO (18) determined that the median hourly wage for physician extenders was about $6 as compared with $24 for physicians. Record (70) found salary (or income) differentials between physicians and physician extenders to be close to $36,000 per provider per year. Several studies stress the importance of such differentials in the physician's decision to employ an NP (33,82). In their systems analysis of the use of physician extenders, Schneider and Foley (82)

Table 2.—First Comparison of Practices With and Without a PA When Supervision Is Considered

	Assumptions				
		With PA/4 minutes supervision			
	Without PA	242 patients	264 patients	286 patients	308 patients
Measures	220 patients per week	per week (10%-gain)	per week (20%-gain)	per week (30%-gain)	per week (40%-gain)
Average physician-patient contact time per day, Including supervision (hours)	5.93	4 34'	5.24b	5.55	6.15
Average time last patient leaves office (minutes past 4 p m)	**30**	**25b**	*27*	**37b**	**66a**
Average total wait per patient (minutes)	17	16	18	**23b**	**39a**
Average percent of patients who wait for admission to examination room	39	**52b**	**54b**	**62b**	**81a**
Maximum number of patients in waiting room on average day	3	3	5		10a
Average annual net Income before taxes	$34,735	$31,970	$35,102	$38,250	$41 ,615[b]

Table 3.—Second Comparison of Practices With and Without a PA When Supevision is Considered

	Assumptions				
		With PA			
Measures	Without PA 220 patients per week	4 minutes supervision 264 patients per week (20%-gain)	2 minutes supervision 286 patients per week (30%-gain)	1 minute supervision 308 patients per week (40%-gain)	No supervision 330 patients per week (50%-gain)
Average physician-patient contact time per day, including supervision (hours)	5.93	5.24'	4.75b	4.84b	4.75b
Average time last patient leaves office (minutes past 4 p.m.)	**30**	**27**	**27**	26a	31
Average total wait per patient (minutes)	17	18	17	20	18
Average percent of patients who wait for admission to examination room	39	53a	53a	**72zb**	**7 l b**
Maximum number of patients in waiting room on average day			5	6a	**7b**
Average annual net income before taxes	$34[3]735	$35:102	$37,567	$42,291'	$46,855[b]

[a]The average value is significantly different from the average value "without PA" at the 0.05 level.
[b]The average value is significantly different from the average value "without PA" at the 0.01 level.

SOURCE J C Hershey and D H Kropp, 'A Re-Appratsal of the Productlvlty Potential and Economic Benefits of Physiclan's Assistant s," Med. Care 17602, 1979

found physician extenders' use to be unaffected when their salaries remained below 47 percent of physician salaries. Once the physician extender's salary reached 62 percent of the physician's salary, however, physician extenders rapidly lost their cost effectiveness in the model.

The amount of time reported for physician supervision and consultation varies considerably among practices. Supervision time varies with the type of practitioner involved. Legal requirements also determine the time devoted to supervision. Forty-three States require direct supervision of PAs and Medex; only 11 States have similar requirements for NPs (18). Within a given practice, variation in consulting time is a function of the reason for the consultation, whether the physician sees the patient or only confers with the NP, and the practice experience of the NP. The actual time per consultation ranges from less than a minute to approximately 8 minutes. Consultation on initial visits requires about half as much time as consultation on continuing visits (105). Record, et al. (72) found that in the 12 percent of cases where the PAs under study requested physician consultation, the physicians were likely to spend as much time with the patient as if they had been the initial provider. In such cases, the extra cost to the practice is represented by the cost of the PA and not that of the physician. Because of the cost implications, direct referral to the physician would be optimal but usually is not possible in such cases.

In its review of available studies, CBO determined that supervision and consultation with physician extenders require between 10 and 20 percent of physician time (18). With CBO estimates of hourly earnings, this adds between $3 and $5 to the physician extender's hourly salary cost. CBO further determined that direct compensation accounted for 54 to 72 percent of the total cost of a physician extender, while supervision costs made up the remainder (18). Table 4 compares the time and costs of physicians and physician extenders, according to patient visits. If both salary and supervisory costs are considered, the hourly costs of NPs range from one-third to one-half of physician costs ($9 to $12/hour **as** compared to $24/hour).

It should be recognized that the salary level of NPs is in part a function of the demand for their services. As Berki (7) points out, with some caveats, demand for physician primary care services can be considered a direct demand expressed by the patient. The demand for NPs is

Table 4.—Patient Care Time and Cost of Physician Extenders and Physicians, 1975 [a]

	Physician extender		
	NP	PA and Medex	Physician
Minutes per patient visit	19.4	13.2	11.7
Cost per hour	$9.43-$12.22	$8.36-$10.73	$23.90
Direct compensation	$6.63[b]	$5.98[b]	$23.90[c]
Supervision	$2.80-$5.60[d]	$2.38-$4.75[d]	N.A.
Cost per patient visit	$3.04-$3.94	$1.84-$2.36	$4.66

[a] Productivity and cost figures refer to each type of provider working alone. Physician data are for office-based, primary care physicians.

[b] Annual median salary for each physician extender type was divided by the annual hours of work for each physician extender type. An average hourly compensation cost for NPs, and for PAs and Medex, was arrived at by weighting the divided hourly salary figures for each specific type of physician extender by its share of the physician extender population.

[c] Median net income. Because this includes profit to the physician, the relative costs of physician extenders and physicians are understated. Primary care physicians who are salaried, such as those in health maintenance organizations, tend to earn less than those in the fee-for-service sector.

[d] Supervisory costs were calculated by multiplying physician median net income by an estimated proportion of time (10 to 20 percent of annual practice time) spent on physician extender related activities. Total supervisory costs were then distributed over the average annual practice hours of each physician extender type to arrive at a supervisory cost per physician extender hour. An average hourly supervisory cost for NPs and for PAs and Medex, was derived by weighting cost figures for each specific type of physician extender type by its share of the physician extender population.

Data Sources

Minutes per patient visit: University of Southern California, *The Collection and Processing of Baseline Data for the Physician Extender Reimbursement Study,* August 1978. (The data are not necessarily representative of all physician extenders and office-based primary care physicians).

Physician extender compensation and weekly hours of work: System Sciences, Inc., *Nurse Practitioner and Physician Assistant Training Deployment Study, September 1976.*

Physician earnings: Z. Y. Dyckman, A Study of Physicians' Fees, staff report prepared by the Council on Wage and Price Stability, March 1978.

Physician weekly hours of work and annual weeks of work: American Medical Association, *Profile of Medical Practice, 1977* (Chicago: AMA, 1978).

Physician supervisory requirements: J. Record and J. O'Bannon, *Cost Effectiveness of Physician Assistants,* final report, 1976, and System Sciences, Inc., *Survey and Evaluation of the Physician Extender Reimbursement Experiment,* final report, March 1978.

SOURCE: Congressional Budget Office, U.S. Congress, *Physician Extenders: Their Current and Future Role in Medical Care Delivery* (Washington, D.C.: U.S. Government Printing Office, April 1979).

one that the physician must "initiate," "express," and "legitimate," making this demand a derived one (7). Goldfarb (30) notes that the market for physician extenders is not sufficiently competitive to raise the relatively low wages of physician extenders to the wage level that would prevail if more physicians expressed demand for their services. She finds that the factors that depress wages are stronger than those that raise them, resulting in a prevailing wage level that bears little relationship to productivity and, on average, leaves them underpaid. Obviously, an increase in demand for NPs resulting from such systemwide changes as enactment of national health insurance or expansion of HMOS, or a decrease in demand resulting from changes in physician distribution through the National Health Service Corps or the potential oversupply of physicians would require a reassessment of salary costs.

The costs associated with NP practice go beyond direct compensation and supervision. The need for additional staff support, space, and equipment may accompany the decision to hire an NP. Moreover, the style of NP practice has cost implications. A number of studies have found that physician extenders perform more diagnostic tests than physicians and have different patterns of medication use (18,26,43,71). One recent study (60) found that NPs performed 53 percent more diagnostic tests per patient than the physicians for whom they worked and 46 percent more than the physicians who did not work with any physician extenders at all. In some cases, these increased lab tests result in identification of additional pathology (43). Although the benefit to the patient in such instances may counter the additional cost, patient discomfort and time plus the cost of false positives or negatives must be considered. Available

evidence also suggests that the use of protocols can diminish the tendency toward excess use of diagnostic tests (33,34).

In addition to spending more time per patient, NPs may log more visits per patient in a given time period. Since the salary and supervision costs of NPs are significantly lower than the salaries of physicians, the increased return visits are not necessarily a financial problem from the practice's perspective, although they do consume the patient's time. However, as Spector, et al. (92) discovered, a disproportionate increase in visits can raise the overall cost per patient beyond the point where the use of NPs is cost effective for the practice. Others stress that in terms of overall medical expenditures such practice patterns may be cost effective if they reduce hospitalizations (78).

When all of these cost factors have been considered, NPs have been found to perform comparable medical care tasks at a lower total cost than physicians. Lewis and Resnik (51) found this to be true for inpatient and ambulatory services for all patients. In the Kaiser-Permanente Medical Care Program, which instituted a Health Evaluation Service (HES) operated by NPs, entry costs (health appraisal, followup, and referral) for the HES group were $43.09 as compared to $61.41 for patients using physicians as the point of entry. Costs of overall medical resources used over 12 months by cohorts of patients with comparable health status were $98.63 for the HES group and $131.18 for the physician group (22). In another Kaiser-Permanente facility, overall combined. costs of NPs were 20 percent lower than physician costs (33). Studies on private physician practices, while not specifically addressing the cost issue, indicate similar experiences (66,86).

Average Expenses per Patient Visit

Even if one allows for supervision costs, NPs can provide selected services at less cost than physicians. This lesser cost does not necessarily translate into lower average expenses per patient visit, the latter of which are a function of total practice expenses and patient volume (18). A number of Studies have documented increases in patient visits which occurred in practices using physician extenders (38,65). Annual patient visits in the University of Southern California survey (103) were 50 to 60 percent higher in practices with physician extenders. System Sciences, Inc. (102) found that practices incorporating physician extenders provided 12 more patient visits per $1,000 of cost than practices without them. CBO reports that the System Sciences study showed practice expenses for physicians with physician extenders to be 74 percent higher than for solo physicians (18). At the same time, patient volume in the physician/physician extender practices was 146 percent higher, resulting in an average expense per patient visit 29 percent lower than that for solo physicians.

While experience has shown that NPs and other physician extenders can lower average expenses per patient visit by as much as one-third, the manner in which the physician or institution uses them and the way in which time freed through task delegation is used will determine whether the potential saving is realized. If NPs are used to provide services complementary to those of the physician rather than services substituting for the physician's, the potential reduction in average per-visit expenses may be diminished or lost. In such cases, however, the complementary services often imply quality enhancement, a different (and implicitly better) visit for the same cost.

With the addition of NPs to a practice, physicians may choose to maintain, increase, or decrease their level of effort. Komaroff, et al., caution (43):

> Over and above any efficiencies introduced by this or any other system, the time a physician averages with patients on a given day is powerfully influenced by two additional factors: the volume of patients to be seen and the "style" and interests of the individual physician. It is therefore unwise to expect too much from, or to attribute too much to, organizational changes of this kind in the absence of strong pressures to optimize efficiency.

In order to achieve the saving that comes from such efficiency, the practice employing an NP

must either expand its volume of patient visits or maintain its volume and reduce its physician input. The latter option is obviously more feasible in an institutional setting where physicians are hired as salaried employees than in physician office practices where physicians are self-employed (and also) would be less likely to hire an NP).

If physicians continue to see the same number of patients, NPs may reduce average per-visit expenses by increasing patient volume sufficiently to more than cover costs accompanying their introduction into the practice. Reduction in physician effort in terms of patient visits, however, may occur for several reasons: 1) physicians may be seeing patients with more complex problems that demand more time per visit; 2) they may devote more time to hospitalized patients; and 3) the presence of NPs may allow physicians to take more leisure time. Furthermore, some physician time is required for supervision and consultation with the NP. For whatever reason, if physicians reduce their patient load, the average expense per patient visit increases, as illustrated in table 5. However, it should be recognized that if the number of patients seen by the physician per day decreases because of more time spent per patient or the delivery of more complex services, the "patient visit" produced becomes a different product that may justify a higher cost.

Contrary to what had been hoped for, the reductions in average expense per patient visit achieved by solo practices have not been realized in many group practices. Using System Sciences, Inc., data, CBO reports average per-visit expenses in group practices employing physician extenders to be only 1 percent lower than those in group practices without them, although solo practices with physician extenders have experienced as much as a 30-percent reduction in average practice expenses (18). CBO speculates that the differential may be due less to practice organization than to the type of physician attracted to each practice arrangement, with physicians in group practice more highly valuing leisure time and using physician extenders to reduce their workload.

Training Costs

Training costs indirectly affect employment costs and the costs to society of NPs. These costs are important because much of them are publicly subsidized and they may have some influence on salary expectations. NPs obviously benefit from public subsidies for their training, just as do other health professionals. They enter the job market with a lower personal investment in training than would have existed without subsidization. This, in turn, means that they are seeking a return on an investment that does not reflect the full costs of their training, thus benefiting their employers through lower salary costs (30).

Total training expenditures for physician extenders are substantially lower than those for

Table 5.--Change in Average Expense per Patient Visit With Reduced Physician Effort

	Hours per day		Hourly cost		Total cost		Number of patients		Cost per patient visit
Physician	8	x	$24	=	$192	-	10	=	$19.20
NP	8	x	$12	=	$96	-	6	=	$16.00
					$288	-	16	=	$18.00 (average expense per patient visit)
Physician	8	x	$24	=	$192	-	7	=	$27.40
NP	8	x	$12	=	$96	-	6	=	$16.00
					$288	-	13	=	$22.10 (average expense per patient visit)

physicians, as shown in table 6. Total expenditures for the segment of training that qualifies one to practice as a physician extender are lower for NPs than for PAs (18). In the case of NPs, the figures in table 6 do not account for the costs of education required to obtain an RN license as a prerequisite to NP training. Depending on the type of initial nursing education program (see appendix) and the duration of the NP training program, the costs of NP training could equal or exceed the costs of PA training. Estimates of the average annual costs of nursing education in 1979 are $5,901 for baccalaureate programs (4 years), $4,974 for diploma programs (3 years), and $4,912 for associate degree programs (2 years) (47). Developing comparable full training cost figures for NPs, PAs, and physicians is complicated by the different education requirements for entry into NP, PA, or medical training programs. Since a baccalaureate degree is a prerequisite for medical school, comparable figures for physician training must include the costs of baccalaureate education if the costs of obtaining the RN license are included for NPs. Program requirements for PAs do not necessarily include postsecondary education, although most PAs have had at least 3 years of college. Whether any of these education costs should be accounted for (as a reflection of reality rather than formal entrance requirements) is unclear.

Looking solely at the expenditures for the NP or PA phase of training (see table 6), higher average annual expenditures for NPs are in part explained by the fact that PA training occurs in medical schools, using their faculty and resources. Thus, there is an indirect subsidy of PA training in medical schools that is met more directly in NP training programs. Moreover, while the average annual cost of NP training is higher than for PAs, the shorter length of NP training results in lower average total costs for NPs.

The total Federal contribution to basic health professions education and training is highest for medical education. This reflects both the costs of that training and the fact that virtually all medical schools receive Federal funds. The amount of Federal support per student and its relation to average annual training costs, as shown in table 7, is significantly higher for physician extender training.

Table 6.-Training Expenditures" for Physicians and Physician Extenders, Academic Year 1978-79

	Cost per student	
	Annual costb	Total costc
Physician		
Mean	$14,200	$60,700
Median	NAd	NAd
Range	$7,600	$ 20,800 $30,200-$83,000
Physician extendere		
PA and Medex		
Mean	$6,800	$11,900
Median	$7.400	$9,900
Range	$4400-$9.900	$7,100-$17,200
NP		
Mean	$12,900	$10,300
Median	$10,100	$8,000
Range	$5,300-$31.000	$3,000-$32,000

[a]Net institutional expenditures—that is, gross expenditures for resources required for educational purposes less income from research and patient care attributable to training activities.
[b]For comparative purposes only. Some physician extender programs are less than 1 year long. (Because of the standardization of the length of NP certificate programs to 1 year in the Nurse Training Act of 1976, this cost estimate for NP training may be conservative.)
[c]Total cost for physicians assumes 4 years of the basic medical education. Total cost for physician extender programs are based on programs that vary in length.
[d]Not available.
[e]Physician extender data are based on a sample of physician extender programs that are not necessarily representative of all programs.

Data Sources.

Physician training expenditure data: Institute of Medicine, National Academy of Sciences, *Costs of Education in the Health Professions, Summary*, January 1974.

Physician extender expenditure data: System Sciences, Inc., *Nurse Practitioner and Physician Assistant Training and Deployment Study*, final report, September 1976. Figures are updated to 1978, assuming an annual 7-percent inflation rate.

SOURCE: Congressional Budget Office, U.S. Congress, *Physician Extenders: Their Current and Future Role in Medical Care Delivery* (Washington, D.C.: U.S. Government Printing Office, April 1979).

Table 7.—Federal Support for Physician and Physician Extender Training, Fiscal Year 1978

	Total Federal support	Amount per student	Percent of average annual training cost s
Physician.	$190 million	$3,000	20%
Physician extender.	$22 million	$4,000-$5,000	50-700/0

SOURCE: Congressional Budget Office, U.S. Congress, *Physician Extenders: Their Current and Future Role in Medical Care Delivery* (Washington, D.C.: U.S. Government Printing Office, April 1979).

The public cost of producing each additional physician and physician extender who would not have been trained in the absence of Federal support has been estimated by CBO (18). Including both construction and operating support, the Federal cost of each additional physician trained between 1969 and 1978 was estimated to range from $40,000 to $60,000. The Federal cost for each physician extender during the same time period ranged from **$10,000** to $20,000.[2] A significant factor in the differential between medical education and physician extender training, CBO noted, is the Federal strategy of providing seed money but not operating subsidies to physician extender programs.

NP programs are less dependent on Federal subsidies than PA programs. In fiscal year 1978, only 40 percent of NP programs received Federal support, as opposed to 90 percent of PA programs. Because they are less dependent of Federal subsidies, NP programs are potentially less vulnerable to changes in Federal training support, although it can be assumed that many NP programs do receive public subsidies at the State level that also might diminish if Federal policy no longer encouraged the training and use of new health professionals.

Annual training expenditures for physician extenders are significantly lower than those for physicians. As Scheffler (80) argues, however, even if the cost of training physician extenders were the same as that for physicians, physician extenders would still be a good investment because of their shorter training period. Scheffler estimated that three PAs can be trained for the cost of training one physician and together can produce 1.8 times more visits than one physician. Although analyses like Scheffler's begin to grapple with the issue of differences in training costs between physician extenders and physicians, their findings do not define the costs associated with the specific services that either group can provide. Detailed cost data on training for specific sets of primary care services are nonexistent. There is no agreement on a uniform set of services that any type of physician extender can provide. Some consensus is a prerequisite to refining currently available data. Without it, only gross comparisons of total training costs are possible.

Medical Care Prices

Lower costs associated with NPs do not necessarily translate into lower prices for their services. Moreover, productivity gains for physicians who employ NPs may not lead to a reduction in physician fees. Therefore, consumers cannot necessarily expect to benefit from a reduction in average charges in practices with NPs. Because the market for medical care services does not conform to the competitive model, a reduction in expenses need not be followed by a decline in prices (7,18,74,90). As seen in table 8, a System Sciences, Inc., survey (102) did reveal lower average per-visit charges of about 21 percent in practices with physician extenders. Similar experience has been documented elsewhere (66). However, the note accompanying the table suggests that the location of many of the physician/physician extender practices in

Table 8.—Average Charge per Patient Visit in Practices With and Without a Physician Extender, 1977

Type of practlcea and provider	Average charge per patient visitb (in dollars)
Phystcian with physician extender	$13.00
NP	8.13
PA or Medex	12.02
Physician	15.06
Physiclan without physician extender	16.48

Includes both solo and group practices.
It should be noted that one source of the lower charges in physician/physician extender practices could be that these practices were located to a greater extent in lower income areas with fewer health resources than the comparison physician-only practices.

Data Sources

System Sciences, Inc., *Survey and Evaluation of the Physician Extender Reimbursement Experiment*, final report, March 1978.

OURCE: Congressional Budget Office, U.S. Congress, *Physician Extenders: Their Current and Future Role in Medical Care Delivery* (Washington, D.C.: U.S. Government Printing Office, April 1979)

[2] These figures were calculated from a method developed in 1974 by George E. Wright at the University of Michigan School of Public Health (107): "Annual Federal operating subsidies and construction support from 1969 to 1978 less pre-1969 levels of support were summed and divided by an estimated gain in the number of physicians (and physician extenders) due to the net increase in support." Due to lack of data, the number of physician extender graduates resulting from Federal support was estimated to be between 25 and 50 percent of all graduates during the period.

lower income areas with fewer available health resources could account for the charge differential.

Few physicians surveyed by the General Accounting Office reported any reduction in fees for physician extender services (27). Moreover, CBO cautions that use of NPs to provide complementary services rather than to increase volume could lead to even higher average per-visit charges (18). Existing data lead to the conclusion that where prices for patient services do decline after introduction of a physician extenders, the change is insufficient to lead to more than a modest reduction in average charges per patient visit. The tendency for physician extenders to order more diagnostic tests can further increase practice revenues if the tests are performed in the physician's office (84). In addition, if the physician extender assumes some of the nonreimbursable physician services (e.g., telephone consultation, prescription refills), that frees physician time to provide reimbursable services. Therefore, in the majority of cases (no price change or modest price change), the physician extender's income generation potential is enhanced by the fact that additional reimbursable services are being provided and that prices may be excessive in relation to the costs of physician/physician extenders practices. Whether the introduction of physician extenders might cause fees to increase less rapidly, thus leading to a relative decline in prices, has not been examined.

There is little reason to expect physicians to charge a lower price for physician extender services or to reduce their fees if the use of physician extenders leads to a reduction in physician time required per patient visit. There is no incentive for physicians to do so. Bicknell, et al., write (9):

> On grounds that they bear ultimate responsibility, most U.S. physicians employing assistants expect to continue receiving their customary fees from all patients, including those examined and treated by the assistant. The result betrays the promise of primary care assistants. Instead of bringing a reasonable dimension to primary care costs, inadvertently the assistants may maximize the worst in the fee-for-service system . . . .

Berki (7) argues that current fee levels do not reflect physician time inputs, citing a study by Schonfeld, et al. (83) that found office visit fees to be significantly higher than could be justified by the value of physician time devoted to such visits. Berki also describes the possible dilemmas of fee differentiation. While physicians could achieve financial benefits from the employment of NPs, even if they received a lower fee for NP services, the incentive to incorporate this innovation into their practices diminishes with any reductions in NP revenue-generating potential. Such fee differentiation also might engender resistance among patients who view the lower price of NP services as a signal that care provided by NPs is of lower quality than that rendered by physicians.

With current physician pricing behavior, NPs are not only a cost-effective addition to their practices, but often a profitable investment for the physician. NPs' income-generation potential gives the physicians more flexibility in maximizing their combined income and leisure objectives. Table 9 illustrates the physician's ability to work less time after employing a physician extender while suffering no loss in income. Rather than working less time and maintaining their incomes, physicians could choose to increase their incomes by maintaining their previous level of effort and by generating even more revenue from an increased volume of patients. This alternative appears to be much more prevalent (103). Most studies of revenue generation and profitability found higher expenses

Table 9.—Physician Time Input and Income With and Without Employment of a New Type of Health Manpower (NTM)

	No NTM	One NTM employed
Physician practice hours/week	60	60
Weeks/year	50	46.7
Office vists/week	120	150
Visits/year	6,000	7,000
Fee/visit	$10	$10
Fee/volume/year	$60,000	$70,000
Market cost/NTM		$10,000
Income/year	$60,000	$60,000

SOURCES: Berki, "The Economics of New Types of Health Personnel," in *Intermediate-Level Health Practitioners*, V. Lippard and E. Purcell (eds.) (New York: The Josiah Macy, Jr. Foundation, 1973).

for practices incorporating physician extenders than for physician-only practices, but also found physician/physician extenders' revenues to be sufficiently higher to show greater profits (21,4O,65,66,8O,81,86,1O8).

The amount of profit realized through the employment of NPs varies considerably among practices. In a separate study of 26 NPs in pediatric practices reported in 1972 by Yankauer, et al. (108), average annual gross revenues generated by the NPs exceeded their expenses by an average of $2,500. In a study of pediatric NPs in 1969, Schiff, et al. (81) found that the NP generates net revenues of about $6,000 after 1 year of practice. Schwartz (86) examined the revenue-generating experiences of three different types of practices employing NPs in California. He found that the average annual net revenue of an NP in a rural solo private practice in 1974 was $18,653, resulting in an increase by more than one-third in the employing physician's income. Kane, et al. (40) found that the higher profits earned by physician/Medex practices were in part due to the physician's being relieved by the Medex to spend time on more highly remunerative activities, such as specialized procedures and inpatient care. Even with limited third-party reimbursement for physician extender services, only one major study cited this as a financial problem for physicians employing NPs (93).

From the physician's perspective, the NP is a cost-effective addition to the practice. The fact that the financial benefits gained from the use of NPs are not passed on to consumers is well documented. As noted earlier, the potential increase in income afforded the physician by the NP is a major incentive for NP employment. Given that income increases are usually the result of expansion in the volume of patient visits, consumers may benefit from improved access to services. While this has been the experience of practices in areas with few available health resources, it is unwise to assume that increased volume, regardless of its character, generally leads to improved access.

Finally, the price effects of physician extender employment in organized systems with capitation should be treated separately. The productivity gains from physician extender employment are likely to result in cost savings in such systems. Given that they provide specified services in return for monthly cavitation payments, such organizations may choose to expand their scope of benefits or increase physician salaries or leisure rather than to pass the savings to the consumer in the form of reduced premiums. Which action such organizations choose depends on how they assess their competitive advantage over similar practices in the area and standard insurance carriers (7).

Medical Care Expenditures

Practices employing physician extenders generally see more patients than those without physician extenders, increasing volume by as much as 50 to 60 percent (18). Prices charged for services in physician/physician extender practices do not differ significantly from physician-only practices even though average per-visit practice expenses tend to be lower. Given current employment and pricing patterns, NPs and PAs do increase medical expenditures beyond the expenditures that would have occurred without them. Because of their small numbers (physicians outnumber physician extenders by 18 to 1), physician extenders' current impact on total expenditures is marginal. If physician extenders were slated to play a substantially larger role, with no other changes, in the current health services delivery system, their impact on overall medical expenditures would grow.

CBO estimated that in 1977 medical expenditures for practices employing physician extenders were 19 to 24 percent higher than those for practices without physician extenders (see table 10). If 50 percent of physician practices employed physician extenders, extrapolation of current trends for both pricing and patient volume increases would result in at least a 10-percent increase in total expenditures related to physician practices, Given the expanding supply of physicians, it is uncertain whether the increase in volume of patient visits required to support this higher number of physician/physician extender practices is possible.

Table 10.—Impact of Physician Extenders on Prices, Patient Volume, and Expenditures

	Average per visit price index	×	Total average annual patient volume index	=	Total expenditure index
Before physician extender	1.00		1.00		1.00
After physician extender	0.79[a]		1.50-1.57[b]		1.19-1.24

[a]Derived from data in System Sciences, Inc., *Survey and Evaluation of the Physician Extender Reimbursement Experiment*, final report, March 1978.
[b]University of Southern California, *Collection and Processing of Baseline Data for the Physician Extender Reimbursement Study*, August 1978.

SOURCE: Congressional Budget Office, U.S. Congress, *Physician Extenders: Their Current and Future Role in Medical Care Delivery* (Washington, D.C.: U.S. Government Printing Office, April 1979).

Total expenditures associated with physician extenders must include training expenditures, much of which are subsidized with public funds. The costs of physician extender training are substantially lower than those for physician training. To the extent that physician extenders substitute for physicians, and that substitution is reflected in the respective numbers of physician extenders and physicians trained, the lower physician extender training costs could reduce total training expenditures. For now, the extension of public support for physician extender programs means an increase in public expenditures for health professions training. Since the potential savings from this public investment are not passed on to the consumer, medical care expenditures also are inflated by the introduction of physician extenders.

The increase in medical care expenditures associated with physician extenders may be outweighed by the benefits their presence brings through increased access. In a recently reported survey, 57 percent of physicians who employ NPs cited the extension of services to more people as the NP's major contribution to medical services delivery (55). Improved access occurs not only as the result of the general increase in volume of patient visits in practices with NPs, but also because NPs tend to serve more low-income and nonmetropolitan patients who traditionally have had diminished access to physicians (61,98). NPs in underserved areas can free overextended physicians to focus on complex medical problems and consultant services (104). Furthermore, with the NP to provide followup, such physicians can discharge hospital patients sooner (91). Improved access to primary care services may reduce expenditures for costly specialized services and hospitalization. To the extent that NPs contribute to the expansion of primary care services, the increase in expenditures accompanying their use could be offset by such savings.

Cost Effectiveness: Actual or Potential?

That individual NPs can be cost effective is documented in numerous studies. Generalizing that experience to the total NP or physician extender population or basing future projections on individual experiences is more difficult. Although the number of physician extenders *is* expected to more than double in the next decade (see table 11), physicians will still outnumber physician extenders by 10 to 1.

Table 11.—Current and Projected Supply of Active Physician Extenders, 1979 and 1990

Type of physician extender	1979	1990[a]
PAs and Medex	9,400	23,900
NPs	12,700	32,300
Total	22,100	56,200

[a]Both the 1979 estimates and the 1990 projections were adjusted by the number of physician extenders expected to be inactive as a physician extender. Further, CBO projections assume that approximately 1,500 PAs and Medex, and about 2,000 NPs will graduate annually through 1990; that losses due to retirement will be negligible; and that losses due to death are similar to mortality rates for the population as a whole. Current levels of Federal assistance to physician extender programs are also assumed to continue.

Data Sources
1979 estimates derived from 1978 data supplied by Health, Education, and Welfare, Health Resources Administration, Bureau of Health Manpower, Division of Nursing, and the National Academy of Physician Assistants.
Projections to 1990: Congressional Budget Office (CBO).

SOURCE: Congressional Budget Office, U.S. Congress, *Physician Extenders: Their Current and Future Role in Medical Care Delivery* (Washington, D.C.: U.S. Government Printing Office, April 1979).

Given the nature of the U.S. health care system and realistic expectations for future structural change, it is uncertain how many NPs and PAs will find employment commensurate with their training and whether society will benefit from their cost-effectiveness potential. In their longitudinal study of NPs, Sultz, et al. (99) found that only 50 percent of employed NPs functioned purely as NPs (see table 12). Others were either performing mixed functions or providing only traditional nursing services. It must be noted that this study was based on 1974 data, thus reflecting the early experience of NPs. Many master's students at that time were faculty in schools of nursing preparing to teach in NP programs. This, in part, may explain the seemingly low percentage of NPs functioning full time in the NP role. Data on more recent experience are essential in order to more accurately estimate the education costs of one fully functional NP, the increased availability of NP services resulting from additions to the supply in the field, and the prospects for future employment. Given their small numbers and current employment experience, the total impact of physician extenders, even if beneficial, will be modest.

The structure of the U.S. health care system is often cited as the major factor inhibiting the achievement by NPs of their full potential. According to Bicknell, et al. (9), the "hospital-based, specialist-intensive, resource-rich" system is incompatible with primary care practice and resistant to innovations that augment primary care capacity. Patterns of financing that cover the costs of an inefficient delivery process, medical education that discourages delegation of patient responsibility, and the prominent role of physicians in defining the boundaries of practice for other health professionals inhibit the growth and efficient utilization of a profession that may invade territory traditionally confined to physicians.

Within the existing structure, incentives to employ NPs vary according to practice arrangement, physician payment mechanisms, and budget constraints. In general, the financial incentive for physicians in private practice to hire an NP or PA is diminished, because physicians earn high incomes and are not constrained by competitive market forces to produce services in the most cost-effective manner. On the other hand, employment of physician extenders can offer attractive benefits to physicians. Physician extenders allow physicians to expand their practices to improve patient access and increase income. They provide the physician an opportunity for more leisure time or a more leisurely work pace. Finally, many physicians who employ physician extenders stress their contribution to upgrading the quality and comprehensiveness of care provided by their practices (90).

Multiple considerations enter into the decision to hire a physician extender. The physician must be convinced that sufficient demand exists for the planned expansion in patient volume. Smith **(90)** cautions, "If the present hindrances of access to medical care are, as some have suggested, merely geographical, we might have the ironical situation of there being no physician to hire the practititioners where they are needed and no need for them where there is a physician to hire them. " Legal and reimbursement policies must not constrain physician extenders' potential to meet the physician's expec-

table 12. —Employed Graduates of NP Programs by Role and Type of NP Program

	Type of program					
	Certificate		Master's		Total	
Role	Number	Percent	Number	Percent	Number	Percent
NP role only	257	55.2°10	67	35.8%.	324	49.70/0
Traditional nursing role only,	51	11.0	71	38.0	122	18.7
NP role and traditional nursing role,	157	33.8	49	26.2	206	31.6
Totala	465	100.0 "/0	187	100.0%	652	100.0%

[a]One employed graduate of a certificate program and one employed graduate of a master's program did not classify themselves as to role

SOURCE H A Sultz, et al *Longitudinal Study of Nurse Practitioners, Phase II* DHEW publication No (HRA) 78-92 (Washington, D C DHEW, September 1978)

tations. Physicians with minimal experience in task delegation may not feel comfortable using physician extenders in the manner required to benefit fully from their employment. Some initial investment for salary and perhaps additional overhead accompanies the introduction of the physician extender into the practice. Sultz, et al. (98) reported that 92 percent of physicians employing NPs thought the benefits of their employment outweighed the costs. For the physician contemplating whether to hire, the incentives also must seem to outweigh the risks.

The rapid expansion in medical school enrollments and projected increases in physician supply add a new dimension that may overshadow other factors influencing physician extenders' employment opportunities. Physician supply is growing and there are thousands more in the educational pipeline who must be absorbed into the system. The effects of this increase in physicians are now only being contemplated, but they could be profound. Among them could be a restriction in employment opportunities for NPs and PAs. Some argue that NPs will fare better because of their nursing background and scope of practice (18). Regardless, there are already signs that physicians, particularly specialists, are redefining the scope of their practices in response to diminished numbers of patients requiring their specialized skills. Aiken, et al. (3) recentl$_y$ concluded, "Despite the current shortage of generalist-physician services, continuing specialist participation in primary care will lead to sufficient generalist medical services by the mid-1980' s." Physicians may be recapturing primary care responsibilities that not so long ago they considered delegating. Moreover, it has been suggested that practicing physicians who perceive this oversupply may hire young physicians to perform the tasks that physician extenders can handle (64).

Organized settings that operate on fixed budgets (prepaid group practices and some clinics) have a much greater incentive to employ NPs and PAs. It is to their financial advantage to produce services with the most efficient combination of inputs, substituting lower priced physician extenders for higher priced physicians whenever possible. Such organizations will display more efficient staffing patterns unless they are able to pass through the costs of more inefficient personnel configurations to third-party payers who reimburse on a cost basis. The value such organizations place on physician extenders is reflected in the fact that half of all PAs and 80 percent of all NPs are employed in organized settings (18). Future changes in practice arrangements and the preferences of new physicians toward entering organized practice settings or private practice, therefore, will have an impact on future opportunities for physician extenders.

Prepaid group practices (PPGPs) have perhaps the strongest incentive to employ physician extenders. Operating revenues derive from fixed cavitation payments for plan enrollees. The PPGPs seek to minimize expenses in relation to revenues by using more cost-effective means of achieving comparable outcomes. This includes the substitution of NPs and PAs for physicians wherever possible. While they have yet to follow their own maximum substitution models, HMOS, the prototype PPGP, are leaders in employing physician extenders and conducting research on their actual and potential utilization (33,69, 71,94). CBO reported that in 1977 HMOS provided care to their members with an FTE of 0.44 physician extenders for each physician, as opposed to 0.07 physician extenders for each office-based physician in the United States (18).

HMOS have the advantage of greater flexibility in modifying personnel arrangements to gain the benefits from substitution. Physicians in private practice, beyond fulfilling their objectives for leisure time, are unlikely to reduce their time inputs to achieve a more efficient operation. Where physicians are salaried employees, however, the efficiency objectives of the employing organization may lead to a reduction in their time, numbers, or income. In line with the HMOS' incentive to minimize total salaries, Greenfield, et al. (33) report on the effects of an experimental physician extender protocol system introduced at the Southern California Kaiser-Permanente Facility and the adaptation of the organization to a more cost-effective model. Before the study, 10 physicians and 3

physician extenders saw 2,700 patients per month, 70 percent of whom had acute illness. Two years after the study, 6.5 physicians and 6 physician extenders saw 2,900 patients per month, 70 percent of whom had acute illnesses.

The use of NPs and PAs results in productivity gains and cost reductions. Yet, their future participation in medical care delivery is uncertain. Available evidence indicates that physician extenders' incorporation into organized settings, particularly HMOS, has contributed to more cost-effective service delivery. However, the experience in private physician practices is less promising. Demand for physician extenders in that setting has been limited. Although the public benefits from increased availability of services, the cost effectiveness of physician extenders in such settings has not reduced prices. Moreover, since most physician extenders are employed in organized settings, employment opportunities are limited by the fact that the majority of physicians are in the private practice, fee-for-service sector.

Government subsicly of NP and PA training has not been accompanied by policies to ensure the promise of these health professionals once they are in practice. Moreover, policies that may inhibit the use of physician extenders, such as those supporting expansion in physician supply, have been enacted simultaneously with policies encouraging their development. Changes could be made-short of a national health insurance scheme with incentives to restructure health services delivery—that would facilitate the efficient use of physician extenders. Modifying current reimbursement policies to compensate for physician extender services in a manner that reflects their lower costs would affect prices, although it might also reduce opportunities for physician extender placement in physician private practices. Opportunities for NPs to practice more independently through removal of legal and reimbursement constraints could provide consumers with a lower cost alternative for receiving the primary care services that both physician extenders and physicians can provide. The expansion of PPGPs and other medical care organizations that operate on fixed budgets would provide more employment opportunities for physician extenders in settings that use them more efficiently, As Berki argues (7):

> Where medical care is provided by hierarchical organizations on a cavitation basis, both service expansion and price reduction are likely. Thus, not only is effective use of new types of health manpower enhanced by the structural characteristics of hierarchical organizations, but also the gains flowing from their employment are less likely to accrue to the providers, and the more likely it is that consumers will benefit by increased availability of services at lower prices.

In evaluating the role of physician extenders, it is insufficient to assess their cost effectiveness without also looking at who gains from the savings. Are the financial benefits of lower training and employment costs to be shared with the public or reaped only by providers? Under the current fee-for-service system, are the modest salaries of physician extenders exploitative, given their income-generation capacity? The organization and financing of health services in the United States encourage inefficiency in the delivery of medical care. Reforms that would optimize the efficient use of physician extenders have implications for the cost effectiveness of other components of the system. Physician extenders can be integrated into the existing system, as they have for the past decade, with perpetuation of existing inefficiencies. From a public policy perspective, it must be asked whether improved access, resulting from employment of physician extenders, but unaccompanied by 1ower prices, is worth the further inflation in medical care expenditures. This is the choice as the system currently functions. Given the overriding concern for containing health care costs, an assessment of NPs and PAs should consider not only their performance within the constraints of the current system, but also their potential role in an integrated strategy of reform to meet public policy objectives.

APPENDIX: BACKGROUND INFORMATION ON PHYSICIAN EXTENDERS

Training

Although physician extender training existed on a very limited scale as early as the 1930's, the major thrust in training both NPs and PAs in the United States began in 1965 (5). Duke University established the first primary care PA training program. PAs generally receive 2 years of academic and clinical training in a medical school setting. Although postsecondary education or previous experience in a health profession is not specifically required, most PAs have had 3 or more years of college-level education or several years' experience in a related health field such as medical technology, physical therapy, or vocational nursing. While the initial intention of PA programs **was** to provide training in primary care, about half of all PAs now specialize in other fields such as ophthalmology, urology, orthopedics, internal medicine, and other medical and surgical subspecialties (46).

Medex often are considered in the same category as PAs because they practice under the same legal authority and receive similar preparation. Medex training was conceived as a way to allow former military corpsmen to apply their skills to rural medical practice. The first training program was established in 1969 at the University of Washington. Medex receive 15 months of training, including preceptorship, often with rural physicians. Unlike PAs, Medex are trained almost exclusively in primary care.

The concept of expanded function nursing grew out of a program to train nurses to become pediatric NPs at the University of Colorado in 1965 (49). Also referred to as nurse clinicians, nurse associates, clinical nurse specialists, or nurse generalists, these individuals all belong to the general category known as NPs, The NP receives additional training beyond that required for an RN license[3] in a particular specialty such as pediatrics, family practice, maternity, adult practice, or psychiatry. There are two types of training programs: those that offer an NP certificate and those that award a master's degree. Table A-1 shows the distribution of different NP training programs by both specialty and type of degree offered.

Until standardization of the length of NP certificate programs to 1 year in the Nurse Training Act of 1976, NP training varied between master's and certificate programs as well as among specialties. Master's degree programs require a previous baccalaureate RN license and, on average, require more than a year of training; certificate programs are now 1 year in length. Table A-2 shows the average length of different NP training programs.

Legislation Supporting Physician Extender Training

Federal support for physician extender training was limited before 1970. Some early NP training programs received assistance through special project grants provided under the Nurse Training Act of 1964 (Public Law **88-581)** and, later, title 11 of the Health Manpower Act of 1968 (public Law 90-490) (103). The National Center for Health Services Research funded the first Medex training program at the

[3]Three types of nursing education lead to an RN license: 2-year community college programs; 3-year hospital-affiliated diploma programs; and 4-year baccalaureate degree programs. As a reflection of a trend to make nursing education more academically based and uniform in nature, hospital diploma programs are being gradually discontinued in many parts of the country.

Table A-1 .—NP Programs by **Specialty and Type of Program**

	Type of program					
	Certificate		Master's		Total	
Specialty	Number	Percent	Number	Percent	Number	Percent
Pediatric	42	48.8 "/0	'8	17.8°\o	50	38.2-0/0
Midwifery	5	5.8	6	13.3	11	8.4
Maternity	7	8.1	7	15.5	14	10.7
Family	17	19.8	12	26.7	29	22.1
Adult	15	17.5	8	17.8	23	17.6
Psychiatric	—	—	4	8.9	4	3.0
Total	86	100.0°/0	45	100.OYO	131	100.0°/0

SOURCE: H. A. Sultz, et al., *Longitudinal Study of Nurse Practitioners: Phase I*, DHEW publication No. (HRA) 76-43 (Washington, D.C.: DHEW, March 1976).

Table A-2.—Average Length and Range in Months of NP Programs by Specialty and Type of Program

Type of program/ specialty	Average length (in months)	Range (in months)
Certificate		
Pediatric	7.9	4-24
Midwifery	9.0	7-12
Maternity	5.9	3-10
Family	11.1	3-18
Adult	8.3	3-16
Total	8.5	3-24
Master's		
Pediatric	16.4	12-20
Midwifery	17.0	10-21
Maternity	14.1	11-18
Family	14.7	12-18
Adult	14.8	12-18
Psychiatric	15.8	12-20
Total	15.3	10-21

SOURCE: H. A. Sultz, et al., *Longitudinal Study of Nurse Practitioners: Phase I*, DHEW publication No. (HRA) 76-43 (Washington, D.C.: DHEW, March 1976).

University of Washington. By the late 1960's, PA training programs were receiving funding from a variety of Federal sources, including the Office of Economic Opportunity, the Model Cities Program, the Veterans' Administration, the Public Health Service, the Department of Defense, and the Department of Labor (52). However, most physician extender training programs during this period depended on institutional or private resources.

In the early 1970's, the Federal Government became more interested in the potential of physician extenders to address health manpower problems. Increasing concern over rising costs and the continued shortage of physicians in primary care was reflected in two major pieces of legislation aimed specifically at increasing the number of NPs and PAs. The Comprehensive Health Manpower Act of 1971 (Public Law 92-157) provided the first large Federal provision for NP and PA training programs (35). The Nurse Training Act of **1971** (Public Law **92-150)** provided broadened authority for special project grants and contracts including support for training programs for NPs **(99).** Passage of the Nurse Training Act of 1975 further reinforced the Federal commitment by establishing a new, separate section for support of NP training. Further, in 1977, the Health Professions Educational Assistance Act of 1976 (Public Law 94-484) was amended by the Health Services Extension Act (Public Law 95-83) to provide additional grants and contracts for physician extender training programs (64). Although the Nurse Training Act of 1975 and the Health Professions Educational Assistance Act of 1976 authorized traineeships for NPs, no funds were appropriated for this purpose.

Over the last 10 years, the Federal Government has spent $65 million to train physician extenders. Appropriations rose from $1 million in fiscal year 1969 to more than $21 million in fiscal year 1979 (20).[4] It appears that support for NP training continues as of this writing. While President Carter vetoed the Nurse Training Amendments of 1978 as being too inflationary, the administration made special note of the fact that NP programs would still receive funding under a continuing resolution and therefore would not be jeopardized by the veto.

Although the Federal investment has been substantial, many physician extender training programs, especially NP programs, operate without Federal assistance. Some 60 percent of NP training programs and 10 percent of PA training programs currently do not receive Federal support (18). The remainder rely on institutional sources, private foundations, or funding from the States. In California, for example, funds are provided through the Song-Brown Family Physician Training Act of 1977 to a number of physician extender training programs in the State which train NPs and PAs to work in teams with family practice residents (70).

Location Patterns

The location patterns of physician extenders show that physician extenders have been more responsive than physicians to underserved populations. As shown in table A-3, Sultz, et al. (100) found that one-third of NPs are employed in inner-city settings and another 17 percent are in rural areas. Data compiled by CBO indicate that 34 percent of PAs, 24 percent of NPs, and 57 percent of Medex practice in nonmetropolitan areas (18). By comparison, only 14 percent of physicians are located in such areas.

Since physician supervision is a legal requirement of physician extender practice, their presence in underserved areas depends not only on their willingness to locate in these settings, but also on the availability of physicians in such areas. As a result, many areas without physicians may be unable to benefit from physician extender services. As noted by CBO, only 30 percent of physician extenders are practicing in areas designated by the Department of Health, Education, and Welfare as physician shortage areas (18).

[4] In fiscal year 1979, $12 million was given to NP training programs and $9 million to PA training programs. Funding for NP training has risen steadily, but appropriations for PA training have remained at $9 million for the last several years (32).

Table A-3.—Practice Setting Location of NPs by Type of NP Program[a]

Practice setting location	Type of program: Certificate Number	Certificate Percent	Master's Number	Master's Percent	Total Number	Total Percent
Inner city	126	31.40/0	41	42.4°10	167	33.6°\o
Other urban	65	16.3	24	24.7	89	17.9
Suburban	35	8.8	11	11.3	46	9.3
Rural	77	19.3	7	7.2	84	16.9
Combination.	16	4.0	3	3.1	19	3.8
OtherC.	81	20.2	11	11.3	92	18.5
Totald	400	1 00.0°/0	97	1 00.0°/0	497	1 00.0°/0

[a]NPs for this presentation are those providing primary care.
[b]*Combination* includes two or more of the selected setting locations.
[c]*Other* includes military installations, Veterans Administration hospitals, college/university campuses, Indian reservations, religious communities, and construction sites.
[d]Three NPs completing certificate programs did not supply information on practice setting location.

SOURCE: H. A. Sultz, et al., *Longitudinal Study of Nurse Practitioners. Phase II,* DHEW publication No. (HRA) 78-92 (Washington, D.C.: DHEW, September 1978)

The tendency of NPs to locate more often in inner-city areas may be partially explained by the fact that NP training programs are largely based in urban centers (see table A-4). Moreover, most nurses, who comprise the applicant pool for NP programs, are employed in metropolitan areas initially and thus are more likely to remain there (18).

Table A-4.—NP Programs by Availability of Inner City and/or Rural Practice Setting and Type of Program

Practice setting available	Type of program: Certificate Number	Certificate Percent	Master's Number	Master's Percent
Inner city	39	45.3%	23	51.1%
Rural	5	5.8	3	6.7
Inner city and rural	36	41.9	18	40.0
Neither[a]	6	7.0	1	2.2
Total	86	100.0%	45	100.0%

[a]*Neither* was not specified.

SOURCE: H. A. Sultz, et al., *Longitudinal Study of Nurse Practitioners: Phase I,* DHEW publication No. (HRA) 76-43 (Washington, D.C.: DHEW, March 1976)

In the past, it has been difficult for many underserved areas to attract and maintain physicians. However, practice in these areas may have special advantages for physician extenders. One study of **85** NPs in rural areas (97) showed that **40** percent chose rural practice because it "offered a creative approach to health care delivery." Another **25** percent were in rural settings because of "the opportunity for role autonomy." Both of these responses can be interpreted as reflections of the inadequacy of physician supply in relation to consumer needs. What may be defined by physicians as problems of rural practice may instead present themselves as opportunities for physician extenders which may not be available in areas with an adequate or excess supply of physicians (8,15,37,73,97),

Several training programs have been developed specifically to prepare NPs to practice in underserved areas. One of the largest such programs in the country is the FamiIy Nurse Practitioner Program at the University of California. Students in this program are recruited from rural areas and trained with a self-selected physician preceptor in a rural practice. Administrators of the program feel that this system has helped to promote a positive relationship between physicians and NPs and to encourage their further use in rural areas (88). Other institutions, including the University of North Carolina and the University of Minnesota, operate similar training programs which place NPs in Area Health Education Centers and other rural health clinics in their States **(28).** In Kentucky, the Frontier Nursing Service trains nurse-midwives and family NPs to provide services to rural areas of southeastern Kentucky and is the only available source of primary care to most residents in this area (62). These programs have succeeded in placing and maintaining a high percentage of their graduates in rural areas.

The practice location of NPs varies by both their specialty and type of training program from which they graduated. The specialties most likely to be represented in inner-city locations are pediatrics, midwifery, and maternity, while family NPs are the most likely to be represented in rural areas (see table A-5). Moreover, a larger percentage of practitioners from certificate programs (19 percent) than graduates of master's degree programs (7 percent) is in rural areas.

Although physician extenders have made their presence known in underserved communities, and, as

Table A-S.—Practice Setting Location of NPs by Specialty and Type of NP Programa

Type of program/practice setting location	Specialty													
	Pediatric		Midwifery		Maternity		Family		Adult		Psychiatric		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Certificate														
Inner city. ., .,	70	41.1 0/0	3	33.4%	8	32.0%	28	27.5 %	17	18.1%	—	—	126	31 .40/o
Other urban. . . .	28	16.5	2	22.2	10	40.0	14	13.7	11	11.7	—	—	65	16.3
Suburban.	20	11.8	1	11.1	1	4.0	5	4.9	8	8.5	—	—	35	8.8
Rural . . .	26	15.3	2	22.2	4	16.0	29	28.4	16	17.0	—	—	77	19.3
Combinatlonb.	11	6.5	—	—	—	—	5	4.9	—	—	—	—	16	4.0
Other c	15	8.8	1	11.1	2	8.0	21	20.6	42	44.7	—	—	81	20.2
Total. . . .	170	100.0	9	100.0	25	100.0	102	100.0	94	100.0	—	—	400	100.0
Master's														
Inner city. .	3	42.80/0	12	48.0%	3	75.0%	16	36.3%	7	50.0%	—	—	41	42.4%
Other urban, .,	1	14.3	6	24.0	1	25.0	12	27.3	4	28.6	—	—	24	24,7
Suburban.	1	14,3	3	12.0	—	—	5	11.4	—	—	2	66.7 %	11	11.3
Rural . . ., . .	1	14.3	—	—	—	—	3	6.8	2	14.3	1	33.3	7	7.2
Combinationb.	—	—	2	8.0	—	—	1	2.3	—	—	—	—	3	3.1
Other c.	1	14.3	2	8.0	—	—	7	15.9	1	7.1	—	—	11	11.3
Total.	7	100.0	25	100.0	4	100.0	44	100.0	14	100.0	3	100.0	97	100.0
Totald														
Inner city, . . .,	73	41 .2'70	15	44.1%	11	37.9%	44	30.2%	24	22.2%	—	—	167	33.60/'
Other urban. , . . .	29	16.4	8	23.5	11	37.9	26	17.8	15	13.9	—	—	89	17.9
Suburban.	21	11.9	4	11.8	1	3.4	10	6.8	8	7.4	2	66.70/0	46	9.3
Rural	27	15.3	2	5.9	4	13.9	32	21.9	18	16.7	1	33.3	84	16.9
Combinationb.	11	6.2	2	5.9	—	—	6	4.1	—	—	—	—	19	3.8
Otherc . . .	16	9.0	3	8.8	2	6.9	28	19.2	43	39.8	—	—	92	18.5
Total. ., . . .,	177	"100,0	34	100.0	29	100.0	146	100.0	108	100.0	3	100.0	497	100.0

[a]NPs for this presentation are those providing primary care.
[b]*Combination* includes two or more of the selected practice setting locations
[c]*Other* includes military installations, Veterans Administration hospitals, industry, college university campuses, Indian reservations, religious communities, and construction sites.
[d]Three NPs completing certificate programs did not supply information on practice setting location.

SOURCE: H. A. Sultz, et al., *Longitudinal Study of Nurse Practitioners: Phase II,* DHEW publication No. 78-92 (Washington, D.C.: DHEW, September 1978).

a group, they seem most easily attracted to these areas, it should not be assumed that this trend will continue indefinitely. As noted earlier, under current legal arrangements, physician backup must be available to physician exterders. It is uncertain how many physician extenders can be absorbed in underserved areas given this constraint. Also, until now, many rural practices have been supported by Federal and State funds. If these resources evaporate in the future, such rural practices would have to become financially self-sufficient in order to retain existing personnel or to employ new personnel. A study of physician extender practices in rural communities in California has shown that freestanding rural practices can become financially viable with continued Federal and State support (31). But without such support or third-party reirnbursement, economic viability is much less likely **(63).**

Physician and Consumer Acceptance

From the beginning, physician and consumer acceptance of NPs has been a major issue. The widespread use of NPs depends on the willingness of physicians to hire them and patient receptiveness to the kinds of services they provide, particularly in private physician practices.

Current Federal reimbursement policies, which do not include payment for services provided by physician extenders, serve as a disincentive for physicians to employ physician extenders. Among the other reasons most frequently cited by physicians for not hiring NPs are legal restrictions, limitations on space or facilities, and resistance from other health providers (100). Concerns about liability and malpractice coverage also may discourage physicians from hiring NPs **(45,56,107).** However, the use of NPs also provides advantages for physicians to expand the number of patients in their practices, increase their income, broaden the scope of their services, or acquire more flexibility with their time. Physician extenders may be useful particularly to rural physicians, who, because of their fewer numbers, must see considerably more patients and work longer hours than their urban counterparts **(46).**

The Institute of Medicine (IOM) reported on a series of studies in the last decade which attempted to document both physician approval of the concept of NPs and physician willingness to hire them **(77).** While the findings varied significantly among the

studies, the general pattern showed that physician approval of the concept of NPs often was not accompanied by a willingness to hire them. While one survey cited by IOM found that as many as 70 percent of physicians would hire an NP (67), most others found considerably lower interest. For example, Lawrence, et *al.* **(45)** found that only 24 percent of those surveyed would hire an NP, although 86 percent expressed approval of the concept (45).

Physician attitudes toward NPs are perhaps more strongly influenced by their medical education experience than any other single factor. Medical education does not encourage delegation of patient-care-related tasks to nonphysicians and emphasizes ultimate physician responsibility in all aspects of care. Physicians may feel that by using NPs they will sacrifice quality of care and important elements of the physician-patient relationship. As a result, physicians may be particularly reluctant to delegate tasks to a large degree or to accept the NP as a professional colleague (19,96).

In its review of studies on task delegation, IOM concluded that while physicians who employed NPs were satisfied with their performance, they were "more disposed to delegate duties that are in the realm of nursing practice and not in the realm of medical practice" (105). While confident of the NP's ability to take medical histories, provide counseling, and perform other routine tasks relating to primary care, many physicians express hesitation in allowing NPs to perform physical examinations or other more technical procedures. In the past, pediatricians have been the most receptive to NPs functioning in an expanded capacity, but the recent increase in the number of pediatricians and pediatric NPs, combined with the declining birth rate, may alter this pattern in the future (1).

Because exposure to team practice is a recent and still limited innovation in medical education, older physicians (particularly those in long-standing solo private practices) are somewhat less likely than younger ones to be receptive to NPs, Physicians in group practices generally are more willing to employ NPs than solo practice physicians. Several explanations are offered for this pattern, including the suggestion that members of group practices are more familiar with team practice and more willing to delegate tasks to gain time for other professional activities or for leisure (45,54).

Because of the reluctance of physicians in private practice to employ NPs, most NPs practice in organized settings. As seen in table A-6, only 14.2 percent of NPs surveyed by Sultz, et al. (100) were employed in private physician practices.

Consumer acceptance of NPs is essential to the integration of NPs into medical services delivery. The patient's confidence in the NP's professional competence, the quality of communication between patient and NP, and improved access to services due to NP participation in the practice are key factors in achieving consumer acceptance.

From the beginning, consumers have shown less resistance than physicians to NPs. Studies on consumer acceptance reviewed by IOM show that patients seem to perceive little or no difference between physicians and NPs once an ongoing relationship is established (76). In fact, several studies have found patients preferring NPs for many services previously provided by physicians **(41,48,53,57).** Other studies have reported that patients under the care of NPs broke fewer appointments and complied more strictly with prescribed treatments than those of physicians (14,51,81,85). NPs tend to spend more time per patient visit and place greater emphasis on counseling and education. These aspects of NP practice enhance their attractiveness to patients.

As with physicians, consumer acceptance of NPs increases with exposure to them. It is here that the physician plays a critical role. The patient often uses the physician's attitude toward the NPs as a signal to accept or reject NP services **(68).** Moreover, reports of experimental projects introducing NPs noted the necessity of assuring patients assigned to NPs that such assignment would not restrict their access to the physician. As a result, patient confidence in the availability of the physician was generally sufficient for them to receive the majority of their care from the NP (17).

Obviously, acceptance by physicians and consumers is just as great an issue for PAs as for NPs. Because of the differences in their training and skills, one group may be preferred by physicians in certain situations. Whereas the PA usually functions more directly with the physician or as a physician substitute, the NP may bring a broader spectrum of services to a practice. This is an area which has yet to be explored in depth.

Legal Restrictions

Since licensure is a State responsibility, each State has legal jurisdiction to regulate the practice of health professionals. As new professions emerge, they seek recognition by the State. In such instances, the State must act with little precedent or experience to guide its actions. The lack of uniformity in State *regulation* of NPs and PAs reflects their relatively recent introduction and the continued uncertainty about their appropriate role in health services delivery. Moreover, as pointed out by CBO (18), changes in medical practice legislation generally occur in consultation

Table A-6.—NPs by the One Employment Setting in Which They Spent Most of Their Time as NPs and Type of NP Program[a]

	Type of program					
	Certificate		Master's		Total	
Employment setting	Number	Percent	Number	Percent	Number	Percent
In-hospital practice	22	5.5%	13	13.4%	35	7.0%
Patient unit	17	4.2	12	12.4	29	5.8
Emergency room	5	1.3	1	1.0	6	1.2
Ambulatory clinical practice	248	61.5	69	71.2	317	63.4
Private practice	59	14.6	12	12.4	71	14.2
Prepaid group practice	15	3.7	5	5.2	20	**4.0**
Hospital-based clinic	75	18.6	27	27.8	102	**20.4**
Community-based clinic or center	98	23.1	23	23.7	116	23.2
Other ambulatory practice	6	1.5	2	2.1	8	1.6
Nonhospital institutional setting	80	19.9	1	1.0	81	16.2
School for mentally or physically handicapped	4	1.0			4	0.8
Grades 1-12, public school system	32	7.9			32	6.4
College health programs	43	10.7	1	1.0	44	8.8
Other non hospital institutional setting	1	**0.3**			1	**0.2**
Nonhospital community setting	42	**10.4**	8	8.2	**50**	**10.0**
Health department or home health agency	**40**	9.9	6	6.2	45	9.2
Social services or agency	**2**	0.5	1	1.0	3	0.6
Other nonhospital community setting	—		1	1.0	1	**0.2**
School of nursing	—		2	2.1	2	**0.4**
Extended care facility	4	**1.0**	3	3.1	7	**1.4**
Other[b]	7	1.7	1	1.0	8	**1.6**
Overall	403	100.070	97	100.070	**500**	**100.0%**

[a]NPs for this presentation are those providing primary care.
[b]*Other* includes industry, airport clinics, and faculty in an Air Force nurse midwifery program.

SOURCE: H. A. Sultz, et al., *Longitudinal Study of Nurse Practitioners: Phase II*, DHEW publication No. (HRA) 78-92 (Washington, D.C.: DHEW, September 1978).

with the medical profession. The requirements for physician supervision, restrictions on functions such as drug prescribing, and prohibition of independent practice all reflect the influence of organized medicine on this process.

In 1978, Miller and Byrne, Inc. (58) published a survey of State legislation governing the practice of NPs and PAs. Each State regulates NPs through the State's nurse practice act. In some States, NPs are able to practice without significant changes in existing statutes. Although they perform functions beyond that of traditional nursing, their expanded role is considered an extension of nursing allowed by the statute, rather than a significant departure requiring new regulations. In States that prohibited nurses from engaging in diagnosis and prescription of treatment, NPs could not practice without new statutory authority. The response of these States has been either to replace previous statutes with new definitions of nursing roles or to amend existing law to accommodate expanded role nursing. The response of some States has been to provide more open-ended authority in recognition of evolving nursing roles. For example, the California Nurse Practice Act states that nursing is "a dynamic field . . . which is continually evolving to include more sophisticated patient care, " and also recognizes "the existence of overlapping functions between physicians and registered nurses" and permits "sharing of functions"5 (58). While States have generally recognized the participation of nurses in activities previously restricted to physicians, they have maintained prohibitions against nurses functioning independently in the medical sphere.

The PA, unlike the NP, represented a new type of health professional previously not covered by State law **(58).** For this reason, new statutory authority was required in every State where PAs were allowed to practice. Initially, States responded by expanding physician delegator authority under the Medical Practice Acts to allow PAs to work under physician supervision. The majority of States, however, have

California Nursing Practice Act, ch 6, article 2, 1975.

enacted regulatory statutes giving the State board of medical examiners authority over training and employment of PAs. As with NPs, the laws regarding PAs tend to vary from State to State. For example, legislation in New Mexico, Ohio, and South Carolina contains extensive lists of specific medical tasks which PAs may or may not perform. In other States, such as Oregon, where the laws are much less explicit, the PA may perform whatever tasks are permitted by the supervising physician. There is also wide variation regarding the particular type of supervision required for PAs. Some States permit telephone consultation as a sufficient means of supervision while others also require the physician to establish written protocols and review all patient records on a regular basis. Very few States require direct "over-the-shoulder" supervision, but in remote areas where the physician and the PA may be in different locations, the physician is often required to regularly visit the facility where the PA works. When the Miller and Byrne study (58) was published, four States had no guidelines to regulate PAs.

The legal restrictions placed on NP and PA practice are a significant barrier to their integration into medical delivery. Such restrictions can make it impossible for physician extenders to practice at a level commensurate with their training. Moreover, the lack of uniformity in State laws limits the mobility of physician extenders. While all training programs must meet minimum standards for accreditation, the content of such programs tends to reflect the law of the States in which they are located. While an NP or PA trained in one State may be capable of performing authorized functions in other States, their specific training experience may not fulfill licensing requirements outside their State of training. Although this does not prohibit relocation, it does create a major disincentive. Moreover, since most physician extender training programs are concentrated on the east and west coasts, it may be difficult to achieve a distribution of graduates from areas where they were trained to other areas of the country where their services are most needed.

Reimbursement

Reimbursement remains a major obstacle to the expanded use of physician extenders. Insurers are generally reluctant to extend coverage to new service providers because of either legal restrictions or desire to control costs and to avoid encouragement of other health workers who provide similar services from seeking compensation (18,58). While some private third-party payers support the concept of reimbursement for physician extender services, virtually none provide payment.

Approximately half the States provide some type of reimbursement for physician extender services under their medicaid programs. In all cases, payment is made to the supervising physician or institution. Federal reimbursement under the medicare program has allowed institutions to include physician extender compensation in their calculation of reasonable cost for reimbursement purposes. Federal payments for primary care services provided by physician extenders, however, have been restricted by provisions enacted before these new professions were established. In most cases, services traditionally, performed by physicians are not reimbursable under Federal programs when provided by physician extenders **(64).** Under medicare part B, reimbursement for medical services rendered by physician extenders is restricted to those "furnished as an incident to a physician's professional services, of kinds which are commonly furnished in physicians' offices and are commonly either rendered without charge or included in physicians' bills" (213).[6]

In **1977,** the Rural Health Clinic Services Act (Public Law 95-210) waived such restrictions in the medicare and medicaid programs for physician extenders practicing in certified rural health clinics located in designated underserved areas. The Act provides payment for physician extender services even when not directly supervised by a physician at all times. This allows such clinics staffed only by physician extenders, with physician backup, to provide reimbursable primary care services to medicare and medicaid beneficiaries. Payment is on a reasonable cost basis and is restricted to those physician extender services authorized under State legislation. Because of variation in legal and reimbursement policies among States, the impact of Public Law 95-210 on each State will differ (105).

Changes in reimbursement policy, while significant, have come slowly and on a very limited basis. The result has been to tie physician extender practice to the supervising physician or institution. Because most physician extenders are currently employed in organized settings, reimbursement restrictions have not prevented the growth of their professions. Without expanded employment opportunities in physician private practices, however, physician extenders will not be able to assume an important role in medical

[6] Sec. 1861(s)(2)(A) of the Social Security Act, 42 U.S.C. sec. 1395 (s)(2)(A) 20 CRF 405-231(b)

care delivery. Current reimbursement restrictions make such an expansion unlikely. Modifications of current reimbursement policy could address this problem. A number of questions including the scope of services to be reimbursed, method of payment to physician extenders in physician offices, level of payment for services that both physician extenders and physicians can provide, payment levels in underserved v. adequately served areas, and the recipient of payment for physician extender services must first be resolved **(64).**

Practice With Physicians v. Independent Practice

The functions of NPs are directly influenced by their employment setting. NP training encourages independence, responsibility, and autonomy as important aspects of professional development. As a result, NPs generally prefer employment settings which offer increased self-sufficiency and greater decision-making responsibility in patient care. Organized settings tend to offer less opportunity to meet these expectations, but because such settings are more receptive to hiring NPs, the major portion of NPs are employed in them (1o00. NPs might prefer to work in physician private practices or in independent practices, but the opportunities to do so are limited. The major portion of physicians are in private solo or group practices, and yet a 1976 survey by Sultz, et al. (99) found only 14 percent of NPs employed in physician private practices. While the actual number of NPs in independent practice is not known, the American Nursing Association estimates that there are about 300 private independent NP practices (18).

For many NPs, employment in physician private practices presents several perceived advantages over less flexible institutional settings. In particular, group practices which emphasize a "team" approach seem to allow NPs increased participation in many aspects of practice (11,12), However, physicians may be discouraged from using NPs in their private practices because of legal restrictions or ambiguities and lack of third-party reimbursement for NP services, Also, the increase in the number of medical school graduates may further reduce physician interest in NPs or PAs.

The experience of NPs in physician private practices varies considerably, since the physician determines the exact nature of their responsibilities. In some situations, NPs may actively participate in diagnosis and treatment of illness, provide counseling and patient education, and perform a wide range of other duties. In other settings, however, the physician may be unwilling to delegate a broad spectrum of tasks, and the functions of the NP may be limited to more traditional nursing tasks (11,12).

As an alternative to their interest in employment in physician private practices, a small number of NPs have attempted to establish independent practices. There are many difficulties in undertaking such practices. Initially, an independent practice requires a substantial financial investment. Startup costs can be $15,000 or more, and the NP must be prepared to operate at a deficit until an adequate clientele can be developed (2). Moreover, since in the limited cases where third-party reimbursement is available for NP services, the payment is made to the supervising physician or institution, rather than directly to the NP, virtually all independent practices must rely on out-of-pocket payments from patients. As a result, very few independent practices have attained financial self-sufficiency. Those that have been successful usually have either been located in metropolitan areas or have provided a particular service not widely available otherwise in the community, such as home visits (2,110). However, more often NPs in private independent practice report that they must supplement their incomes through speaking engagements, teaching, and other nursing employment **(2,4, 6,23,95).**

In addition to serious financial problems, the appropriateness of independent practice by NPs is questioned by physicians, nurses, consumers, and policymakers. It has been noted that nurses may perceive NPs as taking on a more dominant role, similar to that of physicians, and therefore may be reluctant to support independent practice **(18).** In one study, **73** percent of nurses and 2 percent of physicians felt that the proper role for an NP is to practice with a physician (18). Since NPs' independent practices would depend on physician referrals to establish a clientele, the concerns expressed by physicians suggest that such referrals generally will not be forthcoming. Consumer reluctance to use independent NPs comes from inherent resistance to any new provider, from unfamiliarity with a nonphysician providing medical services, and because, when given the choice, many would continue to prefer a physician. Some independent NPs' practices have waited several months for their first patients **(87).**

Independent practices will not develop under existing characteristics of NP practice. As a result of current legal specification of the kinds of services NPs can perform without the supervision of a physician, the majority of NPs in independent practice provide traditional nursing care rather than primary medical care **(50).**

Since the introduction of NPs, there have been some changes in licensure laws to allow them to practice in a manner more commensurate with their training. NPs have sought statutory changes which would allow them to practice more broadly. In some cases, States have responded to these efforts (e.g., California recently acted to allow nurses to become members of a medical corporation). ' Whether or not policy makers agree on the degree of independence to be prescribed legally for physician extenders, a growing number support the position that reimbursement policies should be revised to encourage NP and PA employment. With the existing structure of health services financing and delivery and the recent vast expansion in physician supply, the number of NPs engaged in independent practice should be expected to remain very small. If any change in current practice patterns were to occur, it might entail efforts by NPs to move from institutional settings into physician private practices where ultimate authority would remain with the physician. Once again, however, with the growing supply of physicians, such employment opportunities for NPs may in fact diminish in the next decade.

California Statutes of 1979, ch. 472 (formerly AB1112, authored by assemblywoman Jean Moorhead).

REFERENCES

1. Adamson, T, E., and Highly, B. L., "Work Experience of Pediatric and Maternity Nurse Practitioner Graduates" (San Francisco: University of California, School of Nursing, August 1979).
2. Agree, B. C., "Beginning an Independent Nursing Practice," *Am. J. Nurs.* 74:636, 1974.
3. Aiken, L. H., et al., "The Contribution of Specialists to the Delivery of Primary Care, " N. Eng.], Med 300:1363, 1979.
4. Alford, D. M., and Jensen, J. M., "Reflections on Private Practice, " *Am.], Nurs.* 76:1966, 1976.
5. Appel, G., and Lowin, A., *Physician Extenders: An Evaluation of Policy-Related Research, Final Report* (Minneapolis: Interstudy, January 1975).
6. Archer, S. E., and Fleshman, R. P., "Doing Our Own Thing: Community Health Nurses in Independent Practice, "]. *Nurs. Admin. 8:44, 1978.*
7. Berki, S., "The Economics of New Types of Health Personnel, " in *Intermediate-Leuel Health Practitioners,* V. Leppard and E. Purcell (eds.) (New York: Josiah Macy, Jr., Foundation, 1973).
8. Bible, B. L., *Health Care Delivery in Rural Areas* (Chicago: American Medical Association, July 1972).
9. Bicknell, W. J., et al., "Substantial or Decorative? Physicians' Assistants and Nurse Practitioners in the United States, " *Lancet* 2:1243, 1974.
10. Bliss, A. A., and Cohen, E. D. (eds.), *The New Health Professionals* (Germantown, Md.: Aspen Systems Corp., 1977).
11. Brown, K. C., "Nature and Scope of Services: Joint Practice, "]. *Nurs. Admin.* 7:13, 1977.
12. Brown, K. C., "The Nurse Practitioner in a Private Group Practice, " Nur. *Outlook 22:111,* 1974.
13. Burkett, G. L., et al., "A Comparative Study of Physicians' and Nurses' Conceptions of the Role of Nurse Practitioners, " *Am.], Public Health* 68:1090, 1978.
14. Burnip, R., et al., "Well Child Care by Pediatric Nurse Practitioners in a Large Group Practice, " *Am. }. Dis. Child.* 130:51, 1976.
15. C. E. Pagan Associates, *AHECS: A Response to Geographic and Specialty Maldistribution,* contract No. 231-76-0019 (Washington, D. C.: DHEW, 1977).
16. California Health Manpower Policy Commission, *The Fifth Annual Report to the California Legislature* (Sacramento, Calif.: State of California, Dec. 15, 1978).
17. Conant, L., et al., "Anticipated Patient Acceptance of New Nursing Roles and Physicians' Assistants, " *Am,]. Dis, Child.* 122:202, 1971.
18. Congressional Budget Office, U.S. Congress, *Physician Extenders: Their Current and Future Role in Medical Care Delivery* (Washington, D. C.: U.S. Government Printing Office, April 1979).
19. Connelly, S. V., and Connelly, P. A., "Physicians' Patient Referrals to a Nurse Practitioner in a Primary Care Medical Clinic, " *Am.], Public Health* 69:73, 1979.
20. Coulehan, J. L., and Sheedy, S., "The Role, Training, and One-Year's Experience of a MedicaI Nurse Practitioner, " *Health Serv. 88:827, 1973.*

21. Draye, M. A., and Stetson, L. A., "The Nurse Practitioner as an Economic Reality, " Med. *Group Mgt. 22:24, 1975.*
22. Feldman, R., et al., "Nurse Practitioner Multiphasic Health Checkups, " *Prev.* Med. *6:301, 1977.*
23. Felknor, R., "An All-RN Fee-For-Service Group Practice, " RN 37:41, 1974.
24. Fine, L., and Silver, H. K., "Comparative Diagnostic Abilities of Child Health Associate Interns and Practicing Pediatricians, ". *Pediat. 83:332, 1973.*
25. Fisher, D. W., and Horowitz, S. M., "The Physician's Assistant: Profile of a New Health Profession, " in The New Health *Professional,* A. A. Bliss and E. D. Cohen (eds.) (Germantown, Md.: Aspen Systems Corp., 1977).
26. Flynn, B. C., "Effectiveness of Nurse Clinicians' Service Deli very," *Am. Public Health 64:604, 1974.*
27. General Accounting Office, U.S. Congress, *Progress and Problems in Improving the Availability of Primary Care Providers in Undeserved Area.;* (Washington, D. C.: GAO, Aug. 22, 1978).
28. _____ Progress *and Problems in Training and Use of 'Assistants to Primary Care Physicians* (Washington, D. C.: GAO, Apr. 8, 1975).
29. Glen, J. K., and Goldman, J., "Strategies for Productivity With Physician Extenders, " West. 1. *Med.* 124:249, 1976.
30. Goldfarb, M. G., *Economic Aspects of the Use of New Health Practitioners (New* Haven, Corm.: Yale University School of Medicine, 1974).
31. Golladay, F., et al, "Allied Health Manpower Strategies: Estimates of the Potential Gains From Efficient Task Delegation, " *Med. Care 11:457, 1973.*
32. Graduate Medical Education National Advisory Committee, *Interim Report of the Graduate Medical Education National Advisory Committee to the Secretary* (Washington, D. C.: DHEW, April 1979).
33. Greenfield, S., et al., "Efficiency and Cost of Primary Care by Nurses and Physician Assistants, " N. *Eng. J. Med.* 298:308, 1978.
34. _____ "Nurse-Protocol Management of Low Back Pain: Outcomes, Patient Satisfaction, and Efficiency of Primary Care, " *West. J. Med. 123:350, 1975.*
35, Grupenhoff, J. T., and Strickland, S. R., *Federal Laws: Hea/th/Environment Manpower* (Washington, D.c.: Science and Health Communications Group, 1972).
36, Hershey, J. C., and Kropp, D. H., "A Re- Appraisal of the Productivity Potential and Economic Benefits of Physician's Assistants, " *Med. Care 17:592, 1979.*
37. Hill, R. E., et al., "An Evaluation of a Remote, Rural Clinic Manned By a Physician's Assistant, " *Pub. Health Rep. 94:60, 1979.*
38. Holmes, G. C., et al., "Contribution of a Nurse Clinician to Office Practice Productivity: Comparison of Two Solo Primary Care Practices, " *Health* Serv. *Res. 11(1):21,* 1976.
39. _____ "Nurse Clinician Productivity Using a Relative Value Scale, " *Health Serv. Res.* 12(3):269, 1977.
40. Kane, R. L., et al., "Effects of Adding a Medex on Practice Costs and Productivity, "]. Comm. *Health 3:216, 1978.*
41, Komaroff, A. L., et al., "Nurse Practitioner Management of Common Respiratory and Genitourinary Infections, Using Protocols, " *Nurs. Res. 25:84, 1976.*
42. _____ "Protocols for Physician's Assistants, " N. Eng.']. Med. 290:307, 1974.
43. _____ "Quality, Efficiency, and Cost of a Physician-Assistant-Protocol System for Management of Diabetes and Hypertension, " *Diabetes* 25:297, 1976.
44. Lawrence, D., "Physician Assistants and Nurse Practitioners: Their Impact on Health Care Access, Costs and Quality, " *Health & Med. Care Serv. Rev. 1:1, 1978.*
45. Lawrence, R. S., et al., "Physician Receptivity to Nurse Practitioners: A Study of the Correlates of the Delegation of Clinical Responsibility, " *Med. Care 15:298, 1977,*
46. Lee, P. R., et al., *Primary Care in a Specialized World* (Cambridge, Mass.: Ballinger Publishing Co., 1975).
47. Lehotti, D., Division of Nursing, Bureau of Health Manpower, Health Resources Administration, Washington, D. C., personal communication, 1980.
48. Levine, D. M., et al., "The Role of New Health Practitioners in a Prepaid Group Practice: Provider Differences in Process and Outcomes of Medical Care," *Med. Care 15:326, 1976.*

49. Levine, E., "What Do We Know About Nurse Practitioners?" *Am. J. Nurs. 77:1799, 1977.*
50. Lewis, C. E., and Cheyonich, T. K., "Who Is a Nurse practitioner?" *Med. Care* 14:365, 1976.
51. Lewis, C. E., and Resnik, B. A., "Nurse Clinics and Progressive Ambulatory Patient Care," N. *Eng. J. Med.* 227:1236, 1967.
52. Lewis, C. E., et al., "Activities, Events, and Outcomes of Ambulatory Patient Care," N. *Eng. J. Med.* 280:645, 1969.
53. Linn, L. C., "Patient Acceptance of the Family Nurse Practitioner," *Med. Care 14:357, 1976.*
54. Little, M., "Physicians' Attitudes Toward Employment of Nurse Practitioners," *Nur. Practitioner 3:26, 1978.*
55. Mauksch, I., "The Nurse Practitioners Movement: Where Does It Go From Here?" *Am. J. Public Health* 68(11):1074, 1978.
56. McCormack, R. C., et al., "Family Doctors' Use of Office Assistants and Opinions Regarding Nurses in Primary Care," South, *Med. J.* 64:415, 1971.
57. Merenstein, J. H., et al., "The Use of Nurse Practitioners in a General Practice," Med. Care 12:445, 1974.
58. Miller and Byrne, Inc., "Review and Analysis of State Legislation and Reimbursement Practices: Final Report," contract No. 230-77-0011 (Washington, D. C.: DHEW, January 1978).
59. Morgan, W. A., and Sullivan, N. D., "Issues Affecting Nurse Practitioner and Physician's Assistant Clinics in Rural California" (Davis, Calif.: University of California, School of Medicine, August 1979).
60. Morris, S. B., and Smith, D. B., "An Evaluation of the Potential Impact of Physician Extenders on Primary Care Practices in the United States," paper presented at the Second International Congress of the World Federation of Public Health Associations, May **24, 1978.**
61. _____ "The Distribution of Physician Extenders;" *Med. Care* 15(12):1045, 1977.
62. Moscovice, 1., "The Influence of Training Level and Practice Setting on Patterns of Primary Care Provided by Nursing Personnel" (Seattle, Wash.: University of Washington, Center for Health Services Research, 1978).
63. Moscovice, I., and Rosenblatt, E., "The Viability of Mid-Level Practitioners in Isolated Rural Communities" (Seattle, Wash.: University of Washington, Center for Health Services Research, June **1978).**
64. National Academy of Sciences, Institute of Medicine, *Physicians and New Health Practitioners: Issues for the 1980s* (Washington, D. C.: NAS, May 1979).
65. Nelson, E. C., et al., "Financial Impact of Physician Assistants on Medical Practice," N. Eng. J. *Med. 293:527, 1975.*
66. O'Hara-Devereaux, M., et al., "Economic Effestiveness of Family Nurse Practitioner Practice in Primary Care in California," in *The Neu~ Health Professionals,* A. A. Bliss and E. D. Cohen (eds.) (Germantown, Md.: Aspen Systems Corp., 1977).
67. Patterson, P. K., "Physician Response to Delegation of Well-Child Care," N. W. *Med.* 40:92, 1971.
68. Patterson, P. K., et al., "Parent Reaction to the Concept of Pediatric Assistants," *Pediatrics* 44:69, 1969.
69. Record, J. C., Cost *Effectiveness of Plysician's Assistants in a Maximum-Substitution Model,* NTIS report No. HRP-090097 (Washington, D. C.: National Technical Information Service, Division of Medicine, 1976).
70. _____ (ed.) Provider *Requirements, Cost Savings and the New Health Practitioner in Primary Care: National Estimates for 1990,* contract No. 231-77-0077 (Washington, D. C.: DHEW, 1979).
71. Record, J. C., and O'Bannon, J. E., Cost *Effectiveness of Physian's Assistants in a Large Health Maintenace Orgaization: Phase 1 of a Two Phase Study,* NTIS report No. HPR-0900098 (Washington, D. C.: Bureau of Health Resources Development, Nov. 15, 1975).
72. Record, J. C., et al., "Physician Supervision of PAs: How Much Is Enough? And What Does It Cost?" in The New *Health Professionals,* A. A. Bliss and E, D. Cohen (eds.) (Germantown, Md.: Aspen Systems Corp., 1977).
73. Reid, R. A., et al., "Rural Medical Care: An Experimental Delivery System," *Am. J. Public Health* 65:266, 1975.
74. Reinhardt, U. E., "Parkinson's Law and the Demand for Physicians' Services," paper presented at the Federal Trade Commission's Conference on Competition in the Health Care Sector, Washington, D. C., June I-2, 1977.
75. _____ *Physicians Productivity and the Demand 'for Health Manpower* (Cambridge, Mass.: Ballinger Publishing CO., 1975),

76. Ruby, G., "Consumer Acceptance of Nurse Practitioners and Physician Assistants" (Washington, D. C.: National Academy of Sciences, Institute of Medicine, Jan. 31, 1977).
77. _____ "Physician Acceptance of Nurse Practitioner's and Physician Assistants" (Washington, D. C.: National Academy of Sciences, Institute of Medicine, June **20, 1975).**
78. Runyan, J. W., 'Medical Care by Nurses" (letter), *]. A.M.A. 2.34:1118, 1975.*
79. Sackett, D. L., et al., "The Burlington Randomized Trial of the Nurse Practitioner: Health outcomes of Patients, " *Ann. Int. Med.* **80:137, 1974.**
80. Scheffler, R., "The Productivity y of New Health Practitioners: Physician's Assistants and the Medex, " *Res. Health Econ, 1:37, 1979.*
81. Schiff, D. W., et al., "The Pediatric Nurse Practitioner in the Office of Pediatricians in Private Practice, ' *Pediatrics 44:62, 1969,*
82. Schneider, D. P. and Foley, W. J., "A Systems Analysis of the Impact of Physician Extenders on Medical Costs and Manpower Requiremerits, " Med. Car-e **15:277, 1977.**
83. Schonfeld, H. K.., et al., "A Comparison of Three Methods for Estimating the Costs of Primary-Physician Attendance for Adults, " paper delivered at the Biometrics Section, American Statistical Assocation, Joint Statistical Meetings, Montreal, August **1972.**
84. Schroeder, S, A., and Showstack, J. A., The *Dynamics of Medical* Technology *Use:* Anal*ysis and* Policy Options (San Francisco: University of California, Health Policy Program, October 1977).
85. Schulman, J., and Wood, C., "Experience of a Nurse Practitioner in a General Medical Clinic," *]. A.M.A. 219:1453, 1972.*
86. Schwartz J. L., ' Economic Feasibility and Patient Diagnostic Mix of Family Nurse Practitioners, " Pub. *Health Rep,* **94:148, 1979.**
87. Schweitzer, S. O., "The Relative Costs of Physicians and New Health Practitioners, " in *Provider Requirements, Cost Savings and the New Health Practitioners in Primary Care: National Estimates for 1990,* J. C. Record (cd.) (Washington, D. C.: DHEW, 1979).
88. Scott, C., Family Nurse Practitioner Program, University of California, Davis, Calif,, personal communicant ion, September 1979.
89. Silver, H. K., et a ., "The Pediatric Nurse Practitioner Program: Expanding the Role of the Nurse To Provide Increased Health Care for Children, " *], A.M.A. 204:298, 1968.*
90. Smith, K. R., "Health Practitioners: Efficient Utilization and the Cost of Health Care, " in *intermediate Level Health Practitioners,* V. Leppard and E. Purcell (eds.) (New York: Josiah Macy, Jr., Foundation, 1973).
91. Smith, R. A., et al., "Increasing Physician Productivity and the Hospitalization Characteristics of Practices Using Medex, " N. W. *Med. 70(10):701, 1971.*
92. Spector, R., et al., "Medical Care by Nurses in an Internal Medicine Clinic, " *J. A.M.A. 232:1234, 1975.*
93. Spitzer, W. O., et al,, "The Burlington Randomized Trial of the Nurse Practitioner, " N. *Eng.]. Med. 290:251, 1974.*
94. Steinwachs, D. M., et al., "The Role of New Health Practitioners in a Prepaid Group Practice, " *Med. Care 14:95, 1976.*
95. Stratton, C. W., "The Nurse Practitioner in Private Practice, " *Peal. Nurs. 4:24, 1978.*
96. Sullivan, J. A., et al., "Overcoming Barriers to the Employment and Utilization of the Nurse Practitioner, " *Am.]. Public Health 68:1097, 1978.*
97. _____ "The Rural Nurse Practitioner: A Challenge and Response, " *Am.], Public Health 68:972, 1978.*
98. Sultz, H. A., et al., "Highlights: Phase 2 of a Longitudinal Study of Nurse Practitioners, " in *Nursing Personnel and the Changing Health Care System,* M. Millman (cd.) (Cambridge, Mass.: Ballinger Publishing Co., 1978).
99. _____ *Longitudinal Study of Nurse Practitioners; Phase Z,* DHEW publication No. **76-43 (Washington,** D. C.: DHEW, March 1976).
100. _____ *Longitudinal Study* of *Nurse Practitioners; Phase II,* DHEW publication No. **78-92** (Washington, D.C.: DHEW, September 1978).
101. System Sciences, Inc., *Nurse Practitioners and Physician Assistant Training and Deployment Study, Final Report,* contract No. HRA-230-75-0198 (Bethesda, Md.: System Sciences, Inc., September **1976).**
102. _____ *Survey and Evaluation of the Physician Extender Reimbursement Experiment, Final Report* (Bethesda, Md.: System Sciences, Inc., March **1978).**
103. University of Southern California, Division of Research in Medical Education, *Collection and Processing of Baseline Data for the Physician Extender Reimbursement* Study (Los Angeles: USC, Aug. **31, 1978).**
104. **Voltmann,** J. D., "Jamestown Medical Clinic System," *J. A.M.A. 234:303, 1975.*

105. Wallen, J., "Delegability," paper prepared for the Non-Physician Health Care Provider Work Group of the Graduate Medical Education National Advisory Committee, Health Resources Administration, Washington, D. C., May 9, 1978.
106. Wong, D. L., "Private Practice—At a Price," *Nurs. Outlook 25:258,* April **1977.**
107. Wright, G. E,, "Family Nurse Clinicians: Physician Perspective," *Nurs. Outlook 23:771, 1975.*
108. Yankauer, A., et al., "The Costs of Training and the Income Generation Potential of Pediatric Nurse Practitioners," *Pediatrics 49:878, 1972.*
109. _____ "Pediatric Practices in the United States, 'With Special Attention to Utilization of Allied Health Worker Services," *Pediatrics* **45 (suppl.):521, 1970.**
110. Young, K. J., "Independent Nurse Practitioners: The Practical Issues of Practice," *Nurse Practitioner* 2:14, 1977.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1981 341-844/1015