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ABSTRACT

During the 1960's, nursing education shifted dramatically away from hospital-operated diploma schools toward associate degree and baccalaureate programs. This report examines the nature of this shift in training and its anticipated impact on future supply. Other important factors affecting the future supply of nurses are analyzed, including the relative economic attractiveness of nursing compared with other professions, the proportions of female high school graduates entering and completing nurse training, and the proportion of trained nurses who are not working as nurses. A labor supply function is derived, permitting projections of labor supply and labor force participation of nurses through the 1970's. These projections are compared with the expected demand for nurses. (BH)

PRESENT & FUTURE SUPPLY OF REGISTERED NURSES

PRESENT & FUTURE SUPPLY OF REGISTERED NURSES

STUART H. ALTMAN, P...D.

The author, Deputy Assistant Secretary, Health Planning and Evaluation, Department of Health, Education, and Welfare, conducted the research reported in this monograph while he was an Associate Professor of Economics at Brown University and the Director of Health Studies, Urban Institute. The research was performed under Public Health Service Contract Number PH 108 67 204 from the Division of Nursing, National Institutes of Health, and an Urban Institute University Fellowship.

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FOREWORD

The Division of Nursing continually assesses and projects the supply of registered nurses across the Nation as a basis for its recommendations to ensure safe, effective, therapeutic nursing care. An important aspect of this function is the examination of economic variables affecting the nurse supply, such as the costs to nursing education programs, costs to nursing students, and economic returns to practicing nurses. Changes in these variables affect the number and types of nursing programs available and the types of programs selected by students. Salaries and other benefits influence both the choice of a nursing career and duration of professional activity.

In 1967 the Division entered into a contract with Brown University to prepare a comprehensive analysis of the impact of economic factors on the present nurse supply and the projected supply through the 1970's. Dr. Stuart Altman, the principal investigator, was inevitably drawn to a study of noneconomic factors influencing an individual's decisions, such as choice of a nursing career, type of educational program, and continued professional practice. For this additional analysis, he drew heavily on data from "Project Talent," a comprehensive ongoing study of high school students conducted by the University of Pittsburgh.

This report is the culmination of four years of investigation. It adds to our ability to evaluate the nurse supply today and for the future.

We appreciate the assistance given to the author by The Urban Institute, 2100 M Street, N.W., Washington, D.C. 20037.

Jessie M. Scott
Assistant Surgeon General
Director
Division of Nursing

PREFACE

My interest in the subject of nursing supply began in the spring of 1967. Under the urgings of Worth Bateman (who was then the Special Assistant to the Assistant Secretary for Planning and Evaluation in the Department of Health, Education, and Welfare), I began to discuss with the staff of the Division of Nursing of the U.S. Public Health Service how my background as a labor economist and my interest in the work behavior of female members of the labor force might be of value of them. Out of these discussions came the first 14-month contract that was later amended and extended to "Develop and Conduct a Comprehensive Study of the Supply of Nurses." The working relationship I have had with the Division of Nursing, particularly with the Project Officer, Mr. Stanley Siegel, has been excellent. While pursuing the aims of the contract, Stan Siegel has permitted me the latitude to focus my attention on certain subjects not originally included in the contract, and to vary the depth of the analysis depending upon how we both saw the importance of the subject to the total study and the difficulty I encountered in obtaining acceptable results. The support of other members of the Division of Nursing staff and the Director, Miss Jessie M. Scott, was also extremely helpful.

Through this long and at times unending project, I have indeed been fortunate to work with a group of very able assistants. My special thanks to Linda Mansfield, Joe Eichenholz and Barbara Fechter. Their work far exceeded the bounds of statistical assistants and made the project for me (at least most of the time) fun to work on. My thanks to Tom Duston, who is in the final stages of completing his Ph.D. dissertation on a subject closely related to this project and who collaborated with me on the special analysis of the Project Talent data; and to Robert Barro who jointly authored the paper that appears in Appendix V-A. A warm thanks to Sally DesLauries and Valerie Bullock who worked through the many (and sometimes incomprehensible) drafts of this manuscript. I think they now know more about nursing supply than they want to.

I would be remiss if I didn't add a special word of gratitude to Worth Bateman and William Gorham of The Urban Institute. Not only did they provide for me the financial support that permitted my family to survive the high cost of Washington living, but they helped create a research environment at the Institute without which this project would not have been completed.

Stuart H. Altman
Washington, D.C.
June 1971

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CHAPTER I

INTRODUCTION AND SUMMARY

Introduction

The 1960's witnessed unprecedented growth in American expenditures for health care. While much of this was simply the result of inflated medical care prices, the provision of services also expanded greatly. There is every reason to believe the 1970's will bring even greater demands for medical care. But will this care be available? Government is not necessarily the answer. It can, within a short period of time, make available extensive funds to provide particular service, as it did with the enactment of Medicare and Medicaid legislation in the mid-1960's. But the Government has no power (as when it drafts citizens for military service) to force individuals to provide particular kinds of health services no matter how badly these may be needed.

Medical care is a very labor intensive activity; the average hospital in the United States employs more than two workers for every patient.(5) [1] Particularly in hospitals, the professional nurse[2] has been the backbone of the health industry, accounting for 25 percent of the hospitals' professional staff. There are 700,000 professional nurses in practice in the United States today as compared to 50,000 in 1910.(4) This is an increase from 55 nurses per 100,000 population to 341 per 100,000 over the past 60 years. Of all health workers, 16 percent are nurses; of professionally trained health workers, 39 percent are nurses.(2) Even so, continuing shortages of nurses have been reported. The most severe shortages occurred in the early 1960's when hospitals reported being unable to fill 23 percent of their positions for general duty nurses.(6) The current hospital vacancy rate, after a decade of increases in the supply of nurses, still stands at somewhat under 10 percent.(3) Further, the Public Health Service has claimed that an additional 150,000 nurses—more than 20 percent of the present supply—are required to provide the nation with "safe, therapeutically effective and efficient" nursing care.(4)

Through this period, great changes have been happening in the recruitment and training of professional nurses which are likely to have a very

[1] Numbers in parentheses refer to literature cited in reference lists following the chapter or appendix.

[2] A professional or registered nurse is defined as a graduate of a hospital-operated diploma school, an associate degree program, or a baccalaureate degree program (or a professionally trained foreign nurse) licensed by a State to practice nursing.

significant impact on future availability of these crucial health workers. While the number of entrants to nurse training programs has been growing, as a proportion of female high school graduates, those who choose nursing have declined from 7 to 4.8 percent between 1956 and 1969.[1]

The big shift in nurse training institutions has been a drastic dropoff in the role of hospital-operated diploma schools. Prior to 1960, the education of professional nurses was concentrated in these hospital schools. Since then 200 of these programs have ceased operation.[1] In 1960, 78 percent of the nursing graduates came from hospital-diploma programs, 18 percent from baccalaureate programs, and only 4 percent from associate degree programs. By 1969, hospital-diploma graduates had declined to 42 percent of new nurses associate degree graduates jumped to 34 percent, and baccalaureate graduates increased to 24 percent of the total.[1] Much concern has been raised about whether this somewhat unplanned change in the composition of nurse training institutions, and the declining attractiveness of nursing as a career will result in a decline in the future availability of practicing registered nurses.

This report examines the nature of this shift in training and its anticipated impact on future supply. Other important factors that bear on the future supply of nurses are also analyzed, including the relative economic attractiveness of nursing compared with other professions, the proportions of female high school graduates entering and completing nurse training, and the proportion of trained nurses who for various reasons are not working as nurses.

To ascertain whether there will be a shortage or surplus of trained nursing personnel during the 1970's involves the interaction of these and many other complex factors. For instance, health technology will undoubtedly become quite different and the demands for health services will continue to change, but the shape of things to come cannot be predicted with certainty. The projections therefore do not indicate the adequacy of the future nursing supply but rather attempt only to compare future supply estimates with projected growth in population and professional estimates of future "need" for nursing manpower.

Details of various aspects of these projections are discussed in the chapters that follow. In the remaining section of this introductory chapter, the major findings of the study are summarized.

Summary of Findings

The nursing labor market is dominated by one employer—the hospital. Close to 70 percent of employed professional nurses work in a hospital or related institution. The hospital's control over RN's only recently has begun to loosen. It was not uncommon in the past for a few large hospitals in an area to jointly decide on the wages to be paid nursing personnel. Until 1946 collective bargaining or job actions were virtually unknown to the nursing profession. The nurse, in almost all cases a woman and most

often married, lacked the mobility to search for higher earnings in another community.

As might be expected, the concentrated nature of the nursing labor market in the past had a number of negative effects on wages, the attractiveness of nursing as a profession and the supply of nursing services. For example:

- In 1956, hospital nurses in 13 major metropolitan areas earned only 60 percent of the salaries paid to public school teachers and 85 percent of the salaries paid to office workers (chapter IV).
- The percentage of all living previously trained professional nurses working or looking for work as nurses (Labor Force Participation Rate) grew much more slowly during the 1960's than the rate for all women (9.2 versus 22.1 percent) (chapter V).
- The vacancy rate for general duty hospital nurses averaged over 20 percent in the early 1960's (chapter II).
- Even taking into account the shorter training period of a nurse and earlier start on the job, the nurse in 1960 could expect far inferior lifetime earnings—as measured by present value—than teachers and even less than those of office workers (chapter III).
- Hospitals, by running nursing schools, assured themselves of a supply of student nurse labor and new graduates at low wage levels (chapter IV).

On the other hand, there have been a number of positive factors in the nursing labor market that operated to offset the apparent monetary disadvantages. Among these were:

- Hospital training was often tuition free and student nurses sometimes were paid for their work. This made nursing a particularly attractive occupation for girls with higher than average ability but with insufficient family income to attend a 4-year college (chapter III).
- Nonpecuniary attributes, such as prestige and service to humanity, appear to be greater for nursing than for other occupations frequently selected by female high school graduates. Thus nursing has retained its popularity, with 1.0 percent of 11th grade girls choosing it as their preferred occupation (chapter III).
- Nurse vacancy rates in hospitals do not reflect compensatory hiring of practical nurses, nursing aids and attendants, particularly in the South where there are generally low wage levels. With these alternative personnel, Southern hospitals provide essentially the same level of nursing care per patient as received in the Northeast and North Central regions. (Only the West provides significantly more nursing manpower per patient (chapter II).)

In recent years a number of changes have occurred in the nursing labor market that are having, and are likely to have, a profound effect on nursing supply.

● The noncompetitive characteristics of the hospital industry are breaking down and nurses appear to have more choice as to where they work and for how many hours. This has led to:

(a) Rapidly rising salaries for nurses (chapter IV).
(b) A higher proportion of female high school graduates entering nursing (chapter IV).
(c) Reduced vacancy rates for hospital nurses (chapter II).
(d) The closing of hospital-operated diploma nursing programs because they were no longer profitable (chapter IV).

● State and local governments have increasingly undertaken the responsibility for training professional nurses (chapter IV). As a result:

(a) The cost (tuition plus lost wages) of nurse training has gone down and the future benefit (higher salaries) has increased.
(b) Nurse training has become more popular, particularly 2-year associate degree programs.
(c) The overall completion rate for nursing students has declined. This is due in part, at least, to the reduced cost of switching out of the 2- or 4-year general college programs compared to leaving the hospital diploma school with its more specific vocational training.

Combining these past events and recent trends, future projections of the: (1) supply of new admissions to nurse training programs; (2) expected graduates from these programs; (3) total stock of nurses potentially available in the future; (4) percentage of total stock expected to be working; and finally (5) expected supply of practicing professional nurses, indicate that:

Admissions (Chapter IV)

● New admissions to nurse training programs will grow from 69,000 in 1969 to between 85,000 and 92,000 by 1980.

● Diploma programs will either become extinct by the mid-1970's or account for about 1.0 percent of new admissions by 1980.

● The dominant form of training professional nurses will be in associate degree programs. By 1980 between 62 and 66 percent of new admissions will enter such programs.

Graduates (Chapter IV)

● Higher attrition rates in baccalaureate and associate degree programs will reduce the average completion rate in nurse training from 62 percent in 1969 to 56 percent in 1980.

● Whereas the annual level of admissions will grow by about 22,000 between 1969 and 1980 or 31 percent, the number of graduates will rise by only 5,600, or 13 percent.

● The percentage of female high school graduates actually entering the field of nursing will fall from 1.4 percent in 1969 to 1.0 percent in 1980.

● Of the future stock, a greater proportion will come from foreign countries. The number of foreign trained nurses becoming licensed in the United States, which averaged 1.7 percent of the output of U.S. schools in 1950, 6.1 percent in 1960, and 10.0 percent in 1967, will grow to 16.4 percent by 1980.

Labor Force Participation Rates (Chapter V)

● The changing educational mix and the expected slowdown in the growth of nurse earnings will further retard the growth in the percentage of trained professional nurses participating in the labor force during the 1970's. (We assume that the nurse LFPR in each age group will either maintain the level that exists in 1970 or grow by half the rate of the 1960's. Because of the age composition of nurses in the future, the overall nurse participation rate will be somewhat higher than the growth in the rate for each age group.)

Labor Supply (Chapter VI)

● The number of practicing registered nurses will grow from the 1970 level of 700,000 to between 785,000 and 809,000 by 1975, and to between 864,000 and 924,000 by 1980.

● The growth in nursing services will be smaller than the growth in total supply because of the increased use of part-time nursing personnel. Almost 20 percent of the expected growth in the number of practicing nurses will not materialize in additional nursing services.

● The supply of nurses will continue to grow faster than population. By 1980, between 379 and 406 RN's will be available for every 100,000 residents in the United States as compared to 341 in 1970.

● The annual growth rate in the 1960's was six RN's per 100,000 population. The growth rate in the 1970's will be somewhat less, averaging closer to five RN's per 100,000.

Hence, although nurse training has undergone a major upheaval in the last decade, the transition from on-the-job hospital-operated training programs to college-based programs has been relatively smooth. The dire consequences of such a change, as suggested by some, in terms of future availability of practicing nurses do not appear to have materialized. Projected supply, both in terms of absolute numbers and in relation to growth in the U.S. population, will increase rather substantially during the 1970's. Whether this supply will be adequate to meet all demands for nursing services in the years ahead is somewhat of a moot question. What is clear, is that this increased number of health professionals will provide a larger pool of trained manpower to give the medical care industry increased flexibility to meet expected future demands.

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CHAPTER II

NURSING MANPOWER TODAY

Much has been said and written about the declining proportion of high school graduates entering nursing and the chronic shortage of active professional nurses.[23,32] While there is much truth in these statements and they will be discussed at some length in different sections of the study, nursing still remains one of the most popular career fields among women and the supply of practicing nurses has grown at a rate considerably faster than the U.S. population. In this first substantive chapter, the analysis of the entire book is put into prospective by presenting an overview of nursing supply today and by analyzing two of its major problems—the chronic shortage of professional nursing personnel and the unequal regional distribution of nursing manpower.

An Overview

Of the roughly 3.9 million women professional workers in 1968, about two-thirds were employed as school teachers or nurses.[29] Over 11 percent of a representative sample of all 11th grade female students in 1960 selected nursing as their preferred occupation.[30] Only teaching and all forms of office work combined registered a higher percentage. In 1910 there were 50,000 professional nurses employed in the United States or 55 for every 100,000 inhabitants.[25] During the next 20 years a rapid expansion in the training and utilization of professional nurses (see chapter IV), brought the total to over 200,000 or 175 per 100,000 population.[25] Since 1930 the growth has continued at a rate more than proportionate to population, and by 1970 there were approximately 700,000 active nurses or a rate of 341 per 100,000 population (see chapter VI).

Of this 700,000 approximately 69 percent were employed in hospitals or related institutions, 17 percent as private duty or office nurses, 7 percent as public health nurses, 4 percent as nursing educators and 3 percent in occupational health fields.[8]

The high proportion of registered nurses in hospital employment is consistent with the high demand for this type of nursing manpower. In fact, it is in this area of largest employment—hospital nursing—that the greatest shortage of nurses is said to exist.[32] Of the 358,054 employed in hospital nursing in 1968, most actual bedside nursing care was provided

by the 217,678 full-time and 111,780 part-time general duty or staff nurses.[28] In excess of 28,000 other hospital employed nurses or 8 percent of the total were employed in some type of administrative function.[28] Although those in administrative positions, particularly head nurses and assistant head nurses, do provide basic patient care, the greatest need as measured by job vacancy rates occurs at the general duty nurse level. As can be seen in table 1, the vacancy rate for general duty hospital nurses in the early 1960's was about 23 percent, while that for the more senior hospital nursing positions was closer to 15 percent. As explained in the next section, the unfilled positions in hospital nursing result, in part, from the nature of the industry. That the highest vacancy rate is recorded for the lowest rung of hospital nursing should not be surprising, since hospital administrators can always elevate a staff nurse to a more senior position, thus leaving a vacancy at the beginning level.

One way of judging whether 700,000 nurses or any other number is adequate to provide the nursing services desired by this country is to use estimates of professionals as to what is "needed." In 1962, the U.S. Surgeon General's Consultant Group on Nursing estimated that 850,000 professional nurses would be needed by 1970 to "assure safe, therapeutically effective and efficient nursing care for the American people."[27] This was 170,000 more than they estimated would be available by that date, and 150,000 more than actually is available.[27] A recent update of the estimated need for professional nurses in 1975 by the U.S. Public Health Service puts the figure at 1,000,000 or about 200,000 above their estimate of expected supply.[25]

Table 1.—Vacancy rates for full-time professional nurses by position (vacancies as a percent of positions offered)

Position	1961	1962
Hospitals[1]		
All RN's	20.1	20.7
General duty nurses	23.2	23.0
Administrators	12.0	13.4
Supervisors	13.1	15.3
Head nurses	14.0	17.0
Other		
Private duty nurses[2]	32.9	37.3
Public health nurses		
Total	4.9	—
School nurses	0.8	—
Nurse educators	—	10.1

[1] Hospitals data are vacancies for full-time positions in non-Federal general hospitals only.

[2] The figures listed for private duty nurses are actually the percents of total calls unfilled by Professional Nurses' Registries. However, over 98 percent of all calls were for private duty nurses for hospital work.

SOURCE: Donald Yett, "An Economic Analysis of the Hospital Nursing Shortage," Unpublished Ph.D. dissertation, University of California, Berkeley, 1969.

Use of Vacancy Statistics as a Measure of a Nursing Shortage

While professional estimates of what level of manpower is needed is of some value in assessing the adequacy of existing resources in an industry, economists have long felt that the use of the needs criterion to establish the level of demand for workers in an occupation or the existence of a labor shortage is too subjective. They prefer to use a measure that is observable and that reflects the influence of market forces on levels of both supply and demand. The use of budgeted vacancies or the vacancy rate to determine shortages is preferable in many ways. However, this method can lead to unexpected and undesirable results. In particular, it will be shown that if demand for labor in a market is not perfectly competitive, the use of such a measure would seem to imply that a permanent shortage exists when the market is technically in equilibrium (no shortage). Furthermore, if attempts are made to overcome this shortage through increases in supply, the vacancy rate under certain circumstances will increase rather than decrease.

Competitive Versus Monopsony Labor Market

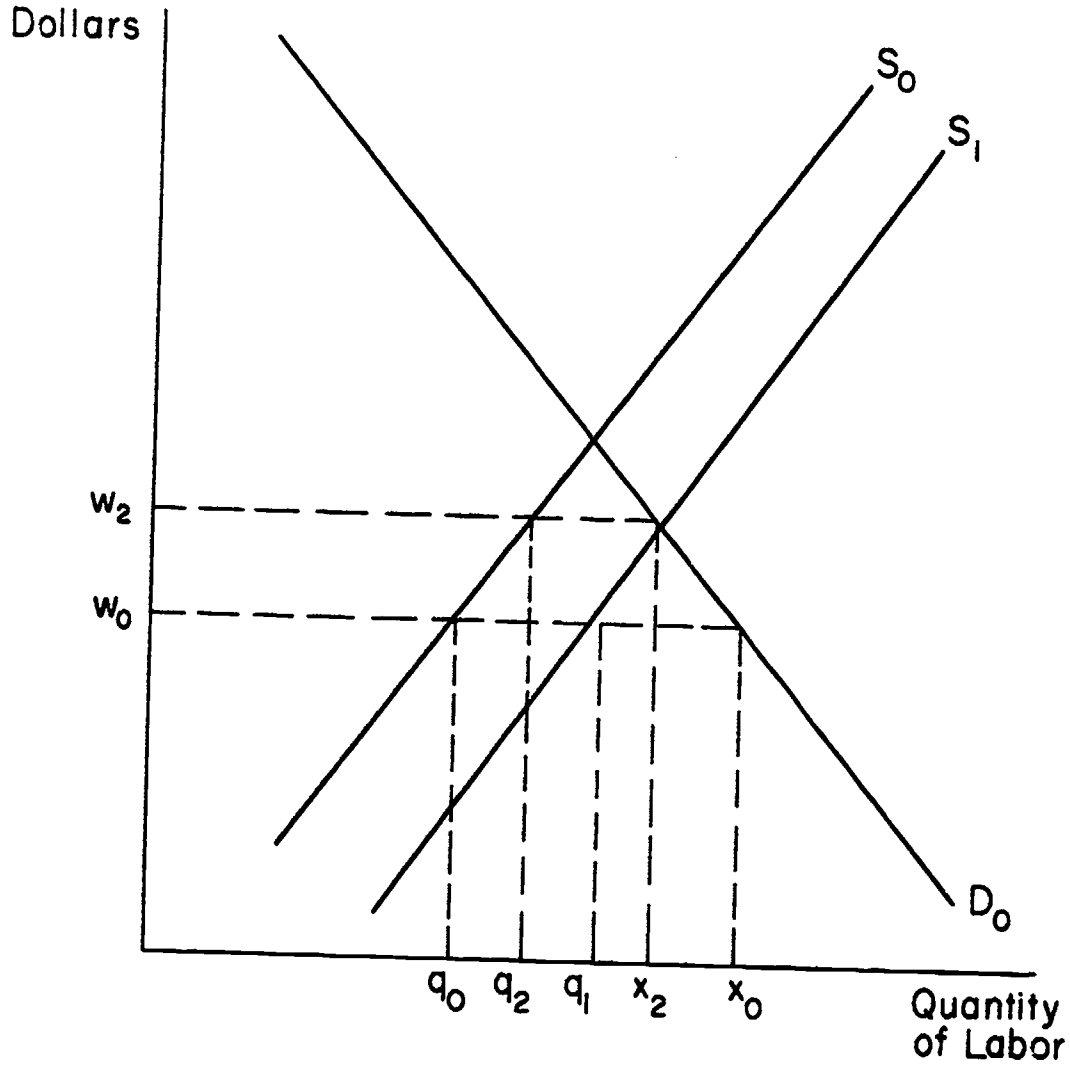
If we define a labor shortage as a situation in which: (1) the market is not in equilibrium; and (2) an excess number of jobs exist at the market wage, then if the labor market is perfectly competitive the budgeted vacancy criterion will perform satisfactorily. (See figure 1.) In such a market, if wages are restrained from rising above the level where supply equals demand; e.g., wage controls, employers will wish to hire more workers at this artifically low wage than are available, (q_0x_0) and the number of unfilled positions or budgeted vacancies will be a measure of such a shortage. Furthermore, increases in either the wage ceiling or the total supply function will lead to a reduction in the shortage and the number of unfilled positions (q_2x_2 or q_1x_0).

But once the labor market takes on some noncompetitive aspects, such as an individual employer who has some control over the wage level, the market can be in equilibrium while a positive number of unfilled positions or budgeted vacancies exist. This can be seen in figure 2, where S_0 indicates a supply schedule in a market where only one purchaser of nursing services exists, for example, a large hospital; i.e., a monopsony market, and M_0 is similar to a demand function for nursing services or what is called a marginal revenue product schedule.[1] The curve M_0 is not a demand curve in the strict sense of the word, since it does not indicate the quantity of labor that will be hired at each wage.[2] It is, however, a measure of the value of the product that would be produced by hiring

[1] For the remainder of this analysis we will assume labor is hired in a monopsony market. Similar conclusions would result if some other noncompetitive market was assumed.

[2] In some sense it is incorrect to talk of a demand curve for a monopsonist just as it is incorrect to speak of a supply curve for a monopolist.

Figure 1.—Competitive labor market



one additional worker and can be used to represent the number of workers that could profitably be hired if recruited at the corresponding wage. In other words, it is a hypothetical demand curve based on the assumption that sufficient supply is available at the indicated wage to meet demand; i.e., the supply curve is perfectly elastic at each wage.

Some would dismiss such a concept as saying nothing more than "at a price of $2,500 I will own one car, but if the price were less I would own more." However, to make such a dismissal would miss the whole point of using the budgeted vacancy shortage criterion in a noncompetitive labor market. The wage w_0 is not some hypothetical price that is less than the market price; it is in fact the market price. While w_0 and q_0 are in essence set by the monopsonist based on his estimate of existing supply and demand conditions, this does not mean that he would not report to his board of trustees (large nonprofit hospital) that he would like to hire q_0x_0 more nurses; or to the city council that he would like to hire q_0x_0 more teachers; or advertise in newspapers or professional journals the existence of q_0x_0 unfilled positions at a wage of w_0. It is clear that such

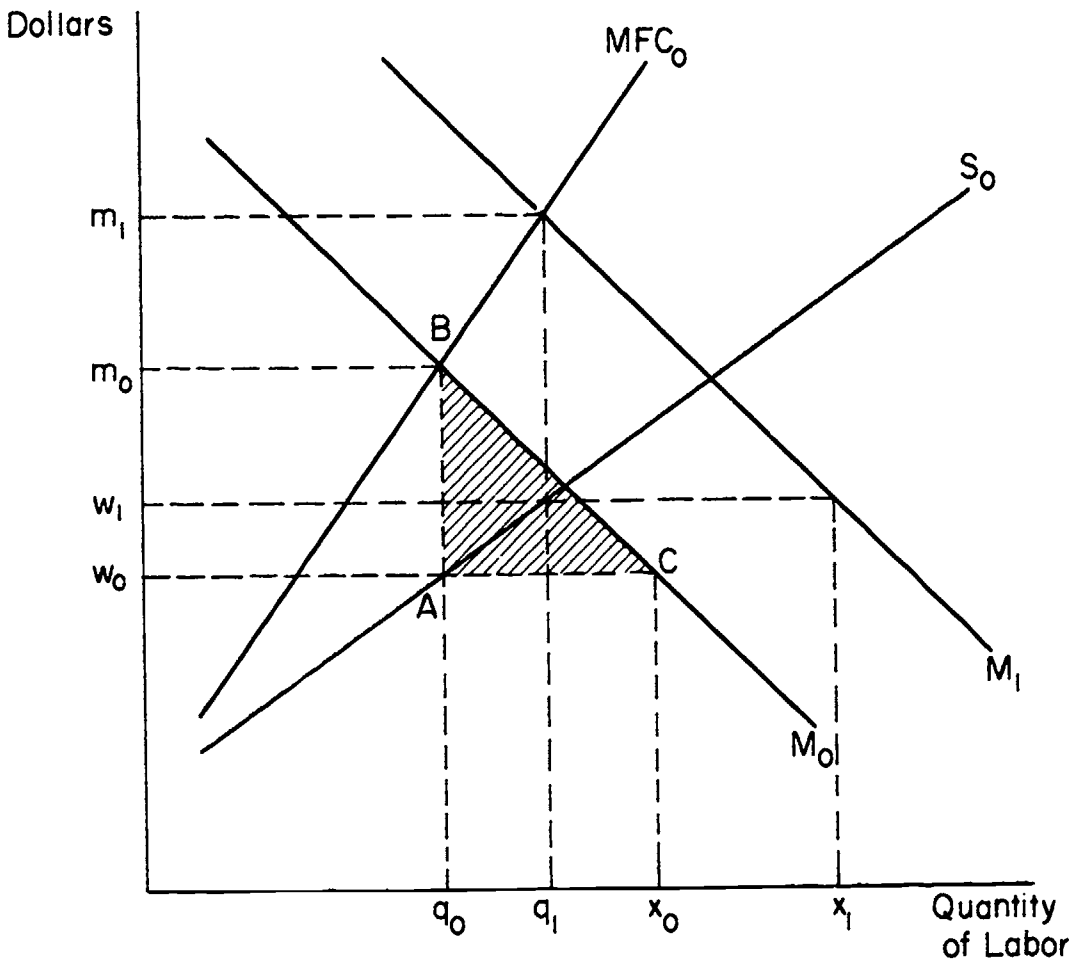
workers, if they could be hired at w_0, would add more to total product than to total cost; i.e., the producer surplus would increase by the area ABC.

The existence of q_0x_0 unfilled positions, however, does create a situation in which the market is technically in equilibrium; i.e., no market forces are operating to change either the wage or the quantity of labor demanded, and yet if the budgeted vacancy criterion is used, it would indicate that a labor shortage exists.[11.31]

Although violating one of the two conditions stated in the definition of a shortage, it is consistent with the condition usually assumed to be both necessary and sufficient; that is, the existence of unfilled jobs at the equilibrium wage. To differentiate between this situation and one in which both conditions are met, we will retain the term "shortage" for the latter, and use terms such as budgeted vacancies, vacancies, or budgeted vacancy shortage when the market is in equilibrium but unfilled jobs exist at the equilibrium wage.

As expected, an increase in the demand for nursing services; i.e., increase in the marginal revenue product schedule from M_0 to M_1 will

Figure 2.—Monopsony labor market



lead to an increase in the number of budgeted vacancies from q_0c_0 to q_1c_1, in the same manner as an increase in demand in a competitive market with a wage ceiling would result in an increase in the labor shortage. But while an increase in supply in such a competitive market will reduce the shortage, there are situations in a monopsony market where an increase in supply can lead to an increase in the number of budgeted vacancies. In appendix II-A, we shall discuss in detail under what circumstances an increase in supply will lead to an increase in the number of job vacancies and why such a seemingly unlikely result is in fact consistent with economic theory of the firm.

The intuitive explanation for this phenomenon is straightforward: With an increase in supply, more labor will be employed at the new, lower equilibrium wage. If further increases in personnel are then desired, the increase in pay necessary to attract them would have to be given to a larger number of individuals. The difference between the equilibrium wage and the total additional cost of paying all existing employees this higher wage will, therefore, grow. Similarly, the gap between the value of the product of the marginal worker and his wage will be larger. Thus, employers will be more anxious than before to hire additional personnel at the going wage, but more reluctant to offer wage increases to recruit them. Supply will have grown, but the quantity demanded will have grown faster, thereby increasing the number of vacancies.

The Nursing Labor Market

Although professional nurses are employed by a variety of industries and firms, the dominant industry is health services and the dominant employer is the hospital. As explained previously, almost 70 percent of all active professional nurses in the United States are employed in hospitals or similar institutions.[8] In addition more than 98 percent of all nurses are women and over 70 percent are married.[7]

The combination of these factors means that one or a few employers in a community dominate the labor market and the employee has very limited economically-directed geographical mobility. Donald Yett has studied the nursing labor market in great detail and has concluded that it can best be described as an oligopsonistic market with a kinked supply curve.[31] He has shown that employers are conscious of the difference between the wage necessary to attract additional nurses and the marginal factor cost of paying that wage to all members of the staff. Further, employers are also conscious of the impact their wage decisions will have on the decision of other institutions in their area.[31]

The hospital nursing labor market therefore has been similar to the noncompetitive market described in this chapter. It is this noncompetitive aspect of the market for hospital nursing services and the fact that hospitals employ the great majority of nurses which help to explain the large shortage of nurses, at least until the mid-1960's. Since then a number

of factors have changed and there are strong indications of a substantial decline in the percentage of hospital nursing positions vacant. A survey conducted by the American Hospital Association in 1969 revealed a budgeted vacancy rate for nursing personnel in all non-Federal hospitals of 7.9 percent.[24] The methodology used in this survey makes it not strictly comparable to the data reported for the 1961 62 period. Nevertheless, it is clear that a substantial decline has occurred in the reported shortage of hospital nurses.

Of the factors leading to this decline most noteworthy have been the rapid increase in the number of practicing nurses (see chapter VI), the rising salaries paid to professional nurses (see chapter IV), and the collective bargaining activities of the American Nurses' Association (see next section of this chapter). Whereas the *annual* increase in the number of practicing nurses between 1954 and 1960 was 17,000, the *annual* growth rate between 1960 and 1970 was close to 20,000 (see table 37). Even on a per capita basis the 1960's was a more productive period. The number of registered nurses per 100,000 population changed from 252 in 1954 to 282 in 1960 or an annual increase of 4.8 per 100,000 population. In the 1960's the per capita rate grew from 282 per 100,000 population to 341 or an annual growth of 5.9 per 100,000 population.

Starting salaries of nurses, which in 1956 averaged 60 percent of the earnings of public school teachers, by 1969 had grown to 80 percent of beginning teacher salaries (see table 28). These increases took place while more and more professional nurses were being trained in 2-year programs as opposed to the almost universal 4-year college training program for teachers. Higher salaries help to eliminate budget vacancies in three ways: (1) they attract more individuals into nursing (see page 77); (2) they offer a further positive incentive for inactive nurses to return to nursing (see page 110); and (3) they force hospital administrators to question the appropriateness of established staffing rates (see page 19).[3]

Finally, the reduced vacancy rate for hospital nurses may have been influenced by the increased collective bargaining activities of the American Nurses' Association. If the ANA or some other union is successful in organizing professional nurses, then much of the special characteristics of a noncompetitive labor market will no longer be relevant for nursing. The union, by establishing a uniform minimum wage for all nurses of a similar kind in different hospitals, can produce a situation similar to that described in a competitive labor market. At the extreme, the market would change back to the no shortage equilibrium situation shown in figure 1; where the union wage would, for example, be equal to W_2, and at that wage the number of nurses offering their services would equal the demand by hospitals and other employers for nursing manpower. If a union of professional nurses increases wages above W_2, they could generate an excess supply of nursing services (unemployment). Increased numbers of nurses

[3] A thorough analysis of the importance of each of these three factors requires data covering a more extended time period.

would enter the market at the same time as substitutes are sought for their now higher priced services. Whether we can reach an equilibrium situation or one close to it depends in part on the success of the ANA in their collective bargaining activities. In the next section the collective bargaining activities of the ANA are analyzed to determine what its impact has been on the wages and working conditions of professional nursing personnel.

Collective Bargaining of the American Nurses' Association

Collective bargaining was established as a legal activity protected by the Federal Government in 1935 when the Wagner Act was passed by Congress. But it was not until 1946 that the American Nurses' Association won its first representation election and signed its first contract.(1) The relatively late arrival of the ANA to collective bargaining activities[4] can be explained by a variety of legal and nonlegal barriers to the organization of nurses for job actions to achieve improved salaries and working conditions.

First of all, the Wagner Act, even as amended through the years (now known as the Taft-Hartley Act), still exempts large numbers of employers as do similar State laws. The ANA summed up the effect of such exemptions on its Economic Security Program for nurses in the following statement:

> . . . the absence of legislation protecting the right of nurses to bargain has been a major barrier to progress. Seven out of ten nurses are employed by employers traditionally exempted from the coverage of labor relations laws: non-profit charitable institutions and government agencies.(4)

Over two-thirds of the employed registered nurses in the country work in hospitals, nursing homes and related facilities; it is obviously these institutions which represent the major opportunity for collective bargaining and organization. The coverage or lack of coverage of hospitals, by type, can be seen in table 2. As also can be seen in table 2, by far the largest percentage of hospitals with collective bargaining contracts are Federal hospitals (22.6 percent). For the other three major groupings the percentage is less than 10 percent.

Even taking into consideration the ANA figure of 70 percent exemption from State and Federal law protecting the right to bargain, this would still leave a pool of approximately 200,000 nurses as a base for possible organization activities. By mid-1970, however, not quite 40,000 were covered by contracts (see table 3). It should be recognized that until

[4] The ANA has always frowned upon outside unionization of RN's as being unprofessional. The ANA has also considered itself to be the only authorized voice of the nursing profession, and has considered dual membership in the ANA and another union as something less than professional.

Table 2.—Extent of collective bargaining agreements in hospitals, 1967

Control	Total number of registered hospitals	Total number of employees	Total number of hospitals with contracts	Percentage of hospitals with contracts
Government (Federal)[1]	416	210,048	94	22.6
Government (non-Federal)[2]	2,141	718,456	115	5.3
Nongovernment, nonprofit[3]	3,692	1,288,896	301	8.2
Nongovernment, for profit[4]	923	91,918	45	4.9

[1] Federal Hospital System: All civilian employees are subject to Executive Order 10988, which gives the right to form and join any organization providing there is no conflict of interest. This was superseded by Executive Order 11491, Labor-Management Relations in the Federal Service.[21,22]

[2] State and Local Government: Twenty-four States have laws protecting the bargaining rights of all or some State and local Government employees. State and local Governments in the 24 States employ approximately one-half the employees in this group.

[3] Private Nonprofit: Are subject solely to State enactments. Forty States provide no coverage, 34 have no statute, and seven (including the District of Columbia, where Taft-Hartley applies) have laws which by court decision or exemption are not applicable to nonprofit hospitals. Ten States do cover nonprofit hospital employees (including Montana, where the law protects only registered professional and licensed practical nurses). In these 10 States private nonprofit hospitals employ 370,000 people, about 30 percent of the total nonprofit hospital work force.

[4] Proprietary: Since 1968 the NLRB has exercised jurisdiction over proprietary hospitals with gross annual incomes of $250,000. Ninety percent of the employees are covered.

SOURCE: Jon D. Miller and Stephen M. Shortell, "Hospital Unionization: A Study of Trends," *Hospitals*, Volume 43, No. 16, August 16, 1969.

Table 3.—Coverage of registered nurses under collective bargainin, agreements

Year[1]	Number of contracts	Number of employers	Number of settings[2]	Number of nurses
1960	(3)	(3)	(3)	8,000
1965	92	142	(3)	9,685
1966	121	245	282	[4] 16,850
1966	166	296	363	[5] 24,011
1968	277	352	453	[6] 30,191
1970	322	(3)	[7] 360	38,116

[1] Year refers to December 31, except for 1970, when contracts were reported as of July.

[2] A number of employers listed having more than one installation.

[3] Figure not available.

[4] Information on number of nurses not available for one contract in Oregon.

[5] Number of nurses not available for three contracts in California and one in Washington.

[6] Number of nurses not available for one contract in Washington.

[7] Includes only hospitals. Number of other settings not available.

SOURCE: Summaries of SNA Economic Security Program Activities, Annual, 1965–1968 by ANA Research and Statistics Department. Figures for 1970 are according to the ANA Research and Statistics Department files.

very recently the number of nurses legally allowed to form unions and bargain collectively was far below this 200,000 base.

In its attempts to achieve collective bargaining, the ANA has also faced a number of nonlegal barriers. Archie Kleingartner[14] listed the following five major factors in this category:

(a) Hospital employers oppose any form of collective bargaining with nurses;
(b) Nurses are apathetic about the ANA's Economic Security Program and lack sophistication in economics;
(c) Nurses lack effective economic sanctions against employers;
(d) ANA and its State affiliates are weak organizationally;
(e) ANA spreads itself too thin, with the consequence that collective bargaining does not receive the attention and resources it should.

Despite the formidable obstacles to collective bargaining, the ANA, at its 1946 convention, adopted a resolution stating:

> The American Nurses' Association believes that the several state and district nurses' associations are qualified to act and should act as the exclusive agents of their respective memberships in the important fields of economic security and collective bargaining. The association commends the excellent progress already made and urges all state and district nurses' associations to push such a program vigorously and expeditiously.[6]

This resolution became the basis of what is now the ANA's Economic Security Program. As outlined in 1946, the goals of the program for nurses were:

(a) Wider acceptance of the 40-hour work week with no reduction of salary (in 1934 the ANA adopted the 8-hour day as a goal);
(b) Minimum salaries sufficient to attract and hold high quality personnel;
(c) Greater participation in the planning and administration of nursing services;
(d) Development of professional associations as exclusive spokesmen for nurses in all questions affecting employment and economic security;
(e) Elimination of barriers to full employment and professional development of nurses from minority racial groups.

The chances for achieving these goals, however, were considerably weakened when the 1950 ANA national convention voluntarily adopted a no-strike pledge. It was not until 1968, 2 years after the California State Nurses' Association (CSNA) repealed this pledge and the first large-scale organized resignations by nurses to achieve pay increases occurred that the ANA reversed its stand and withdrew the pledge.

Table 4.—Labor union membership and registered nurse contract coverage by State, 1968

State	Labor union membership[1]	Rank[2]	Registered nurses covered[3]	Rank[4]
Washington	41.4	2	32.98	1
Michigan	36.2	[5]4	7.75	7
New York	36.2	[5]4	7.73	8
Illinois	36.0	6	5.87	9
Ohio	35.8	9	2.96	14
Wisconsin	32.2	11	4.32	10
California	31.9	12	11.83	4
Oregon	31.6	13	8.85	6
Montana	31.3	14	4.25	11
Minnesota	30.2	15	28.93	2
Hawaii	27.5	18	15.69	3
Delaware	26.0	20	3.57	12
Massachusetts	25.5	21	10.89	5
Connecticut	23.7	23	3.43	13
Colorado	21.8	25	0.34	17
Iowa	21.3	26	2.16	15
Alabama	20.1	28	0.09	16
Tennessee	19.4	29	1.13	18

[1] Percent of nonagricultural employees belonging to labor unions.

[2] These are the ranks considering all 50 States.

[3] Percent of active RN's covered by a collective bargaining agreement.

[4] These are the only 18 States in which RN's are covered by any type of collective bargaining agreement.

[5] Tied.

SOURCES: Labor union membership: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstracts of the United States, 1970*, Washington, D.C., table 356, p. 238.

RN coverage: American Nurses' Association, *Summary of SNA Economic Security Program Activities—1968*, New York, the Association, 1969, p. 3.

Active RN's: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Health Manpower Source Book, Section 2, Nursing Personnel*, Revised 1969, Washington, D.C., table 3, p. 11.

Prior to the switch in the ANA position, nurses in New York City hospitals won an increase in starting salaries from $5,150 annually to $6,400, after submitting letters of resignation. In the San Francisco Bay area, nurses won a $7,200 starting salary as opposed to $5,000 after the submission of resignation notices by many of the 2,400 nurses involved in the CSNA. In general, it appears that in cities where union activity is relatively more intense there is a greater likelihood of an understanding being reached between a hospital and its nurses (see table 5).

During 1967 and 1968 there were 19 more job actions reported (see table 5). Ten were strikes or resignations actually carried out and nine involved threat of job actions that were avoided by settlements. Further, a great deal of progress made by the ANA in the area of wages is not reflected in the statistics of nurses covered by formal contracts. In the

Table 5.—Strikes or resignations: 1967, 1968

Location	Numbers of RN's involved	Issue
Threatened—disputes settled		
Cook County, Illinois	500	Salaries
Dade County, Florida	—	Salaries—public health nurses
Los Angeles, California	68 of 111	Salaries
Pima County, Arizona	—	Salaries
Bowling Green, Kentucky	—	Salaries
New Orleans, Louisiana	RN's from one hospital	Salaries
New Jersey	33	Salaries (Marlboro State Hospital)
Seattle, Oregon	1200 of 1700	Salaries
Corpus Christi, Texas	—	Salaries (Memorial Hospital Center)
Carried out		
Alabaster, Alabama	20	Recognition (2 months)
Ingalls, Harvey, Illinois	128	Benefits and recognition (19 days)
Kentucky	23	Salaries: one week protest—emergency services only
Brookville, Pennsylvania	—	Recognition
Salt Lake City, Utah	21 of 29	Salaries; public health nurses, lasted 6 weeks, 14 of 21 did not return to work
Fresno, California	50 percent of RN's from Fresno General Hospital	One week sick-out
Onondaga, New York	36	Salaries; public health nurses
Covington, Kentucky	120	Recognition and money; one-third got new jobs
Detroit, Michigan	130 of 375	Salaries (5 hospitals)—settled through a private donation of $125,000
Trenton, New Jersey	12 of 16	Public health nurses—jobs filled by others

SOURCE: American Nurses' Association, *Economic Security News*, 1967, 1968. New York, the Association.

absence of collective bargaining agreements, the ANA frequently has been successful in generating understandings between employers and nurses involving improved wages and working conditions.

Still, nurses are likely to face continued resistance to demands for higher salaries. Hospitals are labor intensive firms with wages and salaries making up about two-thirds of total hospital costs. While salary increases

have been passed along to the buyers of hospital services; i.e., patients, hospital administrators are facing increasing external pressures to keep costs down from such sources as insurers and Federal and State Governments.

In sum, collective bargaining, in some instances, and other activities of the ANA have had a positive impact on the wages and working conditions of professional nurses. But at least for the present, the description of the nursing labor market as dominated by one or a few large employers without strong counter-pressure by a union also seems to have some validity. Therefore, we are likely to continue to experience some budgeted nurse vacancies due to the noncompetitive character of the hospital industry although its importance seems to be declining.

Regional Availability of Nursing Manpower

Along with concern about the adequacy of the total supply of employed professional nurses in the United States is the problem of an unequal regional distribution. Using as a base for comparison, nurses per population in different regions of the United States, a U.S. Department of Health, Education, and Welfare Task Force on Health Manpower in 1966 reported that while there were 417 professional nurses per 100,000 population in the Northeast, there were only 217 in the South (table 6),[26]

Table 6.—Active health workers by region

Occupation	Number active	Rates per 100,000 population				
		United States	North-east	South	North Central	West
Total	2,417,000	1,247	1,519	987	1,268	1,247
Physicians (MD and DO)	[1] 288,000	148	181	114	133	161
Dentists	[2] 93,000	48	57	32	46	50
Professional nurses	[3] 600,000	310	417	217	307	325
Other professional and technical	[4] 500,000	258	298	205	260	294
Practical nurses	[5] 265,000	137	181	138	109	115
Aides and attendants	[6] 671,000	346	385	281	413	298

[1] M.D.'s (A.M.A. data), estimated active D.O.'s (AOA data).

[2] DDH estimates.

[3] PHM estimates based on 1964 and 1966 Interagency data.

[4] PHM estimates based on 1960 Census data; includes chiropracters, dietitians, optometrists, pharmacists, medical and dental technicians, therapists and healers (n.e.c.), veterinarians, opticians, and psychologists.

[5] PHM estimate based on 1964 and 1966 DN data.

[6] PHM estimate based on 1960 Census data; includes hospital and physicians' and dentists' office attendants.

SOURCE: U.S. Department of Health, Education, and Welfare, Public Health Service, *Report of Health Subcommittee of the Departmental Task Force on Manpower Requirements and Training Programs*, Washington, D.C., appendix table 9.

with the same general pattern existing for other health professionals. What should we conclude from these figures? We could conclude, as the Task Force on Health Manpower did, that "On the assumption that the Northeast region represents comparatively good practice today, we could estimate a beginning toward meeting total manpower needs as those required to bring the other regions to that level."[26]

As will be shown, however, a more detailed analysis of such regional statistics does not support the conclusion that the Northeast provides relatively (with respect to population) more nursing manpower than other regions. In fact, in this section we will show that the Northeast lags considerably behind States in the Far West in providing hospital nursing manpower. This will be demonstrated by use of a more comprehensive measure of nursing manpower. One of the main features of this manpower measure is that it incorporates nursing services provided by full-time and part-time registered nurses as well as by practical nurses, nursing aides and other hospital personnel. Further, average daily number of hospital patients is adopted as a measure of regional demand for hospital nursing care, rather than total population. This new regional demand deflator is, in some sense, a more appropriate base for comparing the adequacy of nursing manpower per user in different sections of the United States.

Note that this study focuses on four regional areas of the country. It does not address the important problem of inadequate medical care in many rural and urban ghetto areas within regions. Rather, the purpose of this study is to question the appropriateness of some often-used measures of regional adequacy of medical resources and to highlight the adjustment in the medical care industry to regional differences in the availability of trained personnel.

Regional Analysis of Hospital Nursing Personnel

To analyze in greater depth regional differences in nursing manpower, we will use information obtained from a survey of nursing personnel employed in hospitals in each State.[28] The use of professional nursing personnel employed in hospitals rather than all nurses does not alter the basic regional line up of nurse-to-population ratios as used by the Task Force on Health Manpower. As seen in row 1, table 7, the Northeast has the highest rate of 212 hospital nurses per 100,000 population, and the South the lowest, 120 per 100,000 population. The West and North Central regions again show similar rates approximately midway between the Northeast and the South.

In the following analysis, the procedures used to adjust these total hospital nurse-to-population ratios are described and the implications of these adjustments with respect to the regional availability of nursing manpower are discussed.

Table 7.—Alternative measures of hospital nursing manpower by region (rate per 100,000 population)

	United States	Northeast	North Central	South	West
TRN (H)/Pop.[1]	165	212	169	120	174
Percent of U.S.	(100.00)	(128.48)	(102.42)	(72.73)	(105.45)
FTE.RN (H)/Pop.[2]	137	171	134	105	151
Percent of U.S.	(100.00)	(124.82)	(97.81)	(76.64)	(110.22)
Pat./Pop.[3]	690	879	699	618	534
Percent of U.S.	(100.00)	(127.39)	(101.30)	(89.57)	(77.39)
FTE.RN (H)/Pat.[4]	19,847	19,440	19,232	16,996	28,302
Percent of U.S.	(100.00)	(97.95)	(96.90)	(85.64)	(142.60)
FTE Oth. (H)/Pat.	42,096	35,919	41,965	47,023	46,466
Percent of U.S.	(100.00)	(85.33)	(99.69)	(111.70)	(110.38)
Adj. Tot. FTE Nur./Pat.[5]	45,050	44,138	43,865	42,549	57,929
Percent of U.S.	(100.00)	(97.98)	(97.37)	(94.45)	(128.59)

[1] Total active registered nurses employed in hospitals per 100,000 population, 1968.
[2] Estimate of total full-time equivalent registered nurses employed in hospitals per 100,000 population, 1968. (See table 8 for derivation of FTE registered nurses.)
[3] Total hospital patients per 100,000 population, 1968.
[4] Full-time equivalent registered nurses employed in hospitals involved in inpatient care per 100,000 patients, 1968.
[5] Adjusted total full-time equivalent supply of inpatient hospital nurses. Derived from above by obtaining a combined total (using re' tive earnings) of FTE Hosp. RN plus FTE Hosp. Oth. Nur. For "other" nursing personnel, the wages of both practical nurses and nursing aides were used. See table 10 and the text.

SOURCES: Patients: *Hospitals*, Journal of the American Hospital Association, Vol. 43, No. 15, Part 2, Guide Issue, August 1969, pp. 480–491.
Population: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the U.S., 1970*, Washington, D.C., p. 12.
Hospital nursing: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Nursing Personnel in Hospitals—1968*, Washington, D. C., May 1970, p. 55.

Full-time and Part-time Hospital Nursing Personnel

The total number of professional nurses reported in row 1, table 7 include both full-time and part-time workers. By using total nurse-to-population ratios to compare relative adequacy of nursing manpower in each region, we are implicitly assuming that the proportion of part-time and full-time professional nurses in each region is the same. There are several reasons to believe, however, that this would be only a random occurrence.

Part-time female workers are often married with a husband present and can be considered as secondary family workers.[1] Part-time nurses fall in this category.[25] Two factors have been found to strongly influence the labor force participation of secondary family workers (SFW's): (1) the level of family income (the income effect)—the higher the family income, the lower the participation level; and (2) the potential earning level of the SFW (the substitution effect)—the higher the earning level, the higher the participation rate.[17] No clear distinction, however, has been drawn between full-time employment and part-time employment. One possible hypothesis is that for a given level of regional employment, the proportion of part-time hospital nurses will be higher the higher the family income level and the lower the earning level. The income effect of this hypothesis is based on the assumption that an SFW, particularly those with young children, is less likely to work full time as opposed to part time the higher her family income. With respect to earnings, the reasoning goes the other way; the higher the earning level of the SFW, the more likely she is to work full time. The underlying premise of these hypotheses is that for an SFW with young children, the preferred state is nonlabor force activity, the second preferred state is part-time work, and the least preferred is full-time work. To be attracted to full-time activity requires either the strong pulling power of high wages or the strong pushing power of low family income.

It is quite possible, that the income effect and substitution (wage) effect could work in opposite directions with respect to regional trends. Regions of high family income are also areas of high nurse earnings. Therefore, the proportion of hospital nurses working part time will depend in part on the relative weight of these two opposing forces. For purposes of this study, we will compare the actual proportion of total hospital nurses in each category to decide which of the forces dominate.

Using the hospital nursing employment data described above, the total number of active full-time and part-time registered nurses and other nursing personnel were obtained, and estimates of total full-time equivalent supply (FTES) of registered nurses and other nursing personnel were derived (table 8).[28] Total full-time equivalent supply is defined as all full-time workers plus 50 percent of employed part-time workers. (This assumes that the average full-time work week is 40 hours and the average part-time work week is 20 hours.)[15]

Table 8.—Full-time equivalent supply of registered and other nursing personnel employed in hospitals by region, 1968

Regions	Registered nurses[1]					Other nursing personnel[2]				
	Full-time	Part-time	Total (TS)	FTES[3]	FTES / TS	Full-time	Part-time	Total (TS)	FTES[3]	FTES / TS
United States	217,678	111,780	329,458	273,568	.830	542,600	75,306	617,906	580,253	.939
Northeast	63,007	39,449	102,456	82,732	.807	142,612	20,497	163,109	152,861	.937
North central	55,495	38,487	93,982	74,739	.795	147,578	31,015	178,593	163,086	.913
South	56,282	18,476	74,758	65,520	.876	174,156	14,225	188,381	181,269	.962
West	42,894	15,368	58,262	50,578	.868	78,254	9,569	87,823	83,039	.945

[1] Registered nurses employed in hospital inpatient units as supervisors, head nurses and staff nurses.
[2] Licensed practical nurses, and auxiliary nursing personnel, excluding clerical personnel, employed in hospital inpatient units.
[3] Full-time equivalent supply equals full-time plus .5 part-time personnel.

SOURCE: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Nursing Personnel in Hospitals—1968*, Washington, D.C., May 1970

The data presented in table 8 suggest that part-time workers account for a greater proportion of registered nurses and other nursing personnel employed in hospitals in the high family income, high wage areas of the Northeast and North Central regions than in the low family income, low wage area of the South. In the Northeast the part-time rate is 39 percent, and in the North Central region it is 41 percent. In contrast, in the South only about 25 percent of employed hospital nurses work part time. In total, far fewer other nursing personnel work part time in all regions, and to the extent that regional variation exists, it is in the same direction as that for registered nurses.

The smaller proportion of part-time nurses in the South, and the overall smaller proportion of "other" nursing personnel working part time is consistent with the dominance of the income effect over the wage effect. Both the South in general, and families of other nursing workers in particular, have low family income, and receive relatively low wages. This suggests that the pushing power of low family income is more than sufficient to overcome the weak wage incentive to enter the labor market on a full-time basis.

The introduction of full-time equivalent registered nurse-to-population ratios (row 3, table 7) reduces somewhat the variation between the adequacy of services in the Northeast and the South, although the regional ranking remains the same. The Northeast still appears to provide over 30 percent more nursing manpower per population than the U.S. average, with the South more than 20 percent below the U.S. average. There is, however, some question whether population is the appropriate base to deflate relative regional nursing supply estimates. It is to this question that we next turn.

Regional Demand for Nursing Services

Use of overall population figures as a common deflator to adjust for regional differences in demand for health care is at best a crude device. It is well known that certain subgroups of the population such as very young children and the aged demand more in the way of health care. Income in the region is also an important determinant of the amount of health care consumed. Many studies have demonstrated that there exists a high positive income elasticity for health care;[10] that is, other factors comparable, families or regions with high income purchase greater amounts of health care. This would naturally translate itself into a larger demand for nursing services.

An alternative measure of regional demand for nursing services which at least partly adjusts for differences in the composition of the population and per capita income is the average daily number of hospital patients in each region. The use of patients as a measure of regional demand for medical care and therefore hospital nursing services tends to place more emphasis on demographic differences in population since differences in utilization of care by income class is likely to be small. Nevertheless,

differences in lengths of hospital stays for the same illnesses in different regions of the country point to the existence of some choice (how long you stay in the hospital) at even this level of medical care.[13]

By using hospital patients rather than population as a regional demand proxy for nursing services, we can more accurately reflect the extent to which regional variation exists in the number of hospital registered nurses available per direct user of hospital nursing services.[5] That demand for hospital nursing services (medical care) in certain sections of the country is not up to the levels of other regions because of low family income should be of considerable national concern, but the remedies required are different from those designed to increase the supply of medical practitioners.[6] If, as some have suggested, the number of hospital patients in a region is controlled by the availability of hospital based registered nurses then no differences in regional hospital nurse-to-patient ratios would exist. As can be seen in table 7, when only registered nurses are used as a measure of hospital nursing manpower, considerable variation exists in the regional ratios.

As shown in row 3, table 7, the Northeast, the area with the highest nurse-to-population ratio, also has the highest average daily census per 100,000 population (27.4 percent above the U.S. average). The South, on the other hand, has a smaller per capita number of patient days (10 percent below the U.S. average), and therefore presumably less of a demand for nursing services than would be suggested by its relative population size. The Western region actually has the lowest patient/population ratio. In the South, the relatively low patient/population ratio can be accounted for in part by lower family income and in part by the relatively small proportion of the population over age 65—8.3 percent in 1965, as opposed to 10.1 percent in the Northeast.[7] The low ratio in the West must be attributed more to the smaller proportion of the population in the high demand older ages (8.6 percent), and to the shorter duration of hospital stay per illness, as median family income in the West is actually the highest in the country.[8]

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[5] It is possible that supply creates its own demand in the medical care industry. But this is only likely to be true for physicians who have the ability to influence the amount of medical care demanded by an individual; nurses, however, are not likely to have such an influence.

[6] For example, by providing low income families with a high minimum income benefit family assistance program, we could help alleviate the financial constraint for receiving adequate hospital care. Such a plan, however, would have very little impact on the availability of health practitioners in low income areas, except perhaps in the long run.

[7] The proportion of population in each region in the high medical care demand ages, and the regional median family income in 1960 are as follows:

	United States	*Northeast*	*North Central*	*South*	*West*
Percent under age 1:	2.2	2.1	1.9	2.3	2.3
Percent over age 65:	9.2	10.1	9.8	8.3	8.6
Median family income:	$6,174	$6,692	$6,362	$4,808	$7,190

[8] E. Levine, *et al*, found a similar regional pattern when they combined all nursing personnel (RN's, practical nurses, nursing aides, etc.) and computed nurse/patient ratios, but when they computed full-time RN to patient ratios for only short-term general and allied special hospitals in the United States, by geographic region, the Northeast still maintained the highest ratio. When all hospitals were used in this study, however, the West showed up as having the highest ratio. See, E. Levine, reference (7), table 4, p. 46.

The major change in the regional line-up suggested by this alternative measure of relative regional availability of registered nursing manpower; i.e., full-time equivalent RN's to patients, is that the Northeast is now replaced by the West as providing the most hospital nursing manpower per user. The South, although showing a more favorable position, still maintains the lowest rank, with a ratio 23 percent below the U.S. average. But is it correct to interpret even these full-time equivalent hospital registered nurses/patient ratios as true measures of total relative availability of nursing manpower?

Alternative Sources of Nursing Services

The information in rows 9 and 10 in table 7 show the extent to which hospitals in the South make up for their relatively low registered nurse-to-patient ratio by hiring greater numbers of practical nurses, nursing aides, and other health personnel. This is an important factor that must be considered in evaluating the severity of the seeming maldistribution of registered nursing personnel. Whereas nursing services is a crucial input in the production of hospital care, it is not mandatory that all such services be provided by a registered nurse. Practical nurses, nursing aides, etc. can and do provide important nursing services. Although it is not within the scope of this manuscript to investigate the types of functions individuals in each group can and should perform, it does not appear reasonable to assume that each group provides separate and unique functions.[9] In many ways, differences in personal characteristics and training received are greater between 2-year associate degree trained registered nurses and 4-year baccalaureate degree trained registered nurses than between AD registered nurses and practical nurses.[2] The degree of substitution naturally will vary depending on the type of functions being provided and the amount of each group already employed.[18]

Since the degree of substitution is not likely to be perfect (substitution elasticity equal to 1.0), it is not correct to simply add together the number of practicing nurses in each group to arrive at an estimate of total nurse practitioners; nor is it correct to keep them separate and thereby disregard the similarity of the contribution to nursing services made by each group. To provide a more meaningful measure of relative regional availability of nursing manpower, some technique must be used to combine the groups. The approach adopted in this analysis is to assume that the relative productivity of the two groups can be measured by their relative wages. The productivity of "other nursing personnel" in a given region will therefore be assumed to be equal to that fraction of the productivity of a registered nurse which corresponds to the ratio of the earnings of other

[9] One need only tour the nearest hospital to find RN's doing the work of LPN's, on the one hand, and interns and residents on the other. How much flexibility there is will depend on local legal restrictions and the relative availability of the different types of workers.

nursing personnel to the earnings of registered nurses (see equation 2–1).

$$A_i = \frac{FR_i + (W_{0i} / W_{ri}) \cdot FO_i}{PA_i} \tag{2-1}$$

where

A_i = adjusted full-time equivalent supply of nursing manpower per patients in the ith region;
FR_i = full-time equivalent supply of RN's in the ith region;
W_{0i} = average full-time earnings of other nursing personnel in the ith region;
W_{ri} = average full-time earnings of registered nurses in the ith region;
FO_i = full-time equivalent supply of other nursing personnel in the ith region;
PA_i = average daily census of all hospital patients in the ith region.

The implications of this procedure can be seen by comparing the adjusted full-time equivalent supply of nurses in the Northeast and the South (see table 8). If the number of full-time equivalent RN's and other nursing personnel were simply added together, the South would show an advantage of 11,000 nurses. With the approach outlined in equation (2–1), and the relative wage figures of table 9, the estimated contribution to total hospital nursing services of each nonregistered nurse is shown to be lower in the South than in the Northeast—.54 in the South

Table 9.—Vacancy rates for full-time registered nurses by region: average 1961–62 (in percent)

Regions	Rate	Percent of U.S.
United States	20.4	100.00
Northeast	23.3	114.22
New England	23.6	115.69
Middle Atlantic	23.2	113.73
North Central	18.4	90.20
Great Lakes	18.7	91.67
Middle West	17.6	86.28
South	19.8	97.06
Border States	20.4	100.00
Southeast	16.8	82.35
Southwest	25.5	125.00
West	17.7	86.88
Mountain	20.2	99.02
Pacific	17.0	83.33

SOURCE: American Nurses' Association, *Facts About Nursing: A Statistical Summary*, 1966 ed., New York, the Association.

versus .69 in the Northeast. As such, the adjusted total full-time equivalent supply of nurses in the South is estimated to be 24,000 fewer than that in the Northeast.

By using the ratio of wages paid in each region as the coefficient for the relative productivity of other nursing personnel, we can account for the fact that in a region where the wages of a group is relatively low, more of that group will be employed (see tables 9 and 10), and their marginal contribution to hospital nursing services will be lower than in other regions. This is consistent with the law of diminishing marginal returns that can be interpreted to state: for a given quantity of RN's, the greater the employment of other nursing personnel the smaller the marginal contribution of each additional nonregistered nurse.[18]

Interpretation of Results

When the adjusted total FTE supply estimates are compared with the average daily hospital patient load in each region (see row 6, table 7), the results show a striking similarity among at least the first three regions (Northeast, North Central and South). Only the West stands out as providing significantly more nursing manpower per patient than the other sections of the country.

What these results suggest, is that southern hospitals in particular attempt to compensate for their relatively small number of RN's by hiring other nursing personnel. The similarity of the rates also suggests that it may be this adjusted measure of FTE nursing manpower that regulates the availability of hospital facilities on a per capita basis rather than total number of RN's.[19]

Further, there is evidence to suggest that the hiring of nonregistered nursing personnel is not just a temporary measure on the part of southern hospitals, which would be quickly terminated voluntarily if more registered nurses were available (at the prevailing RN wage). If the hiring of other nursing practitioners was entirely a matter of expediency, the vacancy rate for registered nurses in southern hospitals would be the highest in the country. This does not appear to be the case: The vacancy rate in 1961-62 for hospitals in the southern region was 19.8 percent, significantly less than that recorded for the Northeast (23.3 percent) and somewhat less than the overall U.S. average (20.4 percent). Of the nine sub-regions, the States in the Southeast (the area where the registered nurse-to-population is the lowest) actually had the lowest vacancy rate (see table 9).

These relatively low vacancy rates for registered nurses in southeastern hospitals should not be interpreted to suggest that if many more registered nurses became available in the South they would not be hired; nor that, if it became increasingly difficult to hire inexpensive other nurse prac-

[19] In an earlier section of the paper we commented on the possibility that the number of patients in a region is controlled by the available supply of RN's.

Table 10.—Full-time earnings of registered nurses, practical nurses, and nursing aides in non-Federal hospitals by region, 1966

Region	Practical nurse		Nursing aide		Weighted average "other" nurses		Registered nurse		Ratio of "other"/registered	
	Wage	Percent of U.S.	Wage	Percent of U.S.	Wage	Percent of U.S.	Wage	Percent of U.S.	Rate	Percent of U.S.
United States	$72.50	100.00	$58.00	100.00	$60.17	100.00	$100.50	100.00	59.87	100.00
Northeast	80.00	110.35	65.50	112.93	69.10	114.84	101.00	100.50	68.76	114.85
North central	75.50	100.00	57.00	98.28	58.70	97.55	100.00	99.50	58.70	98.05
South	61.50	84.83	47.00	81.03	49.18	81.74	90.50	90.05	54.34	90.76
West	81.50	112.41	67.00	118.97	70.45	117.09	110.50	109.95	63.76	106.50

SOURCE: American Nurses Association, *Facts About Nursing: A Statistical Summary*, 1967 ed., New York, the Association, table 1, p. 139; tables 1 and 2, p. 189.

titioners, the registered nurse vacancy rate would not go up. It may be that one of the major reasons underlying the relative preference for other nurse practitioners in the South is their relative abundance and therefore low cost. As can be seen in table 10, although the absolute level of hospital salaries for registered nurses in the South is the lowest ($90.50 per week versus the U.S. average of $100.50), relative to the earnings of practical nurses and nursing aides, RN's in the South have the highest earnings in the country. That is, "other" nurses in the South in 1966 earned 54.3 percent of the earnings of southern registered nurses. In the Northeast the earnings of "other" nurses was 15 percent above the U.S. average and they earned almost 70 percent of the wages paid to northeastern registered nurses.

The relative RN to other nurse earnings figures help to explain the seeming paradox that the Northeast is, on the one hand, an area with the largest registered nurse-to-population ratio, and yet also records the largest vacancy rate for registered nurses. The reason for this may result, in part, from the relatively small number of other nurse practitioners available in the Northeast to provide nursing services and the fact that they demand relatively high wages. The South, on the other hand, seems to have a greater supply of such workers that can be attracted at lower wages.

These relative earnings figures also suggest something about the regional mobility of the two groups of nursing personnel. A much smaller discrepancy exists in regional differences of registered nurse salaries than for "other" nurses. The difference between the highest wages paid for registered nurses in the West ($110.50) and the lowest in the South ($90.50) is 22.1 percent. In comparison, the difference between the West and the South in wages paid to "other" nurse practitioners is 43.2 percent. It would appear that the willingness and the ability of trained professional nurses to move from one part of the country to the other has something to do with these smaller differences. The fact, however, that a 22.1 percent difference exists in regional earnings of registered nurses suggests that their mobility is still limited.[11]

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[11] If the regional mobility of RN's was infinite then any regional wage difference would disappear except those that could be accounted for by cost-of-living differences of psychic preferences for a particular region

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Appendix II-A. Changes in Labor Supply in Monopsony Markets

Situation 1: Parallel Shift in a Linear Supply Function

In figure A1 we have shown a per unit increase in supply from S_0 to S_1 for a linear supply function. Although more labor is available at each wage and demand has remained the same, the number of budgeted vacancies has increased from q_0x_0 to q_1x_1. The increase in supply resulted in the number of desired workers, if more than q_1 could be hired at the new equilibrium wage, going up faster than the increase in those employed. That such an increase in vacancies will always occur under such a situation is explained as follows.

Consider first angle AGB and the same angle after the increase in supply, $A'GB'$. Since $A'B'$ is parallel to AB, and is further from the vertex, $A'B'$ is greater than AB. Now consider the similar triangles ABC and $A'B'C'$; since $A'B'$ is greater than AB, $B'C'$ is greater than BC; i.e., the difference between the marginal product and the wage (exploitation gap) is larger after the increase of supply. Moreover, the exploitation gap and the number of vacancies will always change in the same direction and by a proportionate amount.[12] Thus, the number of budgeted vacancies will always increase when a linear supply function shifts out by a constant amount at each wage. Furthermore, the increase in quantity employed will be proportional to the increase in the shortage. Thus, the "budgeted vacancy shortage rate;" i.e., the number of budgeted vacancies (q_0x_0) as a percentage of desired quantity of labor at the existing wage (ox_0) will remain constant.[13]

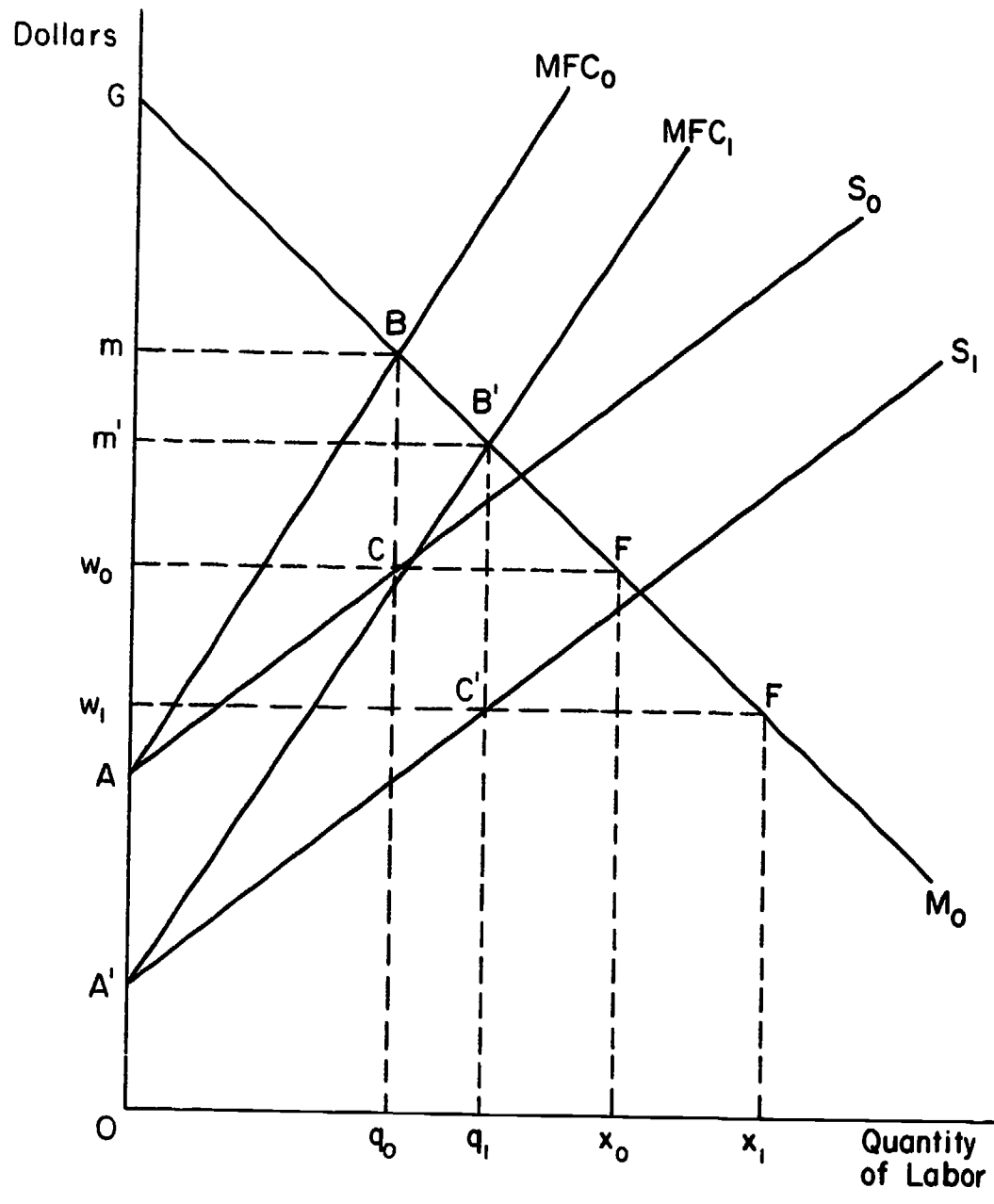
Situation 2: Shift in Slope of Linear Supply Function

Many changes in labor market conditions, such as the introduction of an effective union or state licensing controls act, in part, to alter the slope of the supply function. In the case of unions, the slope becomes closer to zero or flatter; in the case of licensing controls it becomes more

[12] Consider triangles BCF and $B'C'F'$: The three corresponding sides are parallel so the two triangles are similar. Since $B'C'$ is greater than BC, $C'F'$ (the number of vacancies after supply increased) is greater than CF (the original number of vacancies).

[13] Since the triangles MBC and $M'B'C'$ are similar and each share a common side with the triangles BCF and $B'C'F'$, MB is *proportionate* to $M'B'$. Thus, oq_0 is proportionate to oq_1. Given that q_0x_0 and q_1x_1 are proportionate, both the numerator and denominator of the shortage rates will increase proportionately leaving the rate unchanged.

Figure A1.—Parallel shift in a linear supply function

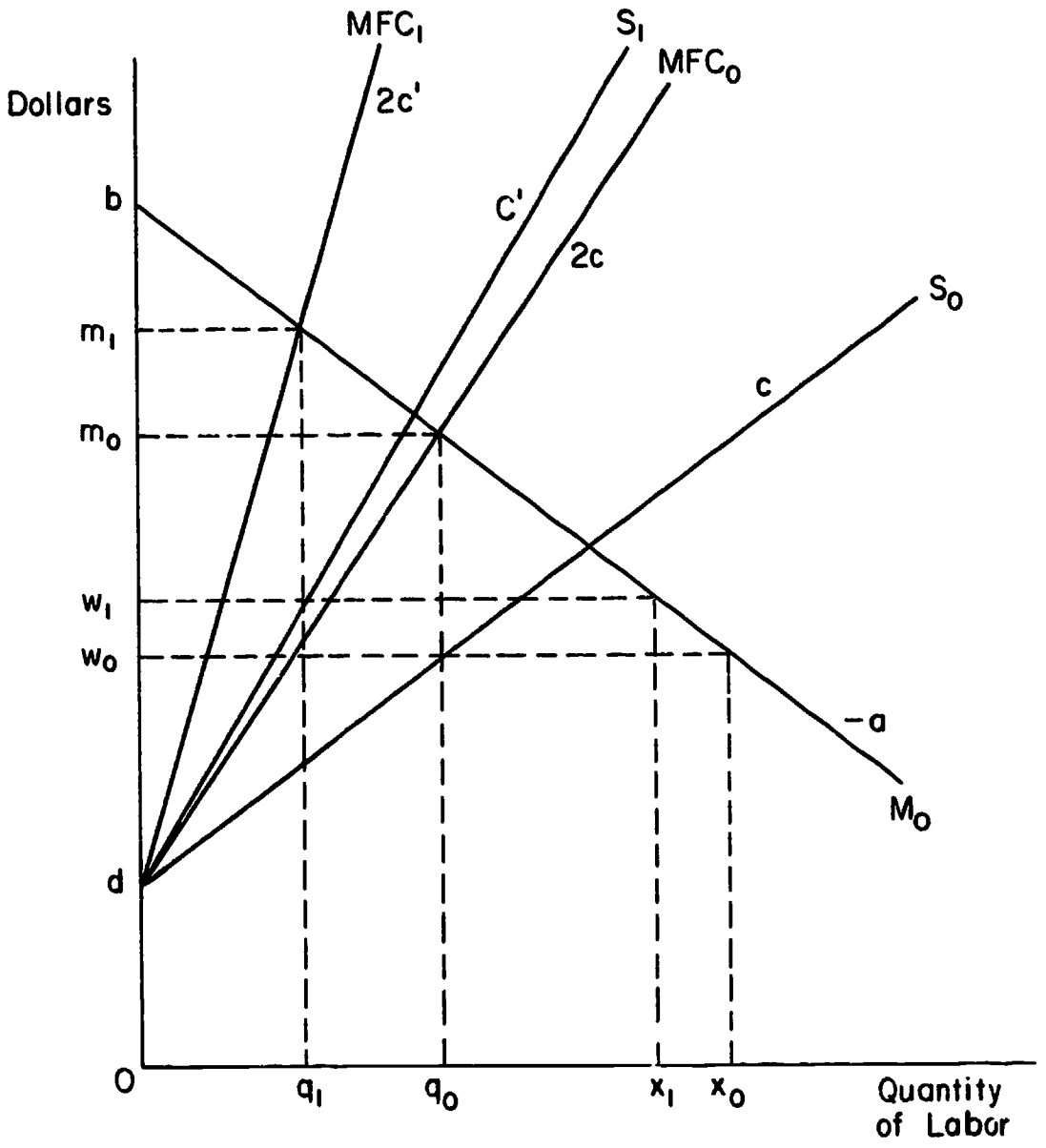


positive or steeper (see figure A2). As the supply function becomes steeper (flatter) the difference between the marginal product and the wage, or the exploitation gap, will become larger (smaller) and the apparent number of vacancies will therefore grow (shrink).

Mathematically, if we define:

(1) $Q_d = -aw + b$
(2) $Q_s = cw + d$
(3) $Q_m = 2cw + d$

Figure A2.—Shift in slope of linear supply function



where:

w = wage
Q_d = quantity of labor demanded (marginal revenue product)
Q_s = quantity of labor supplied
Q_m = marginal factor cost.

Then, we can solve for q_0 and m_0 at the equilibrium point $Q_d = Q_m$.

$$q_0 = \frac{b-d}{2c+a}$$

$$m_0 = \frac{2cb+ad}{2c+a}.$$

We can then determine the equilibrium wage, w_0, by substituting q_0 into Q_s.

$$w_0 = \frac{cb+cd+ad}{2c+a}$$

The difference between the marginal cost and the wage is equal to:

$$m_0 - w_0 = c\,\frac{b-d}{2c+a}$$

The question is what will happen to the value $m_0 - w_0$ as c (slope of the supply curve) becomes larger (goes to c'). If we assume that

$$c' > c$$

and that

$$a \gtrless 0$$

then

$$c'a \gtrless ca$$

hence

$$2c'c + c'a > 2c'c + ca$$

or

$$c'(2c+a) > c(2c'+a).$$

Since

$$2c+a > 0$$

and

$$2c'+a > 0$$

then

$$\frac{c'}{2c'+a} \gtrless \frac{c}{2c+a}.$$

Given that

$$b-d > 0$$

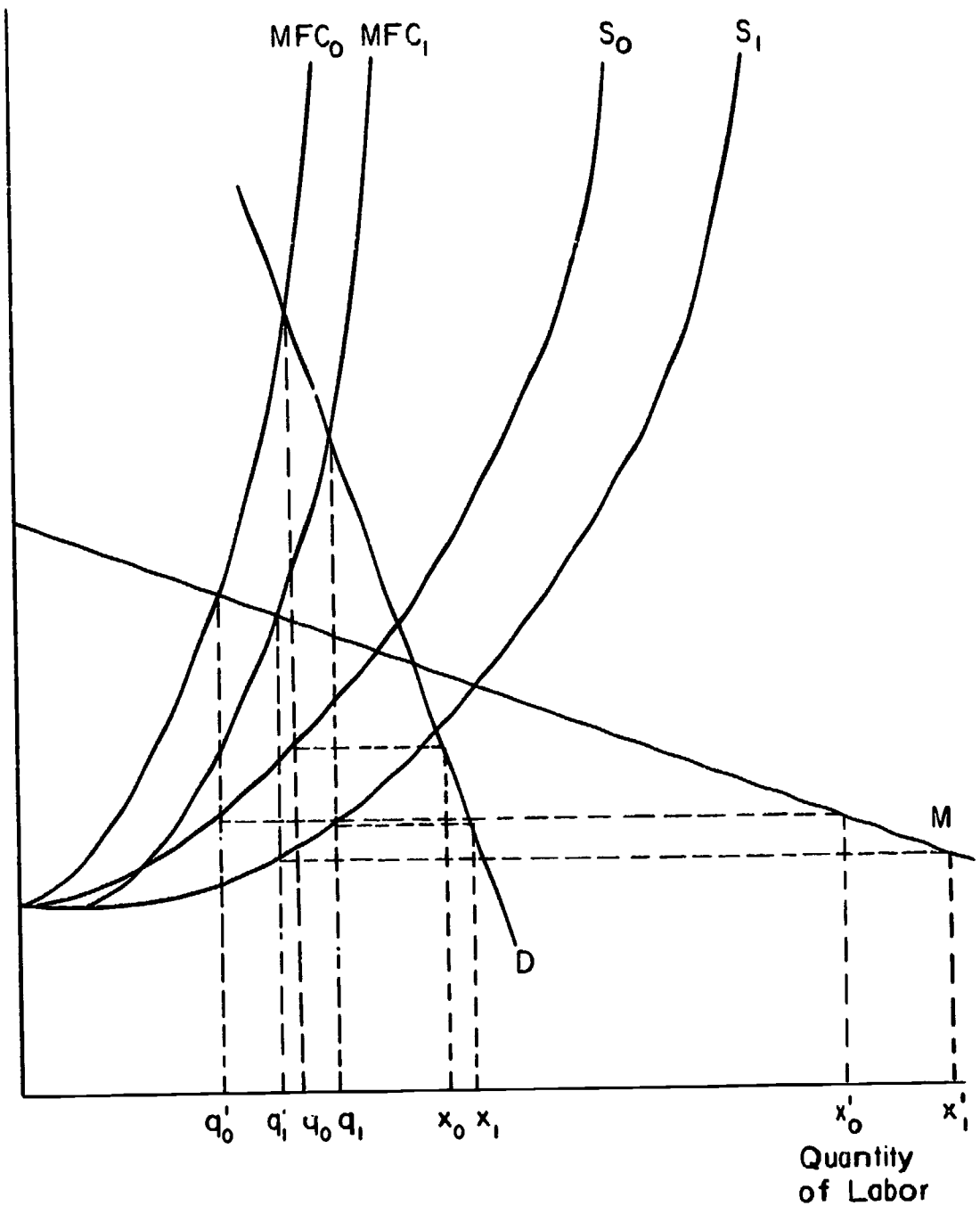
then

$$\frac{c'(b-d)}{2c'+a} \gtrless \frac{c(b-d)}{2c+a}.$$

Hence, as the slope becomes larger the gap between marginal cost and the wage increases. This implies that the number of budgeted variances will increase.

Hence, whenever the slope of a supply function becomes steeper the excess value earned by the marginal worker increases and although the monopsonist cannot profitably bid for additional workers by paying higher salaries, he would more than welcome additional employees at the going wage. Thus, without an increase in demand or a decrease in supply the number of unfilled positions has increased. Of course, a flattening or a reduction in the slope of the supply function would result in the opposite being true.

Figure A3.—Curvilinear supply function



Situation 3: Curvilinear Supply Function

If demand is less than perfectly elastic, a per unit increase in a curvilinear supply function will result in both a parallel shift in supply and a reduction in the slope of the curve at the new equilibrium wage (see figure A3). To the extent that the former leads to an increase in vacancies and the latter to a decrease, the outcome of such a change is unclear. Whether vacancies will increase depends on three factors. (1) The size of the parallel shift in supply—the larger the shift the more likely vacancies will increase. (2) The shape of the supply function—the larger the slope the more likely the vacancies will increase. (3) The slope of the demand function—the smaller the slope the more likely vacancies and the vacancy rate will increase.

The first and second factors are simple restatements of situations 1 and 2. But whereas the slope of the demand function affected only the number of vacancies in these situations, and did not influence the rate, in the curvilinear case, it influences both. If demand is close to perfectly elastic (slope near 0), there will be only a slight change in the slope of the supply function at the new equilibrium point. The major change will be a per unit shift in supply. Thus, an increase in vacancies will result as described in situation 1. At the other extreme, if demand is close to perfectly inelastic, only a change in the slope of the supply curves (becoming flatter) will occur. Such a change in slope will lead to a decrease in vacancies. As one moves, therefore, from a horizontal to a vertical demand function, the positive shift effect will be reduced and the negative slope effect will be increased. In so doing, both the absolute number of vacancies and the vacancy rate will be reduced.

One of the most likely shifts in a curvilinear supply function would be a proportional shift whereby supply would increase proportionately at each wage. In such a situation, it can be shown that unless demand is perfectly elastic, the slope effect will dominate the shift effect and the increase in supply will result in a decrease in vacancies.

CHAPTER III

THE CHOICE OF NURSING AS AN OCCUPATION[1]

The factors influencing occupational choice have interested economists since the time of Adam Smith.[10] Crucial among these are the monetary or pecuniary characteristics of the occupation such as salary and cost of training. Although these characteristics are the most visible, nonmonetary or nonpecuniary characteristics of an occupation (prestige, camaraderie, working conditions, sense of personal fulfillment, etc.) also have a strong influence in occupational choice. Furthermore, just as occupations have different mixes of attributes, so it is with individuals making occupational decisions. Individuals with different socioeconomic backgrounds, ability levels, and interests will differ as to their valuations of the attributes of a given occupation. By investigating the personal characteristics of those who have chosen a career of nursing as compared to those who have chosen other occupations, we hope to better understand these less visible and difficult to quantify nonpecuniary characteristics of nursing.

Characteristics of Entrants to Nurse Training

Some knowledge about the personal and family characteristics of those who select nursing as a career, while of interest itself, also can be helpful as a guide to understanding the attributes of the occupation. Among the more important of these characteristics for this purpose are the sex, age, marital status, family income, and ability level of those who enter nursing training.

The importance of relating personal characteristics to success in training and future labor force behavior was recognized by the National League for Nursing when it embarked on a multi-year career pattern study.[7] This study, begun in 1962 with an initial survey of new entrants to nurse training programs, will be followed up by an analysis of these entrants at different stages of their careers. New entrants in 1965 and 1967 are also being studied. Tabulations are not yet available concerning the behavior of those originally surveyed at the completion of their training

[1] Much of the material reported in this chapter was obtained from a working draft of a dissertation of Mr. Thomas Duston—"A General Theory of Occupational Choice and Its Application to Nursing." This dissertation was financed by the Division of Nursing contract No. PH108-67-204 and was written under the supervision of this author.

Table 11.—Sex, marital status, and ethnicity of professional nursing school entrants by program, 1967[1] (percent distribution)

Program	Sex			Marital status				Ethnicity			
	Women	Men	Total[2]	Single	Married spouse present	Other	Total[2]	White	Negro	Other	Total[2]
Associate degree (2 years)	95.5	4.6	100.0	66.9	26.9	6.2	100.0	90.6	6.9	2.2	100.0
Baccalaureate degree (4 years)	99.1	0.9	100.0	96.6	2.1	1.3	100.0	91.9	6.6	1.3	100.0
Diploma (3 years)	98.2	1.8	100.0	96.5	2.7	0.8	100.0	96.2	3.2	0.4	100.0
Total[3]	97.8	2.2	100.0	89.4	8.4	2.2	100.0	93.8	4.9	1.1	100.0

[1] No significant changes in these distributions were observed between 1962 and 1967 using the 1962–63, 1965, and 1967 Career Pattern Studies.
[2] May not add to 100.0 due to rounding procedures.
[3] Total distribution based on a weighted average of the three programs with weights conforming to actual admissions in each program in 1967.

SOURCE: National League for Nursing, *The Nurse Career-Pattern Study, Biographical Data Reported by Entering Students, Fall 1967*, New York, the League, 1969.

program. For this link-up we have used the results of a somewhat older longitudinal survey originally conducted in 1960 by a group known as Project Talent.[13] This group, headquartered at the University of Pittsburgh, administered an extensive questionnaire to roughly 400,000 high school students throughout the United States in the 9th, 10th, 11th, and 12th grades concerning their backgrounds, abilities, interests, and vocational preferences. Followup surveys have been and will be taken of each group at 1-, 5-, 10-, and 20-year intervals after high school graduation to appraise their education and labor force careers. For our study we selected the 11th grade group in 1960 who were re-surveyed in 1962 and 1966. The scope of the Project Talent survey permitted us to analyze the changing behavior of those who originally selected nursing as an occupation, and to compare this group to those who selected competing occupations.

Perhaps the most obvious and clearly the most important single personal characteristic about nurses is the overwhelming proportion who are females (see table 11). While some attempts have been made to attract males into the profession, in excess of 97 percent of the 1967 incoming class were females. Further, a very high proportion of the new students are white. Some progress has been made in attracting and accepting more nonwhites, but by 1969 they still represented only 5 percent of the professional nurses in the United States. As shown in tables 11 through 14, a major proportion of the girls that enter nurse training are single and less than 20 years of age. A rather high proportion are from the top quarter of their high school class and from families of average income.

In the next chapter we will analyze in detail nursing education and the changes it has undergone in recent years. In brief, however, most nurses have traditionally been trained in hospital-operated 3-year diploma programs. In the last 15 years, the diploma programs have declined and by 1969 only 42 percent of all new entrants were enrolled in hospital schools. Major growth has been recorded in the 2-year associate degree (AD) program, which accounted for 35 percent of new entrants in 1969. The longer 4-year baccalaureate degree program also has grown, but at a much slower pace. By 1969, it accounted for almost 24 percent of new entrants.

As seen in tables 11–18, the entrants to the various programs display quite different characteristics. The average associate degree entrant, for example, is likely to be older (by 2 years); is 10 times more likely to be married, and several times more likely to be a male than the average baccalaureate or diploma entrant. Associate degree programs are more likely to be found in junior or community colleges in metropolitan areas. Baccalaureate programs, on the other hand, are frequently located in a university far from large population centers. Hence the cost to the married female (who is older than the average high school graduate) of participating in a program some distance from home can be considerable and

Table 12.—Age of professional nursing school entrants, by program, 1967[1] (percent distribution)

Program	Fewer than 20 yrs.	Age								
		16–17	18–19	20–24	25–29	30–34	35–39	40–49	50 and over	Total[2]
Associate degree (2 years).....	52.2	9.3	42.9	19.9	7.5	6.2	5.8	6.9	1.4	100.0
Baccalaureate degree (4 years)...	87.0	17.7	69.3	11.3	0.8	0.4	0.2	0.3	0.0	100.0
Diploma (3 years).....	90.4	21.6	68.8	6.9	1.3	0.7	0.3	0.3	0.1	100.0
Total[3].....	80.4	17.7	62.7	11.1	2.7	2.0	1.6	1.9	0.4	100.0

[1] No significant changes in these distributions were observed between 1962 and 1967 using the 1962–63, 1965, and 1967 Career-Pattern Studies.
[2] May not add to 100.0 due to rounding procedures.
[3] Total distribution based on a weighted average of the three programs with weights conforming to actual admissions in each program in 1967.

SOURCE: National League for Nursing, *The Nurse Career-Pattern Study, Biographical Data Reported by Entering Students, Fall 1967*, New York, the League, 1969.

the proximity of the associate degree program can therefore be very attractive. On the other hand, for those with considerable mobility and freedom of action, the 4-year university has many attractions (see chapter IV).

The average nursing school entrant in the baccalaureate program, as might be expected, is more likely to have been in the top one-quarter of her high school class (65.1 percent, versus 49.4 percent of diploma entrants, and 37.3 percent of associate degree entrants). She also is considerably more likely to come from a high income family—18.8 percent come from families whose annual incomes exceed $15,000, as compared to 9.7 percent for associate degree entrants, and 8.8 percent for diploma students. As will be explained in later sections of the chapter, these two characteristics, "ability" and "family income," are particularly important for an understanding of the choice of nursing as well as the selection of the type of training program.

An appreciation of the role that these characteristics play in determining who is likely to enter the field of nursing as opposed to some other occupation, requires an investigation of the personal profiles of those who select nursing as well as those who select competing occupations. For our analysis, we selected two popular career fields for women in addition to nursing that are somewhat similar in terms of post high school education—teaching and office work. Teaching usually requires 4 or more years of college and can therefore be thought of as a high training occupation. Those occupations within the general office work classification that require some post-high school training were selected for this part of the analysis.

Using data from Project Talent, information about females who were originally surveyed in the 11th grade and who 5 years after high school

Table 13.—High school academic standing of professional nursing school entrants by program, 1967[1] (percent distribution)

Type of program	High school academic standing				
	Top 1/4	2nd 1/4	3rd 1/4	Bottom 1/4	Total[2]
Associate degree (2 years)	37.3	44.2	6.7	1.8	100.0
Baccalaureate degree (4 years)	65.1	27.2	6.6	1.1	100.0
Diploma (3 years)	49.4	39.7	10.2	0.7	100.0
Total[3]	50.3	37.8	10.9	1.1	100.0

[1] No significant changes in these distributions were observed between 1962 and 1967 using the 1962-63, 1965, and 1967 Career-Pattern Studies.

[2] May not add to 100.0 due to rounding procedures.

[3] Total distribution based on a weighted average of the three programs with weights conforming to actual admissions in each program in 1967.

SOURCE: National League for Nursing, *The Nurse Career-Pattern Study, Biographical Date Reported by Entering Students, Fall 1967*, New York, the League, 1969.

Table 14.—Family income of professional nursing school entrants by program, 1967[1] (percent distribution)

Type of program	$15,000 and above	Below $5,000	$5,000–$9,999	$10,000–$14,999	$15,000–$20,000	Over $20,000	Total[2]
Associate degree (2 years)	9.7	18.6	45.5	26.1	5.7	5.0	100.0
Baccalaureate degree (4 years)	18.8	14.4	35.8	31.1	10.2	8.6	100.6
Diploma (3 years)	8.8	17.6	49.1	24.6	6.1	2.7	100.0
Total[3]	11.4	17.1	45.0	26.5	7.0	4.4	100.0

[1] As would be expected, the mean income for each type of program category increased somewhat in the 1962–67 period as the mean income of all households increased. No significant changes between type of program are observed over this period.

[2] May not add to 100.0 due to rounding procedures.

[3] Total distribution based on a weighted average of the three programs with weights conforming to actual admissions in each program in 1967.

SOURCE: National League for Nursing, *The Nurse Career-Pattern Study, Biographical Data Reported by Entering Students, Fall 1967*, New York, the League, 1969.

were: (a) registered nurses; (b) teachers with at least a 4-year college degree; and (c) office workers with a business or secretarial school diplom were analyzed. Also shown in tables 15 and 16 for comparison purposes is the distribution of the entire 11th grade female population over the relevant characteristics. All the information in these tables have been adjusted to provide a representative picture of all females in the country who fall in the stated category.

It seems clear from the information shown in table 15 that nurses are drawn primarily from middle income families ($6,000 $9,000). Fifty-two percent of nurses come from this category, versus only 30 percent of teachers, and 31 percent of the total female population. The variance of the nurse distribution around this middle income category is also much less than for either teachers or the total population.

The fact that a relatively higher proportion of teachers (graduates of 4-year colleges) come from high income families, coupled with the information that, within nursing, baccalaureate students have the highest family income, suggests that there is a strong relationship between family income and the probability of obtaining a 4-year college degree. Other studies have demonstrated that the reason for this centers around two factors: (1) the greater ability of high income families to finance the higher cost of university training;[6] and (2) the greater importance that parents and children from high income families place on the nonmonetary (prestige) value of obtaining a baccalaureate degree.

The distribution of ability does not follow the same pattern as that described for income. In this case, nurses are more heavily weighted in the higher ability level groups (table 16). The top three ability level groups representing roughly half the distribution of the total female population, contain 84 percent of the nurses. These same groups contain only 75 percent of the teachers and 48 percent of the office workers. These data, together with those on the distribution of nurses by family income

Table 15.—Occupation of daughter by parents' income (percent distribution)

Reported family income (1960)	All females[1]	Registered nurse	Teacher with bachelor's degree	Office worker[2]
Less than $3,000	9.0	1.0	5.0	4.0
$3,000–5,999	33.0	22.0	28.0	38.0
$6,000–8,999	31.0	52.0	30.0	33.0
$9,000–11,999	15.0	16.0	15.0	14.0
$12,000 or more	12.0	9.0	21.0	10.0
Total	100.0	100.0	100.0	100.0

[1] Representative distributio.. of all 11th grade females in 1960.
[2] With business or secretarial school diploma.

SOURCE: Unpublished tabulations from Project Talent.

Table 16.—Occupation chosen by individual's ability (percent distribution)

Scores on project talent "ability" test	All females[1]	Registered nurse	Teacher with bachelor's degree	Office worker[2]
0–99	4.0	2.0	1.0	0.0
100–149	16.0	2.0	4.0	17.0
150–199	34.0	12.0	20.0	35.0
200–249	31.0	42.0	37.0	39.0
250–299	13.0	40.0	35.0	8.0
300 or higher	2.0	2.0	3.0	1.0
Total	100.0	100.0	100.0	100.0

[1] Representative distribution of all 11th grade females in 1960.
[2] With business or secretarial school diploma.

SOURCE: Unpublished tabulations from Project Talent.

raise an interesting question: Is the large number of nurses (trained in 3-year diploma schools) from families of average income a reflection of individual preferences for nursing, or does it reflect the inability of these families to finance the training of their daughters in the more costly "university occupations?" If the possession of higher ability is a substitute for family income in determining one's chances of securing a loan for financing college, then more nurses could have taken (or demanded) a university program. On the other hand, higher ability may not compensate for low family income and nonbaccalaureate nursing programs may be chosen because of the inability to finance the other, and not from a "free" choice. We may be able to gain some insight into these choice factors by investigating the characteristics of those girls who originally selected nursing, but who, for one reason or another, did not obtain a professional license by the fifth year after high school graduation.

Nurse Dropouts

The discussion thus far has excluded an analysis of a large group of potential nurses. These are individuals who at some time indicated a desire to become a nurse, but never actually obtained a license.

The Project Talent data reveal that of the 105,000 females who expressed a preference for nursing in the 11th grade (table 17), 15,061 (14.3 percent) had received a nonbaccalaureate (diploma) RN degree within 5 years after high school graduation; an additional 2,885 (2.7 percent) received a baccalaureate RN degree, and 278 (0.3 percent) an associate RN degree. In total, 18,224 (17.3 percent) of the original 11th grade group were registered professional nurses 5 years after high school graduation.

Table 17.—Original occupational preference and ultimate career choice of female high school graduates, 1961

Ultimate career choice[2]	Original occupational preference[1]											
	Nurse		Teacher		Office work		Housewife		Other		Total	
	No.	Pct	No.	Pct	No.	Pct	No.	Pct	No.	Pct	No.	Pct
Nurse (total)	29,085	27.6	1,864	1.6	2,744	1.6	1,412	1.6	19,005	4.1	54,110	5.6
Have RN	18,224	17.3	1,576	1.3	1,413	0.8	303	0.3	8,269	1.8	29,785	3.1
Diploma	15,061	14.3	1,533	1.3	1,372	0.8	203	0.2	6,021	1.3	24,190	2.5
Bacc.	2,885	2.7	22	0.0	41	0.0	79	0.1	1,871	.4	4,898	0.1
Assoc.	278	0.3	21	0.0	0	0.0	21	0.0	377	.1	697	0.0
No RN	10,861	10.3	288	0.3	1,331	0.8	1,109	1.3	10,736	2.3	24,325	2.5
Teacher (total)	3,627	3.4	20,032	17.5	4,613	2.7	3,893	4.6	29,831	6.3	61,996	6.5
Have bacc.	2,041	1.9	16,304	14.2	3,978	2.3	2,620	3.1	19,632	4.1	44,575	4.7
No bacc.	1,586	1.5	3,728	3.3	635	0.4	1,273	1.5	10,199	2.2	17,421	1.8
Office work	5,471	5.2	6,261	5.5	26,903	15.2	2,118	2.1	30,035	6.3	70,788	7.4
Housewife (total)	43,966	41.7	39,950	34.8	89,866	50.9	56,000	65.6	200,193	42.1	429,975	44.9
Have bacc.	2,175	2.1	4,843	4.2	985	0.6	1,363	1.6	10,587	2.2	19,954	2.1
No bacc.	41,791	39.6	35,107	30.6	88,880	50.3	54,637	64.0	189,606	39.9	410,021	42.8
All other (total)	23,427	22.2	46,704	40.6	52,745	29.8	21,995	25.8	195,828	41.3	340,700	35.6
Have bacc.	5,465	5.2	25,186	21.9	5,117	2.9	6,290	7.4	62,454	13.2	104,512	10.9
No bacc.	17,962	17.0	21,518	18.7	47,629	26.9	15,705	18.4	133,374	28.1	236,188	24.7
Total age group	105,576	100.0	114,811	100.0	176,872	100.0	85,418	100.0	474,892	100.0	957,569	100.0

[1] Occupational preference expressed by a sample of 11th grade females in 1960.
[2] Ultimate career choice as expressed in a survey continuation 5 years after graduation from high school. It is assumed that by this point most career plans have become finalized.

SOURCE: Special tabulations from Project Talent.

Of those who did not have an RN, 10,861 (10.3 percent) indicated that they still expected to become a professional nurse. Other evidence suggests that some of this group will in fact ultimately obtain certification. While the annual output of domestically trained RN's averaged about 32,000 in the 1960–65 period, the survey results show that 29,700 from this single-age group were certified. This suggests that 2,300 older age females (as well as males) became RN's during this period, and correspondingly some from the 11th grade sample ultimately will become RN's in later years. The largest dropout category from nursing was to the home. Almost 44,000 or 41.7 percent of those who expressed a preference for nursing in the 11th grade, were not in the labor force 6 years later and did not expect to become an RN in the future.

In order to compare those who become nurses with those who do not, the characteristics of two extreme groups were considered: Group 1—those who indicated a preference for nursing in the 11th grade and had received a license at the fifth post-high school year; and Group 2—those who indicated a preference for nursing in the 11th grade, and had neither received a license nor a bachelor's degree (of any kind) by the fifth post-high school year. Hopefully, this method eliminates many of those who changed to an occupation requiring similar levels of advanced training. This group is the least likely to be induced back into nursing through policy decisions. The potential nurses remaining (Group 2) contain those who "dropped out" because of some contraint (such as lack of funds) that could be minimized through policy decisions (see the discussion of the Nurse Training Act in chapter IV) or those who, with remedial help, could succeed academically in nurse training. The distribution of the two groups with respect to their ability and family income appear in tables 18 and 19 for nursing and teaching.

Table 18.—Stability of occupational choice by family income (percent distribution)

Reported family income (1960)	Nurses		Teachers	
	Completed[1]	Dropped out[2]	Completed[1]	Dropped out[2]
Less than $3,000	1.0	12.0	5.0	11.0
$3,000-5,999	22.0	30.0	28.0	29.0
$6,000–8,999	52.0	29.0	30.0	31.0
$9,000–11,999	16.0	17.0	16.0	16.0
$12,000 or more	9.0	12.0	21.0	13.0
Total	100.0	100.0	100.0	100.0

[1] Those who stated a preference for nursing or teaching in the 11th grade and eventually received an RN or bachelor's degree (Group 1).

[2] Those who stated a preference for nursing or teaching in the 11th grade and had not received an RN or bachelor's degree by the fifth post-high school year (Group 2).

SOURCE: Unpublished tabulations from Project Talent.

Table 19.—Stability of occupational choice by ability (percent distribution)

Scores on project talent "ability" test	Nurses		Teachers	
	Completed[1]	Dropped out[2]	Completed[1]	Dropped out[2]
Less than 100	2.0	3.0	1.0	0.0
100–149	2.0	15.0	4.0	10.0
150–199	12.0	35.0	20.0	30.0
200–249	42.0	36.0	37.0	37.0
250–299	40.0	11.0	35.0	20.0
300 or more	2.0	0.0	3.0	3.0
Total	100.0	100.0	100.0	100.0

[1] Those who stated a preference for nursing or teaching in the 11th grade and eventually received an RN or bachelor's degree (Group 1).

[2] Those who stated a preference for nursing or teaching in the 11th grade and had not received an RN or bachelor's degree by the fifth post-high school year (Group 2).

SOURCE: Unpublished tabulations from Project Talent.

The family income distribution of Group 1 nurses is the same as discussed previously, with a large concentration in the middle family income categories. For those who did not complete nurse training (Group 2), a larger percentage are in the lower family income range—42 percent have family incomes less than $6,000 (column 1, table 15). By contrast, only 23 percent of Group 1 ("successful") nurses are in this category. But rather surprisingly, a somewhat higher ratio of Group 2 ("unsuccessful") nurses are in the higher family income range (above $9,000) as well—27 percent compared to only 25 percent of Group 1 nurses. Perhaps differences in ability will be useful in explaining this peculiarity.

The ability distribution of the two groups gives a clear and dramatic illustration of a major difference between the groups. While only about half of the nurse dropouts had ability scores above 200, 84 percent of the graduate nurses were above this ability level. At the lower end of the distribution the results were the opposite, with a greater concentration of nurse dropouts. This would suggest that academic ability is a useful predictor of the probability that an individual who originally indicates a preference for nursing will succeed in entering nursing. There is no obvious indication here that low family income is a barrier to obtaining nurse training once the occupational choice is made. This is not the case, however, for individuals with limited ability. What we don't know yet is whether girls from low income families prescreen their preferences even in the 11th grade because of their anticipation of financial difficulty.[2]

[2] Project Talent attempted to investigate this possibility by asking two questions about occupational choice.

(1) In the following list of occupations, mark the one you *expect* to make your career after you have completed your education.

(2) Which one of the following occupations would you most *like* to enter?

While there was some difference in the responses, they were small and statistically insignificant in the field of nursing.[13]

Occupational Characteristics

An occupational characteristics model of decision-making is a useful theoretical tool for focusing on important decision variables in the choice of an occupation. In particular, an occupation can be defined in terms of the characteristics it possesses: (1) monetary earnings and costs (of training)—pecuniary characteristics and (2) nonmonetary earnings and costs—nonpecuniary characteristics. This section is concerned with an analysis of the characteristics of nursing in comparison with other occupations traditionally chosen by women. In particular, we will continue to concentrate on the occupations of teaching and office work in addition to nursing.

Pecuniary Characteristics

The monetary income generated by an occupation considered either at a point in time or as a stream received over the working lifetime of an individual, strongly influences the choice of that occupation and is the most frequently mentioned attribute of an occupation.

Although the time structure of earnings is the key measure in the occupational choice model discussed in a later section of the chapter, the annual earnings at a point in time can give a rough idea of the relative income ranking of different occupations. Table 20 gives the median full-time monetary earnings for several occupations in 1959 using 1960 Census data.[3]

There are several conceptual difficulties involved in defining full-time occupational earnings.[4] For simplicity, teachers' salaries for the academic year, and the salaries of office and private duty nurses for their "normal" work week were considered as full-time earnings (as they probably are so considered in their own minds).

Of the 10 occupational groups listed in table 20, professional nurses ranked fourth, behind professional and technical workers. and secondary and elementary school teachers, just those occupations usually considered to require comparable ability and similar amounts of training time. The

[3] A more up-to-date source could have been found for some of the occupations and is used to discuss the changing financial picture in nursing (Chapter IV), but to make this information comparable with that used to estimate the time stream of earnings later in the chapter we have shown the median income for 1959.

[4] A teacher, for example, works (as a teacher) perhaps 40 weeks per year. Should the earnings derived from this be the full-time earnings of a teacher, or should the 50-week equivalent be used? (A clear distinction should be made between teaching as an occupation for a male head of household and teaching as an occupation for a single female or a female as a secondary worker. Nonmarket work is much more relevant for the female worker; most male head-of-household teachers work at a reduced salary during their summer "leisure.") A strong argument could be made that one of the characteristics of teaching is the leisure it affords, and because this leisure is valued, the true full-time earnings of teachers should be greater than the 40-week earnings. For the office nurse or private duty nurse (almost one-quarter of all registered professional nurses in 1960) a "full-time" week may only consist of 20 to 30 hours; this is the normal work load, and is done on a 50-week basis. Should these earnings be converted to 40-hour equivalents? One can argue that a full-time office or private duty nurse is defined as one working the reduced work week. The argument for inflating the earnings of these special types of nurses to the extent that leisure time is valued is analogous to that for the female teachers.

Table 20.—Median full-time earnings for females in selected occupations, 1959

Occupation or occupational class	Median earnings in 1959 for females working 50–52 weeks
All workers	$3,161
All professional or technical workers	4,209
Secondary school teachers	5,091
Elementary school teachers	4,546
Professional nurse	3,819
Practical nurse	2,496
Clerical and kindred	3,544
Secretaries	3,807
Sales workers	2,369
Operatives and kindred	2,924
Service workers, except private household	2,081

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Census of Population, 1960*, Washington, D.C., pp. 373–388.

difference of about $700 between the earnings of elementary school teachers and professional nurses is not unique to 1959, although as discussed in chapter IV the difference has narrowed considerably in the last few years. The relationship between the monetary earnings of professional nurses and teachers is discussed in greater detail in a later section of this chapter. What is clear from the data in table 20 is that the choice of nursing by large numbers of female high school graduates each year cannot be completely justified on the basis of earnings potential, at least in relationship to other comparable training occupations.

Cost of Training

There are two types of monetary training costs. The first, direct investment costs is composed primarily of tuition and books. The consumption aspect of training (room and board) cannot be legitimately called a true (educational) investment cost, since it would have to be undertaken even if one were not in training.[5] Table 21 below gives the annual direct investment cost of the three types of professional nurse training programs in 1968–69. The annual cost of teacher education would correspond roughly with the baccalaureate nursing program as practically all teachers are presently trained in baccalaureate programs. The direct investment cost of the occupations not requiring a formal post-high school training program (although perhaps on-the-job training), in comparison, can be considered to be zero.

[5] The social amenities and prestige of attending college (college as a consumption good) are assumed to be "earnings", and hence part of the return of the college investment.

Table 21.—Average annual direct investment costs of nurse training, 1968–69 academic year

Program	Annual direct investment costs (1968–69)
Diploma	
Public	$439
Private	649
Weighted average	615
Associate	
Public	502
Private	1,559
Weighted average	610
Baccalaureate	
Public	638
Private	1,506
Weighted average	1,003

SOURCE: National League for Nursing, "Survey of Nursing Student Financing, 1969–1970," New York, the League.

The wide variation in direct investment costs can be a crucial determinant of a girl's training decision. A significant difference in total earnings (including the pure pleasure of attending college) is necessary to compensate for the $5,018 difference in direct investment cost (over the entire investment period) between the private baccalaureate program and publicly supported associate degree program.

Even more important in absolute amount is the second type of training cost, the opportunity costs of undertaking training. By definition, the opportunity costs of training are the earnings foregone by undertaking the training and therefore not working. The opportunity costs or earnings foregone depends upon the length of the training program and the potential earning capacity of the student. The girl graduating from a commercial course in high school usually can obtain a higher starting salary and therefore faces a higher opportunity cost of training than a girl who has taken a college preparatory course. As seen in table 17, the median earnings in 1960 for secretaries (an occupation open to most business course graduates) was $3,807; for clerical, sales and manufacturing workers (open to nonspecialized high school graduates such as those in the general or college course), the average was $2,946, giving an annual difference of $861. For later years this difference disappears and in most cases is reversed as potential earnings are based more on the value of the earlier years of post-high school training and the ability of the worker.

Concept of Present Value

The earnings stream of an occupation that requires training is characterized by negative earnings during the first few years (the training costs) and positive earnings after the training is completed. An occupation that requires no formal training is characterized by positive earnings throughout the work period but often at a lower level than the training occupation. How does one choose between the two alternative earning streams? Since the choice is made in the present, one would like to know the value in the present of each earning stream. To obtain this, we can derive for each occupation what is called the "total present value" of future earnings (costs).

Assuming that a dollar to be received in the future is worth less than a dollar received today, each year of future income must be discounted to get the present value of that year's income. Future earnings are discounted more the further in the future it is expected. This can be accomplished by dividing the expected annual income in some future year n, by the term $(1+d)^n$; where d is what is called the discount rate and n is the number of years away from the present. Using this procedure, annual earnings are reduced more than proportionately the further in the future it is expected (the higher the value of n). The discounted value of each yearly income can then be added together to arrive at the total present value for each occupation. Since people value time differently; i.e., have different time preferences, they will use different rates to discount the future. The more they prefer the present the higher the rate used to discount future earnings. Hence, the same occupational earning stream will have a different present value to different people. Those who discount the future heavily (prefer the present) are not apt to choose occupations requiring extensive training with high earnings only after an extended time period. They would prefer an occupation having little or no formal training, positive earnings right away.

The actual calculation of the present value of the earnings of an occupation requires the use of an equation similar to (3–1) below; where PV_{jk} represents the total present value of occupation j for individual k, C_t the cost of training in each year, e_t the earnings of occupation j in year t, and d_k the discount rate appropriate for individual k. In equation (3–1) it is assumed that training takes place for three years (C_0, C_1, C_2) and thereafter the individual receives positive earnings through year n.

$$(3\text{–}1) \quad PV_{jk} = C_0 + \frac{C_1}{(1+d_k)} + \frac{C_2}{(1+d_k)^2} + \frac{e_3}{(1+d_k)^3} \cdots \frac{e_n}{(1+d_k)^n}$$

Using equation (3–1) the total present value for the earnings of nurses in 1960 are calculated as well as for all females in the labor force, for female professional and technical workers, for teachers, clerical workers (excluding secretaries) and secretaries. Ideally an 18-year-old entering nurse training in 1960, for example, should estimate what the total future

costs and earnings will be for her and from this calculate the present value of the monetary earnings and cost of training. We, as most researchers, have relied on a snapshot approach: That is, to use the earnings of individuals in that occupation at different ages in one particular year (1960).[6]

Census data which were used to calculate the monetary present value of each occupation unfortunately does not provide full-time earnings[7] by age and occupation. They do, however, provide income for various numbers of weeks worked by age and occupation. This information can then be corrected to give full-time earnings by age and occupation; i.e., the age-earnings profile, as seen in table 22. This is accomplished by using equation (3–2) where:

Y_{ij}^* = median full-time earnings for age group i in occupation j,
Y_{ij} = median earnings for age group i in occupation j,
N_k = number of weeks worked in weeks-worked group k,
w_{ijk} = proportion of individuals of age group j, in occupation i,
n = number of weeks-worked groups,

and assuming 50 weeks represents full-time employment.

$$Y_{ij}^* = \frac{\frac{50}{\sum_{k=1}^{n} W_{ijk} \cdot N_k} \cdot Y_{ij}}{\sum_{k=1}^{n} W_{ijk}} \qquad (3\text{–}2)$$

The resulting estimated full-time earnings for six female "occupations" and four age groups are reported in table 22 and graphed in figure 3. This is, then, an estimate of the profile of gross monetary earnings faced by a female making an occupation choice in 1960.

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[6] Much has been said and written about the pros and cons of using this approach and we refer the interested reader to reference (6) in the list following this chapter.

[7] A different dimension to the concept of "full-time" is the participation rate over one's lifetime. Should the earnings of only those who have been in the labor force all of their working lives be the measure of full-time earnings? The participation rate is a special problem in the case of females since male workers normally have close to 100 percent participation rates. Female workers are characterized by considerable movement into and out of the labor force. It can be argued that only the 100 percent participation rate is relevant because this yields the actual stream of earnings available. On the other hand, most females are likely to view their working lives as incorporating rather significant periods of not doing "market work" at all [see Cain (2), pp. 5–14 and Bognanno (1), pp. 17–34]. The relevant time structure of earnings from their point of view may well be that of the worker with the average rather than 100 percent participation rate.

Obviously the question of whether the occupation allows one to move into and out of employment freely is important; in addition, the cost in terms of loss of seniority advancement and earnings from moving into and out of work must also be considered by the occupational "chooser". An occupation may also provide the opportunity to work on a less-than-full-time basis in terms of weeks worked per year, or hours worked per week. (Of course, it is only partly the nature of the occupation which provides these types of flexibility. Chronic "shortages" on the supply side are important in allowing the occupational participants this freedom.) Since the present study makes a distinction between pecuniary and nonpecuniary earnings, the observed profile (regardless of participation rate history) will be used and the flexibility of working time will be considered as a component of nonpecuniary earnings.

Table 22.—Average full-time earnings by age for several female occupations, 1959

Occupation	Age			
	21	30	40	55
All females	$2,640	$3,130	$3,100	$3,120
Professional and technical workers	3,020	4,450	4,680	5,190
Professional nurses	3,241	3,815	3,879	4,081
Teachers	4,140	5,190	5,450	6,150
All clerical workers	3,460	4,050	4,080	4,180
Secretaries	3,910	4,500	4,590	4,670

SOURCE: U.S. Department of Commerce, Bureau of the Census, *Census of Population, 1960*, Washington, D.C.

The most unexpected result in table 22 is that the age-earnings profile for the category "professional nurses" is below the corresponding profile for "all clerical workers," at all ages. Since the average training time for the professional nurse is 3 post-high school years, and the average training time for most office workers is zero post-high school years, one may doubt the value of using the concept of present value for explaining occupational

Figure 3.—Age-earnings profile for six female occupations

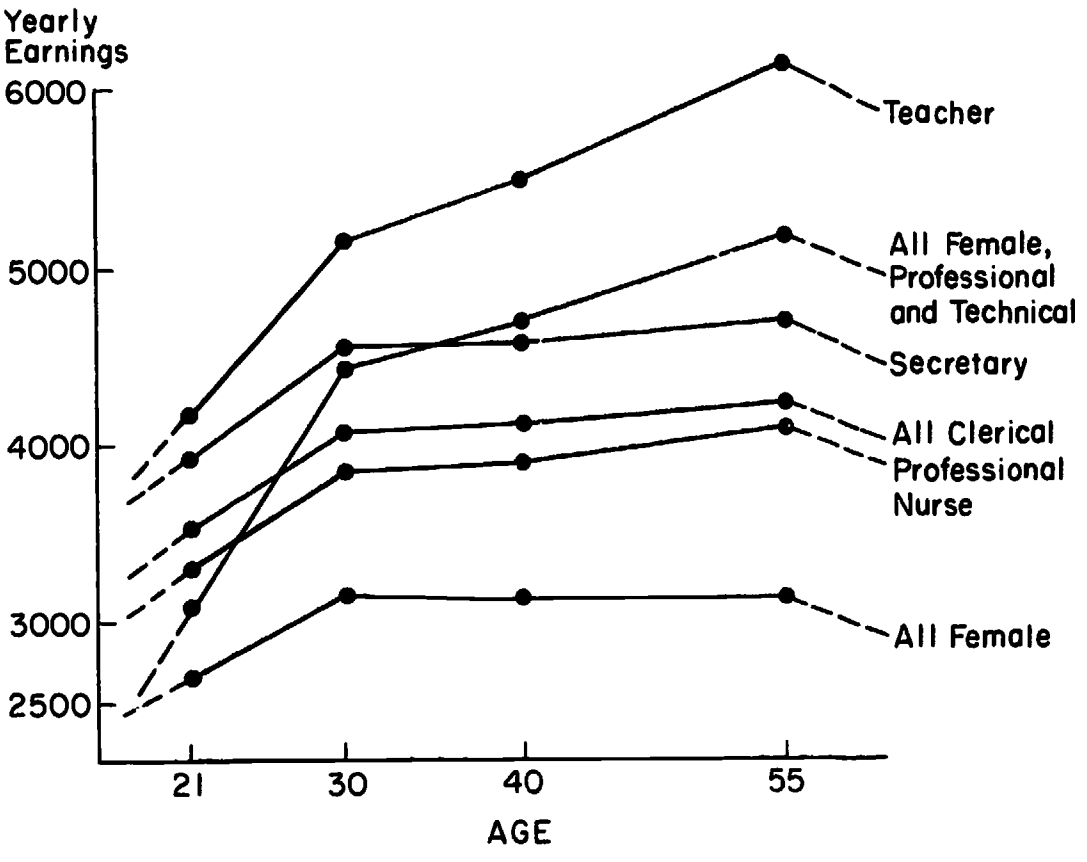


Table 23.—Present value of the monetary earnings of nurses, teachers, and office workers, 1960

Discount rate	Nurses	Teachers	Office workers
2.0	$92,000	$126,000	$107,000
4.0	62,000	85,000	76,000
6.0	44,000	59,000	57,000
6.5	41,000	54,000	54,000
8.0	33,000	43,000	45,000
10.0	31,000	40,000	42,000

SOURCE: Derived from data shown in table 22.

choice. (The present value of a "costly" stream of earnings is less than the present value of a larger but "costless" stream of earnings, regardless of the discount rate).[8] But, as alluded to throughout this chapter, the use of only monetary earnings underestimates the "true" total earnings of nurses relative to clerical workers. For such a comparison we must include some estimate of the value of the nonpecuniary earnings of nursing as compared to clerical work. This is explored in a later section.

In addition to the time stream of gross earnings, the time stream of training costs enters into the present value calculation. For this purpose it is assumed that teachers require 4 years of training that takes place typically in a 4-year public institution (teacher college or university). It is also assumed that nursing requires 3 years of training and is done in a diploma school of nursing.

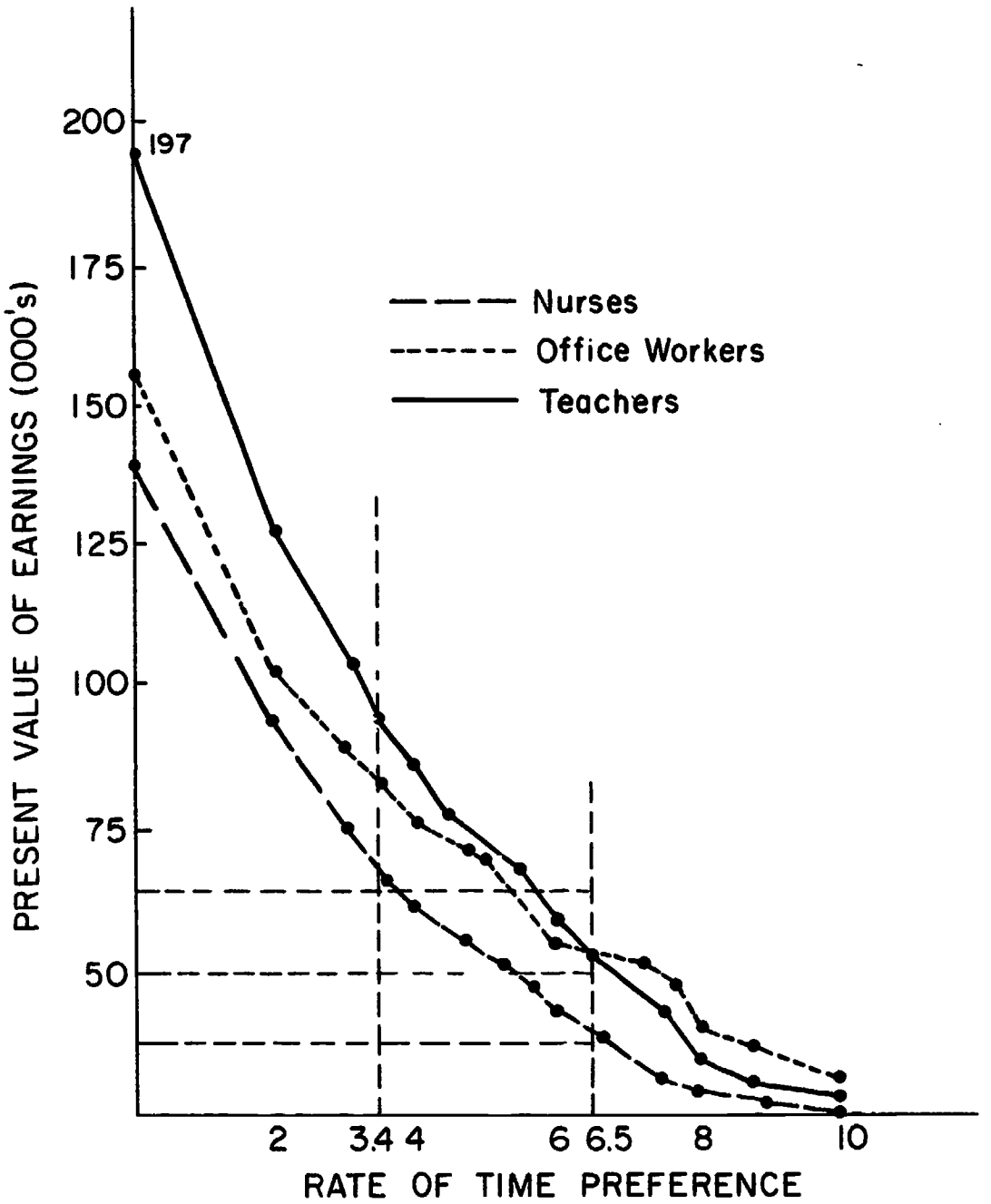
Because we are comparing 2 post-high school training occupations (nurses and teachers) with a no-training occupation, we can account for the opportunity costs of training or the foregone earnings by simply including a zero value of earnings for the training occupations during those years when training takes place.[9] The annual direct costs of nurse training are assumed equal to the average yearly tuition at a private diploma school in 1960 ($608),[12] and for teaching the average yearly tuition in 1960 at a public university ($271).[12]

The present value estimates of monetary earnings at various discount rates are shown in table 23 and figure 4. At the very low discount rate of 2 percent (very limited preference for the present), the longer training occupation, teaching, shows up as having the highest present value of monetary earnings. At rates above 6.5 percent the no-training occupation

[8] Two possible errors in the Census data itself must be considered. One is the problem with defining full-time status which was earlier alluded to. A second arises from the distinction between "professional" and "student" nurse made in the Census. It appears that a number of student nurses were recorded as professional nurses. This would tend to understate nurse earnings (particularly in the lower age groups). This possible error of the Census data is also discussed in Chapter V in connection with the estimates of labor force participation rates.

[9] To include a negative value for foregone earnings during the training period plus a positive value for the earnings of the no-training occupation during the same period would result in double counting.

Figure 4.—Present value of earnings of several occupations at different time preference rates



SOURCE: U.S. Department of Health, Education, and Welfare, Office of Education, *Digest of Educational Statistics, Today's Diploma Schools of Nursing*, Washington, D.C., U.S. Government Printing Office.

of office work has the largest amount. As suggested above, at no discount rate does nursing have the highest present value of monetary earnings. Yet we know that over 35,000 females entered nursing last year and that for most, if not all, it was a free and presumably rational occupational choice. Clearly then, other than monetary factors influenced this choice. A rough estimate of the minimum value of these nonpecuniary characteristics of nursing can be made by assuming that at a minimum for those who select nursing the value of nursing equals that of either teaching or office work.

The present value of these net nonpecuniary advantages is measured in figure 4 by the distance *ac* (nursing versus office work), and *bc* (nursing versus teaching). The value of *ac* at approximately the market rate of interest (6 percent) is $13,000. If it is assumed that nonpecuniary earnings are distributed evenly throughout an individual's working life, then the nonpecuniary advantage of nursing relative to office work equals approximately $780 per year.[10] For a 30-year-old nurse this is equivalent to about a 20 percent increase in salary. Using the same procedure for the comparison between nursing and teaching, the present value of relative nonpecuniary advantage of nursing equals about $15,000 or $900 per year. This is equivalent to an increase in salary for a 30-year-old nurse of 24 percent.

Teaching and office work clearly do not exhaust the set of possible alternative occupations to nursing. They are, however, the most frequently preferred other occupations (although not necessarily a second choice of those preferring nursing) and therefore the best candidates for measuring the relative nonpecuniary earnings of nursing. In addition the time structure of the earnings of office work and teaching may qualify them as proxies for other no-training required and bachelor's degree-required occupations respectively.

These are indeed very rough estimates of the monetized value of the nonpecuniary advantages of nursing over other occupations. In the next section we will attempt to learn more about these nonpecuniary attributes of nursing. At best these estimates are only averages, since there is a wide spectrum between those who have a strong preference for nursing (impute a large positive monetary value to the nonpecuniary advantages of nursing), to those who have an intense distaste for nursing (impute a large negative monetary value to the nonpecuniary disadvantages of nursing). The value of the nonpecuniary component of earnings for the individual who is indifferent at the existing pay scale between nursing and some other occupation will depend upon how far toward the negative end of the spectrum it is necessary to go to fulfill the needs of the labor market for nurses. That is, if only a small percentage of the potential population is needed to provide the necessary nursing services of a community, those who become nurses will no doubt be the ones who have

[10] The total of a yearly increment of $780 for a working life of 34 years is clearly greater than $13,000. But using a discount rate of 6 percent the present value of $780 per year is about $13,000.

the strongest preference for nursing. As the demand for manpower expands, those with a less positive preference for nursing will be recruited. Since they impute a small value to the nonpecuniary advantages of nursing, they will have to be paid a higher salary.

Nonpecuniary Earnings

Just as individuals have different preferences as to the structure of their earnings over time, they also have different preferences for the nonpecuniary component of earnings. Some value a characteristic like occupational prestige very highly and in fact will consider its presence in an occupation as fair compensation for low monetary income. This individual is said to have a strong "taste" for a high status occupation. At the other extreme is the person who derives no satisfaction whatsoever from occupational prestige, or from any other nonpecuniary benefit: his only interest is in monetary earnings and he will always choose the occupation with the highest salary potential. As might be expected, most of the population tends to have some less extreme set of preferences.

Since it is generally believed that individuals derive benefits from the social status or prestige of their occupation, the value of this prestige can be viewed as part of the earnings of the occupation. The premier study in the occupational prestige area is that of North and Hatt conducted in 1947, and since enlarged and refined. Known as the National Opinion Research Center (NORC) study, it has been extensively reported and discussed in Reiss[9] and Hall.[5] A major expansion of the NORC prestige ranking is the socioeconomic index developed by Otis Dudley Duncan[4] and used in Census Bureau reporting of socioeconomic status. The NORC study ranked occupations based on the results of the survey question:[4]

> For each job mentioned please pick out the statement that best gives your own personal opinion of the general standing that such a job has:
>
> 1. Excellent standing
> 2. Good standing
> 3. Average standing
> 4. Somewhat below average standing
> 5. Poor standing
> 6. I don't know where to place that one.

In order to enlarge the number of occupations considered in the prestige ranking, Duncan determined the relationship of the percentage of respondents in this NORC Survey who rated an occupation as either "excellent" or "good" (X_1) to the income level of the occupation (X_2) and the educational level of the occupation (X_3).[11] The estimated function

[11] Duncan corrected these for different age distributions in occupations, but by his own admission, "... the age adjustment is slight in magnitude for all but a few occupations with highly unusual age distributions...."[4]

was found to be:

$$\hat{X}_1 = 0.59X_2 + 0.55X_3 - 6.0 \qquad (R^2 = 0.83) \tag{3-3}$$

$\hat{X}_1$ (the estimate of X_1) is Duncan's "socioeconomic index." This index is particularly important for our study since two of our key occupations, nursing and office work, were not included in the original NORC survey. Given the percentage in these occupations in the various income and education classes, their socioeconomic index was derived from the equation (3–3). Table 24 below gives the Duncan socioeconomic index and the NORC prestige score for selected female occupations.

As shown in column 3 in table 24 (Duncan's SocioEconomic Index÷NORC Prestige Index), the proportion of the prestige score of an occupation explained by the socioeconomic index varies considerably among occupations. If the "status" of all occupations were related to the education and income level of that occupation to the same degree, the ratio of the Duncan Index to the NORC Index would be the same for all occupations. In fact, the ratio is .923 for teachers and only .657 for professional nurses. This difference suggests that nursing possesses work characteristics that give it "status" above that related to the education needed to become a nurse or its monetary earnings. Another part of the NORC survey is helpful in the exploration of the reasons for the high "status" of nursing. The individuals surveyed were asked to name the one main factor which gives a job excellent standing. The breakdown of their answers are reported in table 25 for several socioeconomic, age, and sex groups.

Table 24.—Socioeconomic index and prestige rating for selected female occupations, 1950

Occupations	I Socioeconomic index	II NORC prestige score	I–II
Dieticians and nutritionists	39	67	.582
Librarians	60	74	.811
Nurses, professional	46	70	.657
Nurses, practical	22	59	.373
Midwives	37	67	.552
Teachers[1]	72	78	.923
Technicians, medical and dental	48	70	.686
Stenographers, typists, and secretaries	61	74	.824
Telephone operators	45	69	.652
Dressmakers and seamstresses	23	60	.383
Private household workers	7	44	.159
Charwomen and cleaners	10	48	.208

[1] Cannot separate male and female occupation.

SOURCE: Richard H. Hall, *Occupations and the Social Structure*, Englewood, N.J., Prentice Hall, Inc., 1969, pp. 275–294.

Table 25.—Single most important determinant of an occupation's "excellent standing" (percentage distribution)

Criterion	All respondents (percent)	Age			Sex		Years of school completed		
		14–20	21–39	40 and over	M	F	8 or fewer	12 or fewer	12 or more
Pays well	18	21	16	17	19	16	24	17	7
Social prestige	14	15	16	12	14	14	9	14	21
Good future	3	4	4	3	4	3	3	4	2
Security, money	5	3	6	4	5	4	5	5	4
Education, hard work, money	14	13	15	14	14	14	16	13	13
Responsibility	9	5	6	13	9	9	11	9	9
Ability	9	8	9	9	9	9	7	9	13
Service to humanity	16	17	16	16	14	18	11	16	24
Other	12	14	12	12	12	13	14	13	7
Total	100	100	100	100	100	100	100	100	100

SOURCE: Albert Reiss, *Occupations and Social Status*, New York, The Free Press of Glencoe, 1961, pp. 32–33.

The percentages indicating each occupational characteristic (Pays Well, Social Prestige, Good Future, etc.) reported in table 25 cannot be interpreted as precise estimates of the relative importance of that attribute. But the fact that only about one-half of the respondents indicated financial and education returns (Pays Well, Good Future, Money, Education) as the main determinant of an occupation's "excellent standing," suggests that other factors are significant. Important among these and clearly relevant in the case of nursing are "Service to Humanity" (mentioned by 16 percent of respondents), and "Social Prestige" (mentioned by 14 percent of respondents). If the respondents are classified by education, these two factors take on added significance. Of those with more training than a high school diploma, 24 percent rate "Service to Humanity" and 21 percent rate "Social Prestige" as the chief determinants of an occupation's "excellent standing." To the extent that nursing contains these two characteristics, the more education one has or plans to have the more likely nursing becomes an occupational choice. Therefore, not only does nursing possess major nonpecuniary advantages over other occupations, but the nonpecuniary attributes it does possess are more highly valued by better educated individuals.

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CHAPTER IV

THE EDUCATION OF THE PROFESSIONAL NURSE

The nursing labor market in the United States today is somewhat of a paradox. In the face of what some consider to be a severe shortage of trained professional nurses, many hospital-operated diploma schools of nursing have been forced to close. In the decade between 1957 and 1967 the number of hospital schools of nursing dropped from 944 to 732 and the proportion of female high school graduates entering all types of professional nurse training programs fell from 6.6 to 4.5 percent. Whereas the number of nurse training programs in 2-year associate degree schools and 4-year baccalaureate degree colleges are growing, the hospital school of nursing has traditionally been the major supplier of trained professional nurses. In this chapter we will analyze the major reasons for these dramatic changes in the structure of nursing education and the possible effects these changes will have on the future supply of professional nurses.

History of Nursing Education

Hospital schools of nursing sprang up in the early 1870's. They resulted neither from legal action by government nor from public concern over the quality of nursing care, but rather because they added to the operating efficiency of hospitals. The earliest nursing schools were set up on the Nightingale principle. Under this principle, the schools were independent from the hospital and administered by an autonomous board of directors in order to retain nurse control of the education. The schools affiliated with hospitals solely to provide student training experience. The first three diploma or hospital-controlled schools were established in 1873 (Bellevue School in New York, the Connecticut Training School in New Haven, and the Boston Training School, which later became the Massachusetts General Hospital School).

The hospitals that set up nursing schools found themselves assured of nursing staff at low cost. From 1890 to 1910 the Nightingale principle died as hospital schools increased from 35 to 1,069.[7] The amount of study in the hospital school was necessarily limited, however, under the original 1-year program. Thus when nurses urged a 3-year program to provide better training, hospitals were eager to go along since this provided them with cheap labor for a longer period of time.

In a typical early hospital school, each new student was given a preparatory course of instruction of from 3 to 4 weeks, during which time she also worked 25 to 30 hours per week in the hospital.[10] For the remainder of the 3 years, almost all of the training took place in a work setting. In general, the size of the student class and the subjects taught were dictated by the work needs of the hospital.[10] In some sense, almost all, if not all, of the benefits of the early nurse training went to the hospitals conducting the training. As a matter of fact, most of the students upon graduation left the hospitals for other types of nursing service.[10]

Although significant unemployment among nurses existed in the United States and Canada in the 1930's, hospital schools of nursing continued to function at almost pre-Depression levels. When asked why, a number of superintendents stated that while the schools improved the tone and intellectual atmosphere of the hospitals in general, the main reason for their existence—especially in the minds of hospital trustees—was the supply of cheap labor which they provided.[26]

In hospitals without schools of nursing such services were provided by practical nurses and attendants. In hospitals with schools almost all nursing services were provided by student nurses. It is estimated that in the late 1920's, 73 percent of hospitals with nursing schools employed no graduate nurses.[10] The student nurse paid no tuition and in most instances received a salary of from $10 to $12 per month plus maintenance (as compared with $96 per month paid to a graduate professional nurse). With the onset of the Depression, significant unemployment developed among nurses, and a reduction in salaries followed. For the first time, hospitals found it profitable to employ graduate nurses. By the end of World War II most hospitals no longer relied on student trainees as their main source of nursing services.[10]

As efforts were made to upgrade the profession, greater distinction was made between "nurse training" and "education in nursing." The merits of the apprenticeship system versus a scientific background for nursing technique were argued. Although the first collegiate school for nursing was founded in 1909, it was not until 1933 that there was renewed interest in university education for nurses.[12] It was then argued that intelligent nurses were more valuable; education was necessary for public health work, teaching, and executive positions. As nurses were forced to undertake more of the duties formerly performed by doctors, it was felt their training should be closer to that of the M.D. Universities were reluctant, however, to accept women or to undertake vocational training since this deviated from learning for its own sake.[10] Over time, the nurses prevailed and the 4-year baccalaureate program gained strength. This program differed from the diploma course in that it stressed general education and the study of science and minimized on-the-job apprenticeship learning.

Until the mid-1950's almost 90 percent of nurses were trained in hospital schools. Only a relatively select group went to college and their training was geared primarily to public health and administrative positions. As

late as 1949, only 7.5 percent of all student nurses were enrolled in collegiate schools of nursing.[21] The introduction of the 2-year associate degree collegiate program in 1952 marked the real turn from the hospital mode of training. Although shorter than the baccalaureate program, the associate degree program followed the goals of the 4-year college in stressing general education and classroom learning. From 1952 to 1968 students in programs offering these two forms of college education for nurses grew from 11,000 to almost 68,000;[21] by 1969 diploma programs graduated only 59.5 percent of the new nurses, associated degree programs 20.6 percent, and baccalaureate programs 19.9 percent.[4]

The trend away from on-the-job instruction and hospital training for nurses is clear. What is not so well understood is the reason for this trend, and what import it has for the future of nursing education and the supply of nursing personnel. In the next two sections we hope to provide a framework to help answer these questions by analyzing the original motivation behind the establishment of nursing training outside the mainstream of higher education and the changes that have occurred in recent years that have tended to reverse this situation. An attempt will also be made to determine what impact these changes have had and will have on the prospective nursing student. Finally, estimates will be presented of what the supply and composition of new nursing students is likely to be during the 1970's.

Theory of Nursing Education

The Training Establishment

Most hospitals are either nonprofit corporations or are controlled by some governmental unit. As such, their decisions are likely to differ from those of the more traditional profit-maximizing firm. Recognition of these differences, however, does not rule out the use of traditional economic theory as a tool for explaining the behavior of the nonprofit corporation. Once the goals of the institution are established, it is reasonable to assume that it will operate to attain them in the most efficient manner.[18] Furthermore, although the demand for nursing services includes factors other than revenue production, a demand function can be derived, and we can speak of the "marginal product" of an additional nurse, regardless of what is included in the concept of product.

Using this undefined concept of marginal product and the assumption that hospitals will attempt to produce that level of output (service) in such a manner as to equate, on the margin, the benefits derived from the last unit produced with the costs of producing that last unit, we can establish the equilibrium conditions under which a training establishment will be operated.

From the historical sketch above it is clear that student nurses performed a valuable service to the training institution, the value of which

was enough to repay the cost of their training plus the wage paid to them during training. We can formally state the equilibrium condition for these early schools of nursing (prior to 1930) as follows:

$$B_s^h = C^h \tag{4-1}$$

where

$$B_s^h = \sum_{t=0}^{n-1} \frac{(MP_t^s - W_t^s)}{(1+i)^t}$$

$$C^h = \sum_{t=0}^{n-1} \frac{C_t^h}{(1+i)^t}$$

B_s^h is present value of the benefits to the hospital of employing a student nurse; C^h is present value of costs to the hospital of providing professional nursing training (other than wages paid to the student nurse); MP_t^s is value to the hospital of the marginal product of the student nurse during the tth period of her training; W_t^s is wage paid to the student nurse during the tth period of her training; C_t^h is cost to the hospital of providing nursing training during the tth period (other than the wages paid to the student nurse); i is discount rate; and n is number of years of training.

With the employment of large numbers of graduate professional nurses in the hospitals, it became possible to extend the benefits past the training period. Benefits could continue to accrue to the training institution provided the student nurse continued to work for it after graduation and the marginal product of the graduate nurse exceeded her wage.

$$B_g^h = \sum_{t=n}^{m-1} \frac{(MP_t^g - W_t^g)}{(1+i)^t} > 0 \tag{4-2}$$

where B_g^h is benefit to the hospital of employing a graduate nurse; MP_t^g is marginal product of the graduate nurse in the tth period; W_t^g is wage of the graduate nurse in the tth period; and m is number of years of training plus employment in the hospital.

If we continue to assume that all costs are borne during the training period, but that hospitals can charge tuition (T), the new equilibrium equation becomes:

$$B_s^h + T + B_g^h = C^h. \tag{4-3}$$

Traditional economic theory requires only that labor be hired in a competitive labor market in order for the wage of the worker to be equal to his marginal product. Recent modifications in this theory, however, have shown that in situations where a firm provides specific on-the-job training; i.e., training that raises the student's productivity only in the firm providing it, the firm can recoup part or all of the expenses of such training.[6] This can be accomplished by paying the worker his lower opportunity marginal product after training, while at the same time receiving the value of his raised marginal product.[6]

In a competitive labor market it is irrelevant whether the training is specific or general to the industry as a whole, since competition within the industry will bring about equality between a worker's marginal product and his wage. Once the labor market takes on some of the characteristics of a monopsony market; i.e., a single employer, however, a gap develops between a worker's marginal product and his wage, regardless of the type of training he receives. The more insulated the industry from competitive pressures of other industries, the larger the gap. That is, if the training, although common to all firms in a given industry (increases the worker's productivity an equal amount in all firms), is specific to the industry as a whole (does not increase the worker's productivity at all in other industries), then the supply curve to the industry will be relatively inelastic, and the gap between the marginal product and the wage will be larger.[1]

However, because the cost of hiring an additional worker is larger than the wage paid to him, it may be incorrect to interpret the value of the gap as a benefit. In the more normal monopsony situation, equation 2 should be modified by substituting marginal factor cost (MFC) for the wage. But, as will be explained below, by providing nursing training a hospital may be able to secure part or all of the gap as a return for operating the training program.

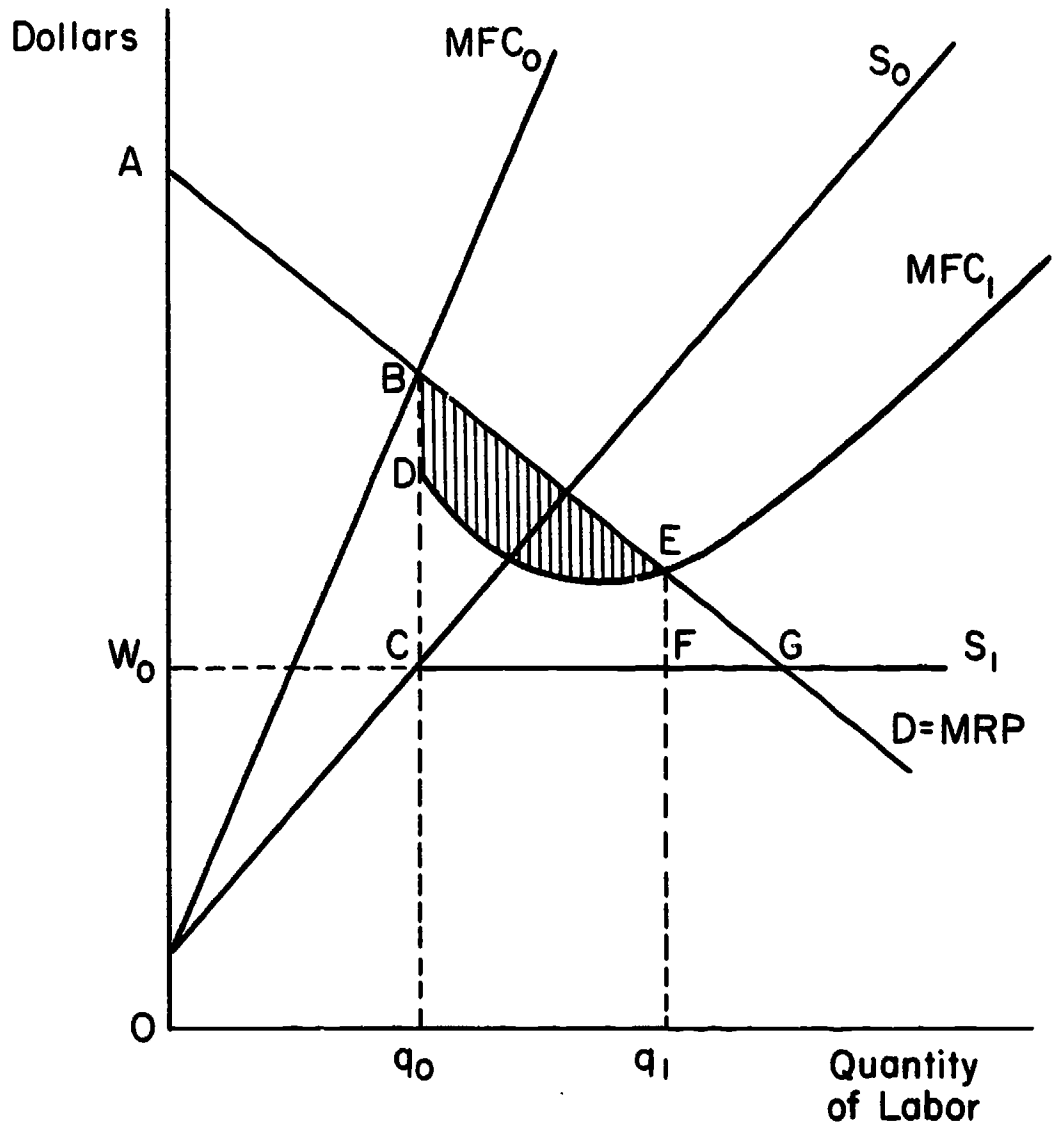
Benefits of a Training Program

It is often suggested that, because of loyalty, inertia, or other factors, institutions providing nurse training are able to retain a substantial portion of their student nurses without paying an above-the-market wage. The importance of this factor can be seen by referring to figure 5. We can assume that a hospital without a training program would hire nurses up to the point where MFC=MRP. At this equilibrium position the hospitals would be earning a producer surplus equal to the trapezoid w_0ABC. Let us further assume that by operating a training program, recruitment at w_0 could be increased; the larger the program, the larger the number of additional nurses. While the supply curve beyond q_0 can be thought of as being perfectly horizontal for an institution with a training program (S_1), the hospital would have to consider the additional costs of operating such a program ($C^h > B_g^h$); that is, the marginal factor cost would have to include both the wage offered to the graduate nurse and the cost of training her. Assuming training costs to be positive, MFC_1 will be above S_1 at every point, but for those institutions that operate a training program MFC_1 will be below MRP for a certain range; that is, a benefit or surplus will accrue to the training institution equal to the value.

$$B_s^h = \sum_{t=n}^{m-1} \frac{(MRP - MFC_1)}{(1+i)^t} \tag{4-4}$$

[1] Vacancy statistics have been discussed at length in chapter II.

Figure 5.—Hospital nursing labor market



The equilibrium position for the training institution would then be at q_1, and the increase in benefits over costs, or increase in the producer surplus, would be equal to the shaded area *BDE*. The number of budgeted vacancies would be reduced from *CG* to *FG*.[2] The more expensive the training program; i.e., the larger the deficit between C^h and B^h_s, the higher MFC_1 is above S_1. For those institutions where MFC_1 is above MRP at all levels, it would not pay to establish a training program.

The operation of a training program, therefore, depends on whether it is more profitable to maintain such a program or to rely on other institutions to produce new nurses. Given that only 11 percent of hospitals operate nursing schools,(2) it is clear that such an operation is not profitable for all. The question is why such an operation is profitable for some institutions and not for others.

[2] See second section, chapter II.

If we assume that within a labor market w^a is the same for all nurses with comparable experience in the same position, then differences in B_a^h will depend on variations in MP^a. It is not unreasonable to assume that, as the size and complexity of a hospital grows, the number of rules and procedures specific to the hospital also grows. In a large, complex institution it is necessary for all personnel to become familiar with these special rules and procedures, either through orientation courses or on-the-job instruction. It is clearly to the advantage of the hospital to provide this orientation while the nurse is a student as opposed to being on the payroll as a registered professional. We can, therefore, differentiate for these large hospitals, at least for the first 6 months to a year, the higher value of a nurse trained by them as compared with one trained in another program. The more specific the functions in the hospital, the greater the difference in value between the two groups and the larger B_a^h.

In the absence of salary differentials between institutions, the retention rate of the ith institution will in part be related to its proportion of total employment in the area. Therefore, large institutions will benefit by having larger retention rates than could be accounted for purely on the basis of loyalty and inertia.

Finally, there is also strong evidence to indicate that the per student cost of training (C^h) is negatively related to the size of the institution. In a study of the cost of nursing education, it was found that when each hospital school was ranked for the number of student-weeks accumulated during the year and for the cost of educational functions per student-week, the relationship between the two ranks was $-.495$.[3] [18] The relationship appeared even stronger when the institutions were divided into three subgroups by size of enrollment—small (fewer than 70 students), medium (from 70 to 120 students), and large (120 students or more). The average rank of schools in terms of cost of education was \$101.60 for small schools, \$61.58 for medium-size schools, and \$47.78 for large schools.[18]

In summary, there are three reasons why we would hypothesize that the size of an institution is a critical factor in determining whether or not it operates a training program: (1) a positive correlation exists between the size of a hospital and the value of the firm-specific portion of its training; (2) retention rates will be larger for large institutions; (3) economies of scale tend to reduce training costs per student.

To test this hypothesis, all general private and governmental non-Federal hospitals in the United States were placed in seven categories based on number of beds in the institution. Within each category the proportion of hospitals with schools of nursing was calculated. As can be seen in table 26, the correlation between bed-size category and presence of a nursing school was almost perfect. In hospitals with fewer than 100

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[3] A high correlation exists between the size of an institution and the number of students enrolled in its training program.

Table 26.—Distribution of hospital schools of nursing[1]

Number of beds	Number of hospitals	Number of schools	Proportion of hospitals with schools	Proportion of schools that intend to close
1–99	3,192	8	.0025	-----
100–199	1,070	139	.1299	.1367
200–299	541	196	.3623	.0918
300–399	294	153	.5204	.0784
400–499	145	98	.6322	.0612
500–749	117	70	.5983	.0857
750+	62	40	.6452	.0999
Total	5,421	704	-----	-----

[1] Includes all general voluntary nonprofit, government non-Federal, and proprietary for profit hospitals in 1965.

SOURCE: *Hospitals*, Journal of the American Hospital Association, Part 2, Guide Issue, August 1, 1967.

beds, only .0025 had a nursing school. At the other end of the spectrum, in hospitals with 750 beds or more the proportion reached .6452.

Our hypothesis would also predict that if C_t^h is going up and MP_t^s is going down proportionately for all hospitals, those programs that would feel the pressure most strongly would be located in smaller hospitals (administering smaller programs). Consequently, the closing rate among small schools would be greater than among large schools. This relationship was less clear-cut than in the first instance, but the data still suggest a higher proportion of closings among the smaller schools. Of the schools in the 100- to 199-bed category, .1367 were expected to close, while those in the 400- to 499-bed category reached a low of .0612. In the two largest bed categories, however, the proportion rose again. Although this result appears to contradict the implications of our theory, it may not actually do so. Schools in these larger institutions are more likely to have merged with some type of collegiate program where general education would be provided at the college and clinical subjects at the hospital. By freeing itself of all general education courses the hospital greatly reduces the cost of training, and by continuing to offer clinical instruction it can still provide some hospital-specific instruction.

Costs and Benefits to the Student

The most obvious benefit of undertaking nurse training to the student is that without it she cannot become licensed as a registered professional nurse. To the extent that the earnings of a registered nurse plus the nonpecuniary benefits of nursing provide a "surplus" or "quasi-rent" above the most attractive alternative occupation, a student would be willing to pay the cost for part or all of her training. As one moves from

the truly dedicated nurse to those whose attachment to the profession is more marginal, the amount of the surplus falls and the amount she is willing to invest in her own training declines. For the truly marginal student the capitalized value of the future benefits of nursing just compensates her for the costs (including foregone alternative earnings and tuition payments) associated with selecting nursing as an occupation.

If we define

$$B^s = \sum_{t=n}^{m-1} \frac{(W_t^g - W_t^a)}{(1+i)^t} + N \tag{4-5}$$

$$C^s = \sum_{t=0}^{n-1} \frac{(W_t^a - W_t^s) + (T_t^n - T_t^a)}{(1+i)^t} \tag{4-6}$$

where B^s is benefit to the student of selecting nursing as an occupation; C^s is cost to the student of selecting nursing as an occupation; W_t^g is wage paid to a graduate nurse in the tth period; W_t^a is wage paid in the best alternative occupation in the tth period; N is nonpecuniary benefits of nursing relative to the best alternative occupation; W_t^s is wage, if any, paid to the student during training; T_t^n is tuition charges for nursing education in the tth period; and T_t^a is tuition charges for training in the best alternative occupation; then for the marginal student

$$B^s = C^s. \tag{4-7}$$

Factors that increase B^s will tend to move out the area under the total benefit function and increase the number of individuals who find nursing a "profitable" occupation. Likewise, factors that increase C^s will have the opposite effect, tending to reduce the flow of individuals into nursing.

We can now return to the different components of nurses' training and see to what extent each influences these cost and benefit equations. The benefits of orientation-type courses (higher productivity of the worker) accrue only to the institution, since the nurse continues to receive at most her opportunity marginal product, which has not risen. Nursing education courses are somewhat different in that the student's future productivity is raised in all firms that employ her as a nurse. However, part of this increase in productivity goes into an increase in the exploitation gap. Hence the benefits of such training are shared by the student, in the form of higher wages, and the institutions, in the form of an increase in the exploitation gap. The relative proportion going to each depends on the slope of the supply and demand functions.[4]

General education courses, on the other hand, will primarily be of benefit to the student (and to society). To the extent that these courses provide the student with meaningful occupational alternatives to nursing,

[4] See second section, Chapter II.

the supply curve facing all employers of nursing services will shift to the left (less nursing service available at each wage). It will also give the individual greater flexibility to leave nursing if wages and working conditions lose their competitive attractiveness. Thus the nursing supply function will become more elastic at each wage; the more elastic the supply function becomes, the smaller the divergence between the nurse's marginal product and her wage.[5] Thus general education courses will tend to reduce the exploitation gap and for any given value of the nurse's marginal product will increase her wage.

It is clear that if all other things are equal a student would prefer to be trained in a program that emphasizes general education. All other things, however, are not equal. General education courses add to the expense of operating a training program and must either be added to the previous work load or substituted for part of it. If the first alternative is taken, the length of the training program will be increased, adding to the student's opportunity costs (higher W_i^a). If some orientation and nursing education courses are dropped, the benefits of operating a training program to the training institutions are reduced. In both situations an increase in tuition charges would be likely.

It is possible, therefore, that the increased costs of entering a training program with a larger number of general education courses could counterbalance the increased benefits that such training would have for the student. Were it possible to enter a program that tended to stress general education without requiring any increase in training time or in tuition, such a program would clearly be very attractive to a student, and in general it would make nursing a more attractive occupation; i.e., it would shift the entire B^s function without increasing C^s. It is just these factors that have made the associate degree nursing program so popular in recent years.

Analysis of Recent Experience

As we indicated in the last section, considerable differences exist among the various training curricula respecting the relative benefits to the training institution, or ultimate employer, and the student or professional nurse. Prior to the mid-1950's, when few alternatives for training existed, it is understandable that the hospital school curriculum would be heavily weighted in favor of institution-specific and occupation-specific subjects. A major conclusion of a 1949 study on the quality of nursing education in hospital schools was that "the major share of the nursing school program was regarded as not being predominantly focused on education and that to most schools, service to the hospital was as important an objective as was the education of the students."(11)

[5] Ibid.

For the career nurse, however, such a training program had severe limitations, since it provided her with very limited occupational flexibility. But as her numbers and influence increased, the professional nursing associations began to influence the structure of nursing education. These associations, the American Nurses' Association (ANA) and the National League for Nursing (NLN), made it clear which direction they thought nursing education should be placed in institutions of higher learning.[5] Recognizing that a transition to a collegiate program of nursing education would take time, the associations were also interested in reshaping the curriculum of the diploma schools. A major vehicle used to alter diploma education was the accreditation program of the NLN. Its major goals are to reduce substantially, if not eliminate, the hospital-service portion of the training and to greatly enlarge courses geared to general education.

The accreditation program received a major boost in 1953, when the ANA voted to acknowledge it and to support its recommendations. Although nursing schools are permitted to function without NLN accreditation, an unaccredited school faces the burden of trying to recruit faculty and students without the endorsement of the most powerful and prestigious professional nursing association. Also, an unaccredited school in most instances is ineligible for Federal funds allocated under the Nurse Training Act of 1964 as amended.[22] As a result, the percentage of accredited diploma programs rose from 53 to 78 between 1959 and 1968.[3]

The impact on hospital training programs of curriculum changes necessary to receive accreditation is substantial. By minimizing in-hospital service, MP^g and therefore B_g^h are reduced [see equations (4–1) to (4–3)]. The addition of more general education courses substantially increases C^h, and by providing the graduate nurse with greater occupational flexibility reduces the number of nurses who are prepared to work at low wages. Hence the supply function for nursing services becomes more elastic. Furthermore, to the extent that general education courses are substituted for institution-specific instruction, the hospitals are forced to provide such training after the nurse is officially hired as a registered professional. Thus MP^g is somewhat reduced, at least for the first 3 to 6 months.

With benefits reduced and costs increased, there is little most diploma schools could do except increase tuition or close their doors. Furthermore, considering the short working life of many graduate nurses and the promotional path of career nurses, which often takes them away from bedside patient care within a few years, there is even some doubt that the increased emphasis on general education actually added to the longrun productivity of the professional nurse in a hospital setting. It is not surprising, therefore, that many hospital administrators have strongly criticized these curriculum changes as leading to the destruction of nursing education in hospitals[13] and that over 200 hospital schools

have in fact closed since the end of World War II, with more expected to follow in the next few years.

It would be incorrect to place responsibility either for the decline in hospital schools or the shift toward more general education solely on the professional nursing associations. There have also been significant changes in the occupational outlook of female workers. Increased family income, greater availability of scholarship funds and educational loans, and the greater likelihood of spending a significant portion of one's working life in the labor force have made such occupations as nursing far less attractive. Free tuition and relatively high starting salaries outweighed the low lifetime earnings potential of nursing offered up to the 1950's. But in the postwar period, nursing's attractiveness declined. The percentage of female high school graduates entering nursing schools declined from slightly less than 7 percent in 1952 to about 4.8 percent by 1969.

To encounter the declining number of diploma nursing programs, many State and local governments established schools of nursing as part of their general programs of higher education. Whereas hospitals must consider costs and benefits primarily on an internal basis, the community can justify expenditures by including the social benefits of a greater supply of trained professional nurses. In 1968 alone, 51 new associate degree programs and 14 new baccalaureate degree programs were instituted throughout the country.

With collegiate programs offering an alternative source of supply, hospitals were compelled to rethink the long-term benefits of continuing to operate generally unprofitable training programs; that is, assuming that $B_s^h \angle C_s$, a hospital would be in a more favorable position if it could increase its supply of nurses at the market wage without the net cost of training. While a hospital might lose that part of the training benefit that results from the institution-specific instruction and from the greater likelihood of recruiting its own graduates, it could minimize this loss by affiliating with a college program.

If the theory is correct, admissions to college schools should be negatively related to admissions to diploma schools but positively related to overall admissions. Between 1952 and 1960 the proportion of female high school graduates entering a hospital school declined from .059 to .040, about 3.6 percent per year. From 1960 to 1969, during a time when collegiate enrollment increased rapidly, the proportion fell from .040 to .020, a relative decline of 5.5 percent per year. The overall admission rate, on the other hand, declined by 3 percent per year between 1952 and 1960, but the rate of descent was reduced to about 1.0 percent per year in the 1960–67 period.[21] In other words, the experience between 1952 and 1969 tends to support the hypothesis that the introduction of collegiate education for nurses has accentuated the decline of diploma programs but has had a positive influence on overall admission to schools of nursing. The interrelationship between the three training programs and their impact on new admissions to nursing schools is discussed in the next section.

Supply of Admissions to Nurse Training Programs

Although nurse training programs have undergone a radical change in the last 15 years, it appears that the shift from hospital-based diploma programs to college-based degree programs has been quite orderly. That is, the shift did not occur in a way that blocked entry into nursing. At several intervals within the 15-year period, surveys were conducted to determine whether adequate numbers of spaces were available to permit all qualified applicants to enter a program.

In 1960, 59,300 applicants applied to the 965 diploma and associate degree programs in the United States.[6] Of this number, 41,500 were admitted and enrolled, 1,200 were accepted but did not enroll, 800 qualified applicants were rejected from specific schools because of limited capacity in that school[15] and 15,800 did not qualify. The survey suggested that an unspecified number of unfilled openings for students also existed. Considering that no national matching procedure exists, a qualified rejection rate of less than 2 percent (800/59,300), coupled with at least an equal number of openings is consistent with the hypothesis that the actual number of new entrants is an accurate representation of those who desire to enter. The study team, composed of members of the National League for Nursing (NLN) and Public Health Service, seemed to accept this hypothesis. They stated that, "...a large number of qualified applicants needs to be attracted to schools of nursing in order to meet future demands for professional nursing."[15]

For the 1965 incoming class, the NLN again surveyed all basic programs of nursing. It was found that the number of admissions to diploma schools could have increased by 11.1 percent if qualified applicants had been available. For associate degree programs the unfilled openings rate was 19.7 percent, and for baccalaureate degree programs 14.5 percent.[17] As in the previous study, some schools indicated that they were forced to restrict enrollment because of insufficient clinical facilities. Substantial vacancies were found again a year later. The unfilled openings were 14.1 percent for diploma schools, 11.4 percent for associate degree schools and 8.2 percent for baccalaureate schools.[19]

The nursing labor market differs in this respect from the physician labor market. Although both appear to suffer from unfilled vacancies (a labor shortage), in the case of physicians, part of the problem is the restricted supply of available training facilities. For nurses, virtually no such constraint exists and the shortage problem rests primarily, if not entirely, on the nature of the demand for nursing services and the willingness of qualified applicants to enter nursing.

The Model

To capture the importance of the factors influencing high school graduates to enter nursing, a labor supply model for new admissions is

[6] Baccalaureate programs were not included in this survey.

necessary. Such a model should include the increased relative earnings of nurses, in addition to such factors as the reduced training time for associate degree graduates (3 to 2 years); that most if not all of the direct tuition charges in 2-year associate degree programs are paid for by the State as opposed to private tuition charges in hospital-run programs;[7] and that a larger proportion of training time is devoted to general education in the associate degree program than in the diploma program. Such factors can be incorporated into a supply model either by determining the extent to which each affects the relative present value of nursing, or by deriving separate equations for each training program. The benefit of the latter approach is that it permits a direct identification of the relative attractiveness and differential growth rate of each program. By isolating, for example, the admission rate to associate degree programs, the importance of the general education component of the training can be captured in the size of the constant term, and the combined impact of reduced training time and subsidized tuition can be incorporated into the relative pay coefficient. For this reason, a separate equation approach was used in our estimates of a new admission supply function.

The supply model for new admissions to nurse training programs therefore incorporates four basic factors: (1) the unique noneconomic educational value of each type of training program; i.e., the nonmonetary value of being trained on a college campus as compared with training received in a hospital; (2) the economic attractiveness of nursing as an occupation; (3) the flow of applicants to alternative programs; and (4) the relative stage of growth of the particular program. These factors are included in the five-equation model presented below. The three behavioral equations, (4–8), (4–9), and (4–10) explain the admission rate in each year in each program. Equation (4–11) is definitional and combines the three programs into a total admission rate and a total number of admissions. The baccalaureate degree training program is not included as a substitute form of nurse training for the diploma or associate degree programs and vice versa. This exclusion was due primarily to preliminary tests of the model that revealed lack of a statistically significant relationship between changes in these programs. This result is consistent with the data shown in chapter II suggesting that the socioeconomic characteristics of entrants to baccalaureate programs are quite different from those of entrants to diploma or associate degree programs.[16]

Explanation of the Variables

Although the three training programs differ in duration and tuition charges, until recently there has been little or no distinction in the earnings

[7] During this period we also witnessed substantial increases in government financial help through the Nurse Training Act. While potentially important, the benefits of the program have been spread rather thinly and its impact is rather difficult to quantify.[23] The importance of the Nurse Training Act is discussed in a later section of this chapter.

of graduates from each. There are certain jobs, such as that of public health nurse, which generally pay higher wages and which require a minimum of a baccalaureate degree. But the proportion of all baccalaureate nurses hired in such higher paying jobs has been small. In part, the total dominance of diploma trained nurses in the past lead to a single wage rate for all professionally trained nurses. That is, total supply from other programs was so small relative to that generated by diploma programs that a differential pay scale was neither necessary nor desirable. Therefore, a single estimate for the earnings of all beginning nurses is used to explain past behavior. Such a procedure, however, does not seem realistic for explaining the future. As the proportion of 2-year nurses on one hand and 4-year nurses on the other has grown, differential earnings and type of responsibility are becoming more the rule than the exception.[9] In the projections, therefore, a two-tiered wage system was used with associate degree and diploma nurses receiving lower earnings than baccalaureate trained nurses.

Much has been said and written about the low earnings of nurses, even in relation to other professional occupations hiring predominately women. Nevertheless, no national survey exists that reports the earnings of registered nurses on an annual basis. In fact, except in census years, no national survey of registered nurse earnings is available at all. To overcome this data deficiency we have attempted to piece together a series of absolute and relative earnings of nurses both over time and in different regions of the country. For this we have relied on earnings data reported by the Bureau of Labor Statistics for hospital nurses in 13 major metropolitan areas throughout the United States.[23] (See table 27 for a list of the cities reported.) Such information is available for the years 1956, 1960, 1963, 1966, and 1969. The same source reports earnings for industrial secretaries. A biennial survey conducted by the National Education Association provides comparable data on salaries of public school teachers.[14]

Using 1960 population figures for each city, weighted averages of the ratios of nurse-to-teacher and nurse-to-secretary earnings for the 13 cities combined were derived. These weighted averages are shown in table 27 along with absolute earnings of general duty hospital nurses. What is evident from these ratios is the relatively poor position of registered nurse salaries in 1956 and the dramatic improvements in both absolute and relative amounts that have occurred between 1956 and 1969. In 1956, the average registered nurse earned $3,489 in the 13 cities surveyed—60 percent of the earnings of public school teachers and 85 percent of the earnings of secretaries. By 1969, registered nurse earnings had increased by 124 percent and they now earned 83 percent of the earnings of public school teachers and 21 percent more than secretaries. While the relative improvement has been steady throughout the period, major changes have taken place since 1966. In relation to teacher salaries, nurse earnings improved by 4.7 percent per year in the last 3 years as

Table 27.—Earnings of registered nurses employed as general duty nurses in hospitals relative to earnings of secretaries and public school teachers (13 cities,[1] selected years: 1956–69)

Year	Earnings of nurses	Average annual change	Percentage of teacher salaries paid to nurses[2]	Average annual change	Percentage of secretary salaries paid to nurses[2]	Average annual change
1956	$3,489		60.0		85.0	
		$176		.25		.0075
1960	4,193		61.0		88.0	
		174		1.67		.0033
1963	4,714		66.0		89.0	
		350		.67		.0300
1966	5,763		69.0		98.0	
		684		4.67		.0767
1969	7,815		83.0		121.0	

[1] Cities included in the survey are: Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Los Angeles, Minneapolis-St. Paul, New York City, Philadelphia, and San Francisco.

[2] The composite rate is equal to a weighted average of the ratios in each State as opposed to a ratio of the weighted average of the two earnings figures.

SOURCES: General Duty Nurse and Secretary Wages: Bureau of Labor Statistics, *Area Wage Study—Hospitals* (appropriate years). Classroom teachers' earnings by city obtained from National Education Association, *Biennial Survey of Salary Statistics of Public Schools* (appropriate years).

compared to an annual improvement of 0.9 percent for the 1956 to 1966 period. For purposes of analyzing changes in high school graduates entering nursing over time, the nurse-to-teacher earnings ratio was used as a measure of changes in the relative economic attractiveness of nursing over the 14-year period, 1956–1969.[3] Relative earnings ratios were derived for those years between surveys by means of a linear interpolation.

Observable new admissions have not been adversely affected by lack of training facilities. The increased convenience and positive publicity associated with increasing numbers of new AD programs on the one hand, and the generally negative aspects of the declining number of diploma programs on the other are bound to affect admissions. In an attempt to capture the importance of these phenomena, a separate growth or trend variable has been incorporated into each equation. These trend variables should also capture the importance of the effective reduction in tuition costs due to increased Government aid (Nurse Training Act).

[3] On conceptual grounds it would have been preferable to use a relative wage variable in the form of $(W_N - W_T)$ to capture at least partly, the effects of differences in the present value of earnings between the two occupations.[6] Given, however, that the earnings figures were derived from a limited subset of all nurses' earnings and that the sample was concentrated in major metropolitan areas in each region, the absolute difference between the earnings levels is likely to be less representative of a true national average than that obtained via a weighted average of the ratios. We therefore used W_N/W_T as our relative earnings variable.

After a brief period of slow growth during the late 1950's, the number of associate degree programs expanded at a very rapid rate. While this growth probably will continue into the future, it is doubtful that the pace of recent years can be sustained. Constraints on continued accelerated growth will take the form of fewer openings of new associate degree colleges, a declining proportion of existing 2-year colleges that do not operate a nurse training program, and lack of trained faculty personnel. To delineate the different stages of growth the associate degree program has gone through in the past and is likely to undergo in the future, we have used a logistic growth function to represent this trend factor; i.e., first increasing at an increasing rate and then increasing at a decreasing rate toward some maximum limit. The logistic function is of the form,

$$GA = \frac{a}{1+be^{-c(t)}},$$

where a is the expected maximum admission rate, b and c are positive constants representing the position and degree to which GA approaches a.[8, p. 174]

In this study it is assumed that as a maximum, the total admission rate will not exceed 6.0 percent, at least for the foreseeable future—the maximum rate in the 1960's was 5.3 percent. With the baccalaureate rate heading to 2.0 percent, and the diploma rate approaching 0, we used as an upper limit for the associate degree program 4.0 percent. By making $t=0$ in 1969 (-13 in 1956), and setting the value of GA equal to the actual AD rate in 1969 (1.67), b equals 1.4. The value for c was determined by fitting equation (4–8) to date for the 1956–69 period using various values of c and selecting that value which provided the best overall fit. The final growth trend variable was of the form:

$$GA_t = \frac{4.0}{1+1.4e^{-1/4(t)}}, \tag{4–12}$$

The number of diploma programs has been declining continuously throughout the last 15 years. In the last few years the rate of decline has been reduced somewhat, and the general declining growth process seems to fit closely to one described by a declining exponential of the form $GD=a+be^{-c(t)}$;[8, p. 173] that is, a trend function that declines at a declining rate. For the diploma program a, the minimum value was set at 0; using the actual value for D in 1969 (2.03), the value of b also equals 2.03. Again c was chosen by means of a series of preliminary estimates of equation (4–9). The equation that best fits the 1956–69 experience included a value for c of 1/8. Hence,

$$GD=2.03e^{-1/8(t)}. \tag{4–13}$$

Finally, the baccalaureate degree training program has experienced

steady positive growth during the 14-year period. We therefore used a monotonic linear growth function where $t=-13$ in 1956.

(4–14) $$GB_t = t.$$

As explained previously, the model includes substitution between the associate degree (AD) and diploma (DIP), but excludes the interaction between these programs and the baccalaureate (BAC). The period of analysis was limited to the 1956–69 period because of the unavailability of wage data and the insignificant nature of the associate degree program prior to 1956.

Model I

(4–8) $$A_t = \left(\frac{AD_t}{H_t - 1}\right) = f_1(W_t, D_t, GA_t)$$

(4–9) $$D_t = \left(\frac{DIP_t}{H_t - 1}\right) = f_2(W_t, A_t, GD_t)$$

(4–10) $$B_t = \left(\frac{BAC_t}{H_t - 1}\right) = f_3(W_t, GB_t)$$

(4–11) $$T_t = \left(\frac{TE_t}{H_t - 1}\right) = A_t + D_t + B_t$$

Definitions

Dependent Variables

A_t = Associate degree admission rate in year t; i.e., proportion of female high school graduates $(H_t - 1)$ entering an associate degree nursing program during the following academic year t.

D_t = Diploma admission rate in year t.

B_t = Baccalaureate admission rate in year t.

T_t = Total admission rate in year t.

TE_t = Total admissions (entrants) to all basic professional nursing programs in year t.

Independent Variables

$Wt = \frac{WNt}{WT_t}$ WNt, average beginning level wages of general nurses in period t; WT_t, average beginning level wages of public school teachers in period t.

$$GA_t = \frac{a}{1+be^{-c(t)}}$$

$$= \frac{4.0}{1+1.4e^{-1/4(t)}}$$

logistic growth function representing the growth process of associate degree nursing programs.

$$GD_t = a+be^{-c(t)}$$

$$= 2.03e^{-1/8(t)}$$

declining exponential growth function representing the growth process of diploma nursing programs.

$GB_t = t$ linear growth function representing the growth process of baccalaureate degree nursing programs.

$t = -13$ 1956
$\vdots$ $\vdots$
$t = 0$ 1969

Results

Because of the simultaneous aspects of equations (4–8) and (4–9), a two-stage least squares procedure was followed in estimating the model.[8,10] Although equation (4–10) is not formally related to the other structural equations, it is part of the complete model and therefore GB_t was included as one of the independent variables used in the first stage process of estimating (D_t) in equation (4–8), and (A_t) in equation (4–9).

To determine the net impact of relative wages on the various admission rates as well as to facilitate the supply projections, derived reduced form estimates are also shown. The estimated coefficients are for the most part consistent with expectations. The constant term is most negative for the diploma program, suggesting that of the three it is the least desirable after accounting for the other factors. Using this measure of relative desirability, the most attractive is the 4-year baccalaureate program.

Projection Equation Results (1956–69)

Model I

Structural Equations

(4–15) $$(A) = \underset{(-3.0732)}{-1.6657} + \underset{(1.9534)}{1.9606}(W) + \underset{(4.1198)}{0.0960}(\hat{D}) + \underset{(5.1379)}{0.9016}(GA) \qquad R^2 = .9955$$

(4–16) $$(D) = -6.3059 + 13.6576\,(W) - 2.3469\,(\hat{A}) + 0.4516\,(GD) \qquad R^2 = .9705$$
$$(-1.1536)\quad (1.5144)\quad (-1.8850)\quad (7.6741)$$

(4–17) $$(B) = -0.5464 + 2.1097\,(W) - 0.0268\,(GB) \qquad R^2 = .5438$$
$$(-0.9627)\quad (2.8836)\quad (-1.9973)$$
(t values in parentheses)

Reduced Form Equations

(4–15′) $$(A) = -1.8535 + 2.6701\,(W) + 0.0354\,(GD) + 0.7358\,(GA) \qquad \xi_e^A = 3.07$$

(4–16′) $$(D) = -1.9560 + 7.3911\,(W) + 0.3686\,(GD) - 1.7269\,(GA) \qquad \xi_e^D = 1.31$$

(4–17′) $$(B) = -0.5464 + 2.1097\,(W) - 0.0268\,(GB) \qquad \xi_e^B = 1.36$$

In all three structural equations, relative wages are positively related to the admission rate. For the *AD* and *BAC* programs the coefficients are statistically significant at the .1 level, and in the *DIP* equation, it is significant at the .2 level. Using reduced form estimates, the wage elasticity was calculated at the mean rate for the period. Because of the rapid change in the *AD* rate (the mean value is substantially below the current rate −.67 versus .167), this leads to a rather high mean elasticity of 3.07. For the other two programs the wage elasticity estimates are remarkably similar—1.31 (*DIP*) and 1.36 (*BAC*)—and conform quite well to cross-section *a priori* estimates derived elsewhere.[9] That is, these supply elasticities suggest that a 10 percent increase in the relative earnings of nurses will lead to about a 13 percent increase in the admission rate for new nurses. When 1969 rates are used, the relative magnitudes are turned around, with the *AD* elasticity falling to 1.33 and the *DIP* rate increasing to 3.03, the *BAC* rate increases slightly to 1.54.

As expected, the trend factors are extremely important in each equation. The statistically significant value for *GA* of .9 implies that the stage of growth of the *AD* program has had an important impact on the admission rate and that the value of *GA* used to measure this trend is close to accurate. For the *DIP* equation, the coefficient of *GD* is also statistically significant and positive. The value of .45 suggests that after accounting for the positive effects of *W* and the negative impact of *A*, the negative trend is somewhat greater than that caught by *GD* and this is represented by a value of the *GD* coefficient of less than 1.0. The small negative value for *GB* implies that after adjusting for the positive

[9] See chapter III.

effect of increasing relative wages, the slow growth in the number of baccalaureate programs has had a negative impact on the *BAC* admission rate.

The substitution hypothesis is substantiated to the extent that the *DIP* admission rate is negatively related to the *AD* admission rate. The reverse, however, is not the case, with the *AD* rate being positively related to the *DIP* rate. One possible hypothesis to explain this seemingly contradictory result is that the inclusion of (D_t) in equation (4–18), in addition to accounting for the substitution effect, is picking up a non-economic negative trend factor concerning the general desirability of nursing as a profession that has become less important throughout the period. In the *DIP* equation this factor is captured in the declining exponential trend variable. If this hypothesis has merit, it may be preferable to exclude (D_t) from equation (4–8) and to try and capture this negative occupational choice effect by a lower growth trend. We therefore re-estimated the model by excluding (D_t) in equation (4–18), Model II. Since there is no longer a simultaneous estimation problem, Model II was estimated using ordinary least squares. However, reduced form estimates were derived for equation (4–19) for ease of making future projections.

Results of Model II

$$(4\text{–}18) \qquad (A) = -1.891 + \underset{(2.180)}{3.246}(W) + \underset{(2.172)}{0.488}(GA); \qquad R^2 = .9880$$

$$(4\text{–}19) \qquad (D) = -3.380 + \underset{(1.025)}{8.775}(W) - \underset{(1.407)}{1.656}(A) + \underset{(7.604)}{0.436}(GD); \qquad R^2 = .9715$$

$$(4\text{–}19') \qquad (D) = -0.2490 + 3.3820(W) - 0.8080(GA) + 0.436(GD)$$

$$(4\text{–}20) \qquad (B) = -0.546 + \underset{(2.884)}{2.110}(W) - \underset{(1.997)}{0.026}(GB); \qquad R^2 = .5438$$

The major difference between Models I and II is that without the positive relationship between (A) and (D), the coefficient for (GA) is smaller, thus dampening the expected long-term growth in the *AD* admission rate. This also acts to reduce the decline in the *DIP* rate. Although the relative wage coefficient is substantially higher than that observed in structural equation (4–15), it is only somewhat higher than the reduced form estimate shown in (4–15′). It is with this latter net coefficient that the comparison should be made.

To determine the implications of these alternative supply models, both were used to project admission rates for the next 11 years.

Projection Procedure and Results

The projections of admission rates and number of admissions were carried out using the reduced form equations: (4–15′), (4–16′) and (4–17′) in Model I and equations (4–18), (4–19′) and (4–20) in Model II. Values for (*GA*), (*GD*), and (*GB*) were easily calculated using the formulas described above. The major problem concerned the proper (*W*) value to use in the years ahead. Although using a somewhat arbitrary procedure, an attempt was made to account for expected changes in the demand and supply for nursing services on an absolute and relative basis. First it was assumed that demand for health services will continue to grow relative to other sectors requiring large numbers of female professionals, leading to continued greater wage increases for nurses. It is expected also, that the differential growth rate will slow down, and that the relative wage ratio will change more in line with changes recorded just prior to the last few years. Within nursing, it is expected that a distinction will be made between wages paid to baccalaureate degree nurses on the one hand, and associate degree and diploma nurses on the other.

Chart 1.—Admissions to professional nursing schools by type of program: actual 1956–69; projected 1970–80 (percent of female high school graduates)

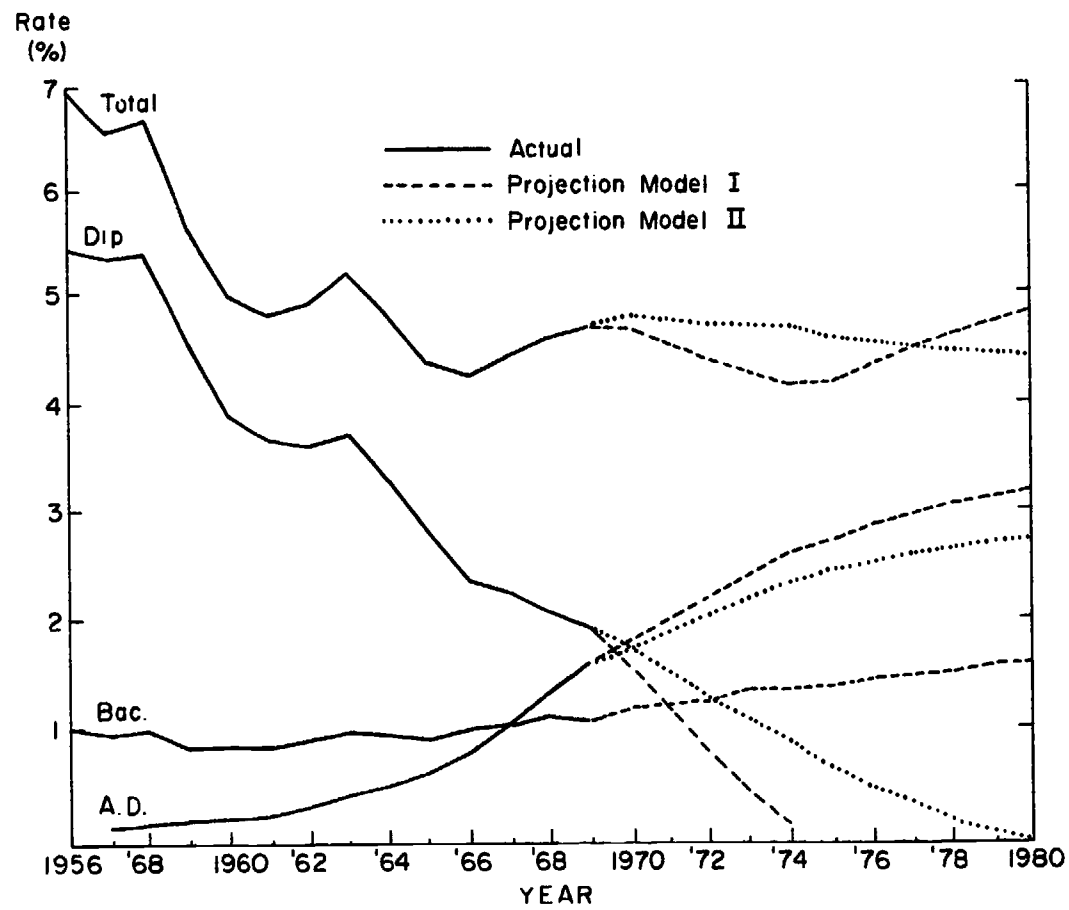
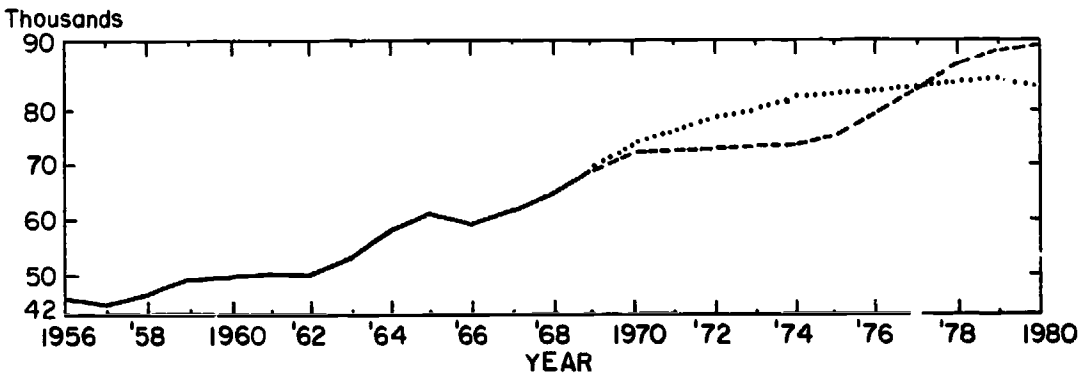


Table 28.—Admissions to professional nursing schools as a percent of female high school graduates, by type of program: actual 1956–69; projected 1970–80

Year	Total	Diploma	Baccalaureate	Associate degree
Actual				
1956	7.01	5.84	1.10	.09
1957	6.65	5.47	1.03	.14
1958	6.75	5.51	1.06	.18
1959	5.79	4.71	0.89	.19
1960	5.12	4.01	0.90	.22
1961	4.92	3.78	0.89	.25
1962	5.03	3.70	0.98	.35
1963	5.32	3.83	1.04	.45
1964	4.94	3.39	1.01	.53
1965	4.49	2.88	.97	.64
1966	4.36	2.47	1.05	.84
1967	4.55	2.35	1.10	1.10
1968	4.72	2.15	1.18	1.39
1969	4.81	2.03	1.14	1.67
Projections[1]				
Model I				
1970	4.80	1.67	1.26	1.88
1971	4.65	1.25	1.30	2.09
1972	4.50	.86	1.34	2.30
1973	4.38	.49	1.39	2.50
1974	4.28	.16	1.43	2.69
1975	4.30	.00	1.47	2.83
1976	4.46	----	1.52	2.95
1977	4.61	----	1.56	3.05
1978	4.74	----	1.60	3.14
1979	4.85	----	1.64	3.21
1980	4.96	----	1.69	3.27
Model II				
1970	4.90	1.85	1.26	1.79
1971	4.86	1.60	1.30	1.96
1972	4.83	1.37	1.34	2.12
1973	4.82	1.15	1.39	2.28
1974	4.81	.96	1.43	2.42
1975	4.74	.75	1.47	2.52
1976	4.68	.56	1.52	2.60
1977	4.63	.40	1.56	2.67
1978	4.60	.27	1.60	2.73
1979	4.58	.15	1.64	2.78
1980	4.56	.05	1.69	2.82

[1] Both projections assume that relative nurse to teacher earnings continues to grow in the next few years but that in the future a distinction is made between associate degree and diploma graduates on the one hand, and baccalaureate degree graduates on the other. For associate degree and hospital diploma graduates a maximum ratio of .9 is reached by 1975 and thereafter the relative earnings ratio levels off. For baccalaureate degree graduates the growth in relative earnings is greater (equal to the average yearly change of the last 5 years) and continues to expand throughout the 10-year period.

Chart 2.—Admissions to professional nursing schools by type of program: actual 1956–69; projected 1970–80



To account for these two factors, we assumed that wages for BAC nurses will grow at a rate relative to teacher earnings equal to the average recorded for the last 5 years, reaching a ratio value of 1.2 by 1980 (appendix IV-A.1). For the AD and diploma graduate, the growth in earnings will be slower, with a change from .83 to .90.

Projections of admission rates are shown in table 28 and chart 1. In Model I, entrants to diploma programs are estimated to end by 1975; for baccalaureate schools, the projected growth is slow and continuous reaching a level of 1.69 percent by 1980 as compared to the 1969 rate of 1.48 percent. The most prevalent form of nurse training during the 1970's is the associate degree program. Consistent with the logistic growth trend, the associate degree admission rate rose at an increasingly faster rate through 1967 and thereafter is expected to grow at a declining rate. Between 1970 and 1980 the AD admission rate will almost double and reach a level of 3.27 percent.

The assumption about the slow down in the rate of growth of relative nurse wages and the continued declining diploma admission rate leads to a decline in the total rate through 1975 in Model I. In the latter part of the decade the admission rate begins to increase and reach a level approximately equal to that recorded in 1961.

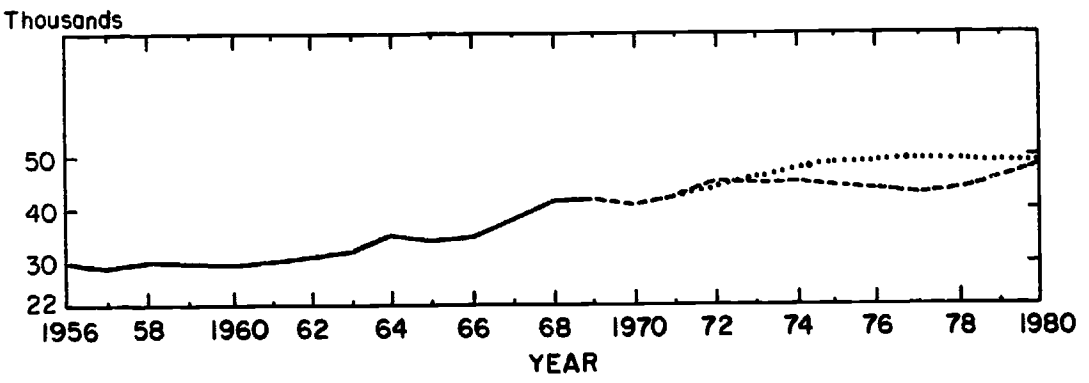
Using Model II, the decline in the diploma program is less steep and the program, while reaching very low levels, is estimated to remain in existence throughout the decade. The growth in the AD program is smaller than in Model I and the *total* rate after increasing in 1970 shows a slow but continuous 10-year decline. The relationship between the two estimates can perhaps best be appreciated by referring to chart 2. The results of Model II seem more in line with expected behavior: (1) a continually operating diploma program at low levels; (2) a slow steady growth in the BAC program; and (3) a slower rate of growth in the AD program. The relative value of the alternative projection models should be evident within the next few years.

Table 29.—Admissions to professional nursing schools by type of program: actual 1956–69; projected 1970–80

Year	Total	Diploma	Baccalaureate	Associate degree
Actual				
1956	45,255	37,571	7,106	578
1957	44,221	36,402	6,866	953
1958	46,263	37,722	7,275	1,266
1959	49,166	40,013	7,555	1,598
1960	49,487	38,702	8,700	2,085
1961	49,805	38,257	9,044	2,504
1962	49,521	36,434	9,597	3,490
1963	52,667	37,936	10,270	4,461
1964	57,604	39,609	11,835	6,160
1965	60,701	38,904	13,159	8,638
1966	58,700	33,283	14,070	11,347
1967	61,389	31,628	14,891	14,870
1968	64,192	29,240	16,048	18,904
1969	68,873	28,887	16,222	23,764
Projections[1]				
Model I				
1970	72,060	24,977	18,863	28,220
1971	72,472	19,542	20,289	32,641
1972	72,574	13,834	21,659	37,081
1973	72,607	8,162	22,990	41,455
1974	73,127	2,806	24,412	45,909
1975	75,269	------	25,780	49,489
1976	79,515	------	27,003	52,512
1977	83,604	------	28,268	55,336
1978	88,049	------	29,754	58,295
1979	91,145	------	30,882	60,263
1980	92,094	------	31,352	60,742
Model II				
1970	73,571	27,792	18,863	26,916
1971	75,851	25,011	20,289	30,551
1972	77,897	22,065	21,659	34,173
1973	79,842	19,123	22,990	37,729
1974	82,200	16,410	24,412	41,378
1975	83,001	13,133	25,780	44,088
1976	83,398	10,056	27,003	46,339
1977	84,041	7,312	28,268	48,461
1978	85,444	4,942	29,754	50,748
1979	85,932	2,832	30,882	52,218
1980	84,753	968	31,352	52,433

[1] Based on the projected admission rates shown in table 1 and the projection of future female high school graduates obtained from unpublished statistics prepared by the National Center for Educational Statistics.

Chart 3.—Graduations from professional nursing schools by type of program: actual 1956–69; projected 1970–80



When both sets of projections are applied to estimates of future high school graduates, the results suggest a strong similarity in the total number of admissions for the 11-year period, with Model II estimates larger during the early 1970's, but leveling off sooner and falling below Model I estimates in 1978 (see table 29). By 1980, between 85,000 and 92,000 applicants will be admitted to a professional nurse training program as compared to 50,000 in 1960 and 69,000 in 1969. A portion of this increase, however, will not show up as increased numbers of licensed graduates or practicing nurses. This phenomenon will be explained in the next sections.

The Nurse Training Act, 1964 and 1968

The Nurse Training Act (NTA) of 1964 authorized 5 years of financial support for the expansion and improvement of nursing education. Appropriations were to be made for (1) grants to assist in the construction of facilities; (2) grants to defray the additional costs of projects to strengthen nurse educational programs; (3) payments to diploma schools of nursing to reimburse them for a portion of the costs of the increased enrollments attributable to the expanded activities under the provisions of the Nurse Training Act; (4) extension of the Professional Nurse Traineeship Program to upgrade the skills of previously trained nurses; and (5) loans to full-time nursing students.[20]

It appears that the major thrust of the NTA of 1964 was to upgrade and expand the training facilities for nursing education, with direct support of new students of secondary importance. This emphasis changed rather markedly in the 1968 revision as explained below. Of the $283 million authorized under the 1964 Act, $57 million was provided for undergraduate student support, with only a portion going to first year students. Of the $57 million, more than half ($29.6 million) went to diploma school students, with less than $5 million going to students enrolled in associate degree programs. The percentage of students enrolled

in initial nurse training programs receiving loans varied from 2.7 percent in 1965 to 17.8 percent in 1969. The initial set of loans required interest payments of from $4\frac{1}{4}$ percent for fiscal years 1965 and 1966, to $5\frac{3}{8}$ percent in fiscal year 1969. Loans are repayable over a 10-year period with up to 50 percent of the total loan (including interest) forgivable at the rate of 10 percent for each year of full-time employment as a professional nurse in a public or other nonprofit institution or agency.

With the major emphasis of the 1964 Act directed toward construction of training facilities—786 additional first-year student places—the improvement of existing facilities—benefiting 14,500 students—and the upgrading of existing programs,[28] it seems rather doubtful that the provisions of the Act had a significant impact on the decisions of high school graduates to enter nursing. To test this assumption the admission rate equations include alternative measures to capture the importance of the Nurse Training Act for the 1965–69 period. The first measure used was the percentage of total enrollments in each program participating in the loan program; the second was a simple 0/1 dummy variable procedure, denoting those years when the Act was in existence with a 1. As shown in appendix table A2, neither procedure indicated that the loan provision of the Act significantly added to the flow of new enrollments. Therefore, no specific Nurse Training Act variable was included in the projection equations. The trend or growth variables, however, are expected to capture the growing availability of training facilities for AD and BAC programs.

The 1968 extension and revision of the Act was directed much more toward the problem of recruiting qualified applicants.[20,24] It established an order of priorities for awarding of grants, based on the applicant's financial need and the extent to which the project would increase enrollment of full-time students receiving nurse training. To further assist new enrollments, the interest rate payable was reduced to 3 percent, and effective July 1, 1969, up to 100 percent of the total loan (as opposed to 50 percent) may be cancelled at the rate of 15 percent a year when the borrower is employed full time in a public or nonprofit private hospital in an area that the Secretary of Health, Education, and Welfare determines has a substantial shortage of professional nurses. Finally, the 1968 revision established a new program of scholarship grants to schools for full-time students of exceptional financial need. Under this provision a student could receive up to $1,500 with no matching funds by the educational institution.

It is too early to tell what impact these procedures will have on increasing new enrollments. If these procedures have a positive impact on enrollment, the future admission projections could be biased on the down side. It is unlikely, however, that the total impact on the supply of practicing nurses in 1975 and 1980 will be substantial unless such a program is continued throughout the decade.

Graduates from Professional Nursing Schools

The relatively high dropout rate within basic nurse training programs is of great concern to nursing educators and planners. This is particularly true for the associate degree and baccalaureate programs. Over the 5-year period, 1963–68, the completion rate; i.e., percentage of entrants who graduate from the program, averaged 55 percent for associate degree schools and 59 percent for baccalaureate schools, as compared to 70 percent for diploma schools.[4] No discernible trend is evident in the completion rates and the variance around the average has been relatively small. There is therefore some confidence in using these rates as estimates of future completion rates. It is important, however, to understand why these completion rates vary by program and whether these differences can be expected to continue into the future.

To understand the behavior of students within a training program it is helpful to designate three important junctures in the occupation choice process: (a) prior to high school graduation; (b) within a training program; and (c) just before entering the labor market. Using a modified version of Becker's theory of human capital,[6] one can consider the training for an occupation as progressing from very general—returns accrue to the individual no matter what occupation chosen—to very occupational specific—of value only in the occupation chosen. Since returns from general training are not lost when one changes occupation, the cost of changing future occupational plans increases more than proportionally as the amount of training time increases. That is, as the training progresses from general to specific the cost of change increases. Certain occupations, such as nursing, require much more occupation-specific training than, for example, teaching. Within nursing the same distinction can be drawn between baccalaureate training (very general), on the one hand, and diploma training (very occupational specific) on the other. As such, if differences in the cost of changes in occupational choice have an influence on the willingness to make such changes, then the stability rate; i.e., percentage of a group choosing an occupation at one decision juncture who maintain that choice at another juncture, should be higher for the more specific nurse training program than for teaching, and for nursing students enrolled in diploma school programs in comparison to baccalaureate or AD students.

To test the validity of this hypothesis, occupational choice stability rates were calculated for those 11th grade females in the Project Talent sample (see chapter II) who initially selected nursing (specific training) and teaching (general training) and office work (no training) (see table 30). Also shown in table 30 are the stability rates within the three types of nurse training programs. The stability rates were calculated for three time intervals: (a) between the initial survey in the 11th grade and 1 year after high school graduation (S_{12}); (b) between 1 year after high school

and 5 years after high school (S_{23}); and the cumulative stability rate (c) between the 11th grade and 5 years after high school graduation (S_{13}). Since most students in the 1-year followup survey who continue to express a preference for a training occupation are enrolled in such a program, S_{12} can be thought of as the proportion of students who go so far with their 11th grade occupational preferences as to enter a training program. The second stability rate, S_{23}, is for the most part a measure of those who complete the previously stated training program, although these figures also include some females who drop out of the occupation after entering the labor force. For AD nursing students this factor is particularly important, since many could have completed the training program 3 years prior to the third survey. For nursing students, on the other hand, once enrolled in a training program they appear much more willing to complete the program—S_{23}=.52.

Table 30.—Estimated stability rates of occupation preference between major decision junctures

Index	Total			Within nursing programs		
	Office worker	Nurse	Teacher	Bacc.	Dip.	Asso. degree
S_{12}	.41	.37	.51	---	---	---
S_{23}	.21	.52	.24	.53	.70	.33
S_{13}	.11	.23	.15	---	---	---

NOTE: S_{ij} = fraction indicating preference for given occupation at time j who also preferred this occupation at time i.

Time 1 = 11th grade
Time 2 = 1st post-high school year
Time 3 = 5th post-high school year

SOURCE: Special tabulations of Project Talent.

During the early period (S_{12}) a prospective nurse, particularly one who enters a diploma program must make a major training choice. If she chooses nursing, the cost of changing that decision while in the program can be quite substantial. Often, it involves dropping out of a program completely with very little transfer of credit. Therefore a good number of the marginally interested students appear not to enroll in a nurse training program. Once in the program, however, the nursing student seems more likely to complete the program. A willingness to enter a teaching program, on the other hand, is often a relatively low cost decision.

Table 31.—Graduations from professional nursing schools by type of program: actual 1956–69; projected 1970–80

Year	Total	Diploma	Baccalaureate	Associate degree
Actual				
1956	30,236	26,828	3,156	252
1957	29,933	26,141	3,516	276
1958	30,410	26,314	3,671	425
1959	30,312	25,907	3,943	462
1960	30,113	25,188	4,136	789
1961	30,267	25,311	4,039	917
1962	31,186	25,727	4,300	1,159
1963	32,398	26,438	4,481	1,479
1964	35,259	28,238	5,059	1,962
1965	34,686	26,795	5,381	2,510
1966	35,125	26,278	5,498	3,349
1967	38,237	27,352	6,131	4,654
1968	41,555	28,197	7,145	6,213
1969	42,196	25,114	8,381	8,701
Projections				
Model I				
1970	40,838	22,140	8,301	10,397
1971	42,324	20,468	8,786	13,070
1972	45,210	20,221	9,468	15,521
1973	45,008	17,484	9,571	17,953
1974	45,203	13,679	11,129	20,395
1975	44,455	9,684	11,971	22,800
1976	43,742	5,713	12,779	25,250
1977	42,747	1,964	13,564	27,219
1978	43,285	------	14,403	28,882
1979	45,645	------	15,210	30,435
1980	47,994	------	15,932	32,062
Model II				
1970	40,838	22,140	8,301	10,397
1971	42,234	20,468	8,786	13,070
1972	44,493	20,221	9,468	14,804
1973	45,828	19,454	9,571	16,803
1974	47,432	17,508	11,129	18,795
1975	48,168	15,446	11,971	20,751
1976	48,923	13,386	12,779	22,758
1977	49,299	11,487	13,564	24,248
1978	49,082	9,193	14,403	25,486
1979	48,903	7,039	15,210	26,654
1980	48,961	5,118	15,932	27,911

Often, the only commitment for the first 2 years is merely to enter college and to undertake general instruction. The student still maintains many options and can change major fields of study at very little loss of credit.

The data in table 30 appear consistent with our hypothesis. Of those females surveyed who said while still in high school that they planned to be teachers, 15 percent still planned to be teachers 5 years after high school graduation (S_{13}). For nurses the rate was 23 percent. But, whereas 51 percent of the original teacher group maintained that preference 1 year after high school graduation (low cost decision) (S_{12}), the stability rate for prospective nurses was only 31 percent (high cost decision). The major dropoff in preference for teaching came during the training program (S_{23}) where only 24 percent maintained their preference between the 1-year and 5-year survey.

The survey information therefore reinforces the contention that the higher the degree of general education embodied in a training program, the more attractive it is to enter (higher admission rate), but the lower the cost of changing fields of study and the smaller the completion rate is likely to be within the program. Differences in average completion rates in nurse training programs for the last 5 years are consistent with this hypothesis, and therefore there is some justification to assume that they will remain roughly the same in the future. Of course, as the relative importance of each program changes, the average completion rate for all programs will also change. Unfortunately, in terms of the cost to nursing, we estimate that the changing composition of training programs will result in the average completion rate falling to about 56 percent in 1980 compared to 62 percent in 1969.

The impact of a falling overall completion rate can be seen rather dramatically in chart 2. Whereas the number of admissions is expected to increase by about 22,000 or 31 percent between 1969 and 1980 (table 29), the number of actual graduates will grow by 5,600 or 13 percent (table 31). This relative stability in the expected number of graduating nurses in the face of a rising number of eligibles will lead to a fall in the proportion of female high school graduates actually entering the practice of nursing—from 1.4 percent in 1969 to 1.0 percent in 1980.

Table A1.—Data used for admission rate regression equations

Year	Admission rates			Relative nurse to teacher earnings	Growth (trend) factors		
	AD	DIP	BA		GA	GD	GB
1956	.09	5.84	1.10	.5794	.1078	10.3124	−13
1957	.14	5.47	1.03	.5858	.1374	9.0979	−12
1958	.19	5.51	1.06	.5924	.1747	8.0313	−11
1959	.19	4.71	.89	.5992	.2215	7.0853	−10
1960	.22	4.01	.90	.6061	.2801	6.2548	−9
1961	.25	3.78	.89	.6223	.3526	5.5181	−8
1962	.35	3.70	.98	.6394	.4417	4.8698	−7
1963	.45	3.83	1.04	.6579	.5499	4.2975	−6
1964	.53	3.39	1.01	.6684	.6795	3.7926	−5
1965	.64	2.88	.97	.6789	.8324	3.3469	−4
1966	.84	2.47	1.05	.6901	1.0091	2.9537	−3
1967	1.10	2.35	1.10	.7326	1.2091	2.5805	−2
1968	1.39	2.15	1.18	.7800	1.4298	2.3004	−1

Table A2.—Measuring the impact of the Nurse Training Act

Model II-A[1]

$$(A) = 0.371 - 0.617(W) + 0.845(GA) + 0.192(SA)$$
$$\qquad\qquad (0.721) \quad (7.641) \quad (6.924) \qquad R^2 = .9979$$

$$(D) = 8.913 - 13.507(W) + 3.513(AD) + 0.444(GD) - 0.273(SD)$$
$$\qquad\qquad (0.956) \quad (1.190) \quad (8.630) \quad (1.874) \qquad R^2 = .9795$$

$$(B) = 0.023 + 1.255(W) - 0.022(GB) + 0.019(SB)$$
$$\qquad\qquad (1.009) \quad (1.445) \quad (0.856) \qquad R^2 = .5749$$

Model II-B[1]

$$(A) = -2.896 + 5.065(W) + 0.121(GA) + 0.110(N)$$
$$\qquad\qquad (2.123) \quad (0.278) \quad (0.977) \qquad R^2 = .9891$$

$$(D) = 1.455 + 0.780(W) - 0.285(AD) + 0.397(GD) - 0.385(N)$$
$$\qquad\qquad (0.070) \quad (0.166) \quad (5.864) \quad (1.088) \qquad R^2 = .9748$$

$$(B) = -0.507 + 1.972(W) - 0.031(GB) + 0.067(N)$$
$$\qquad\qquad (2.640) \quad (2.195) \quad (0.972) \qquad R^2 = .5832$$

New Variables

SA, SD, SB represent the proportion of enrollments in each program that received a loan (subsidy) during a given year.

(N) is a 0/1 dummy variable indicating whether or not the Nurse Training Act was in existence.

[1] For discussion of Model II, see section IV-4.

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CHAPTER V

SUPPLY OF ACTIVE NURSES

When analyzing age-specific labor force participation rates (LFPR) of nurses; i.e., the percentage of the total stock of previously trained nurses in each group working as nurses in the labor force, two important factors that have been mentioned before must be borne in mind. Over 95 percent of trained nurses are women, and over 70 percent are married. As such, the labor force participation pattern of nurses is likely to differ significantly from the participation pattern of other occupations composed primarily of either men or single women. In this chapter, LFPR's are calculated for nurses in several age groups using the number of active nurses reported by the U.S. Census Bureau.[1] By comparing these participation rates with those for other female labor market groups, it can be determined to what extent the labor force behavior of nurses can be explained by the labor market behavior of other female groups. Such information will aid in understanding future participation rates as the educational background of professional nurses changes.

Analysis of Labor Force Participation

In table 32, labor force participation rates are presented for nurses, female high school graduates only, female college graduates and above,

[1] It is generally believed that the major problem with Census data is that they include many student nurses. One method of adjusting Census estimates is to subtract the known number of student nurses in each State and for the United States as a whole. The belief among U.S. Public Health statisticians is that, "while the results of the adjustment in Census figures are only approximations, they nevertheless appear reasonable and are consistent with data from inventories that include only registered professional nurses."(9) However, when adjusted Census data are used to derive labor force participation rates by age a serious bias is revealed. If the U.S. Public Health statisticians are correct and the major reason for the inflated Census count is due to the inclusion of student nurses, then the participation rate of 20- to 24-year-old nurses should be the most seriously affected (most student nurses are in their late teens' and early 20's). However, this does not appear to be the case. Using unadjusted data, the participation rate for 20- to 24-year-old nurses in 1960 was 72.4 percent (table 32), almost exactly the same rate as that for all females with at least a college degree. When Census data were adjusted by subtracting from the 20- to 24-year-old total the estimated "overcount" of students in each State, the participation rate for 20- to 24-year-olds is less than 50 percent. This figure is highly unlikely and if correct would suggest that within 2 years after graduation less than half of any graduating class is still practicing nursing. It is more reasonable to believe that the Census overcount is spread more evenly throughout the age groups. In our analysis, we will assume the age distribution is correct (although somewhat inflated), as derived from Census information, and adjust downward the estimated supply obtained from these participation rates to conform with the estimates obtained from an inventory of professional nurses conducted by the American Nurses' Association.(2) That is, the Census figures are used to estimate age-specific labor force participation rates and estimated supply in each age group, but the total number of practicing nurses is then adjusted downward to conform with the ANA estimate.

Table 32.—Labor force participation rates for professional nurses and other female labor force groups, 1950 and 1960

	Age	1950 (1)	1960 (2)	Absolute change (3)	Percent change (4)
Nurses					
	20–24	60.2	72.4	12.2	20.3
	25–34	47.0	48.8	1.9	3.8
	35–44	44.1	54.5	10.4	23.6
	45–64	49.1	56.6	7.1	15.3
	65 and over	47.5	36.5	−12.6	−23.2
Total	-----	48.8	55.3	6.5	13.3
High school graduates					
	20–24	29.9	49.1	19.2	64.2
	25–34	32.6	34.6	2.0	6.1
	35–44	36.3	42.9	6.6	18.2
	45–64	34.2	47.0	12.8	37.4
	65 and over	10.8	13.5	2.7	25.0
Total	-----	31.9	37.3	5.4	16.9
College graduates (4 years or more)					
	20–24	67.8	72.3	4.5	6.6
	25–34	45.9	46.6	.7	1.5
	35–44	50.3	52.7	2.4	4.8
	45–64	53.4	65.3	11.9	22.3
	65 and over	18.3	24.4	6.1	33.3
Total	-----	49.4	56.3	4.9	9.9
Total women					
	20–24	42.9	44.3	1.4	3.3
	25–34	31.8	34.5	2.7	8.5
	35–44	35.0	42.4	7.4	21.1
	45–64	28.8	42.7	13.9	48.3
	65 and over	7.8	10.1	2.3	29.5
Total	-----	31.5	36.2	4.7	14.9

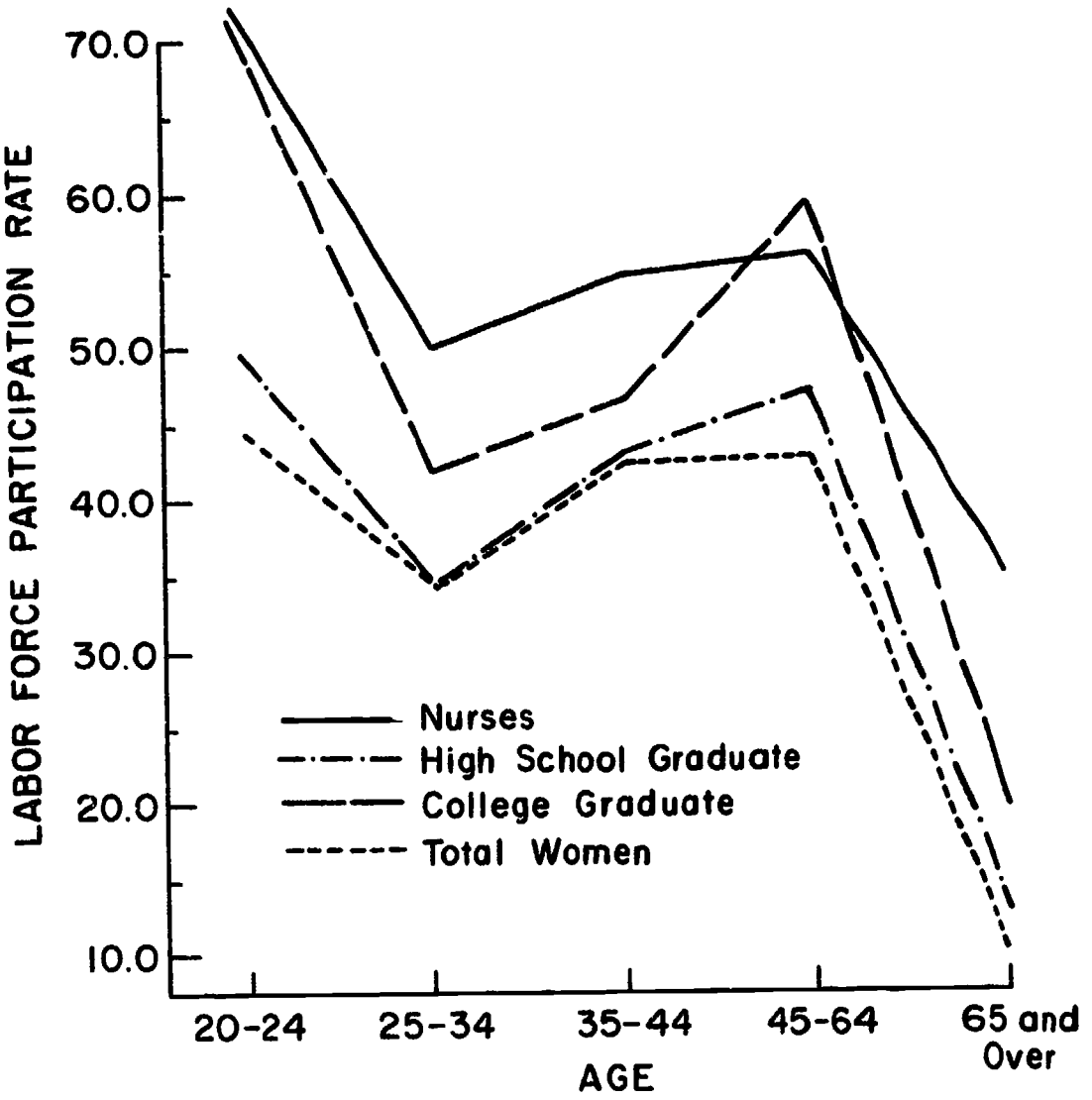
SOURCES: U.S. Department of Commerce, Bureau of the Census, *U.S. Census of Population*, 1960. Washington, D.C., U.S. Government Printing Office, 1962.
Appendix table A3, p. 129.

and all women, by age group. A comparison between nurses and the other groups in 1950 and 1960 reveals the same overall pattern for each female group: high participation following graduation from school, a falling off in the rate during the child bearing ages (late 20's and early 30's), and a second upswing after age 35. This bi-modal pattern is especially pronounced in 1960.

A comparison of nurse participation rates with those of other female groups indicates that a greater percentage of nurses are employed than either the percentage of all potential women workers or those with a high

school education only. The total percentage of nurses working is remarkably similar to that of female college graduates and above (the nurse rate was somewhat higher than that for women with a baccalaureate degree only). While the overall rate of these two higher education groups is the same, the age pattern is somewhat different. The two rates are about the same in the period immediately after graduation (72.4 percent as opposed to 72.3 percent); a greater proportion of college graduates drop out of the labor force in their late 20's and early 30's, but come back into the labor market after age 45. Whereas the participation rate for college graduates rose between ages 35 to 44 and 45 to 64 by 12.6 percentage points or 24 percent, the nurse rate increased by 1.6 percentage points or 3 percent. In other words, the nursing profession neither loses as many active participants during their late 20's and early 30's nor attracts as great a proportion back to labor market activity after age 35.

Chart 4.—Labor force participation rates for females by age and education, 1960



Perhaps the fact that a smaller proportion of nurses are married—in 1966 the marriage rate for all nurses was 71.0 percent versus 92.4 percent for all females 25 and over[8,9]—helps explain this phenomenon. At least it should be a factor in the smaller dropoff in labor market activity in the child bearing ages. But the question still remains, why of those who leave the labor force in the child bearing ages does a smaller proportion return in later life?

A somewhat similar pattern emerges when the change in the labor force participation rate between 1950 and 1960 is compared for the four groups. While the total nurse rate grew by 6.5 percentage points or 13.3 percent, a growth rate similar to that for high school graduates and all women, the growth rate among middle-aged nurses was the lowest of the four groups. During the 10-year period, the participation rate for all women ages 45–64 increased by 48 percent, for high school graduates the rate increase was 37 percent, and for college graduates it was 22 percent. Similar large increases were also reported for women in these groups over age 65. In comparison, the rate for nurses age 45–64 increased by only 15 percent and the rate declined for nurses over 65 by 27 percent.

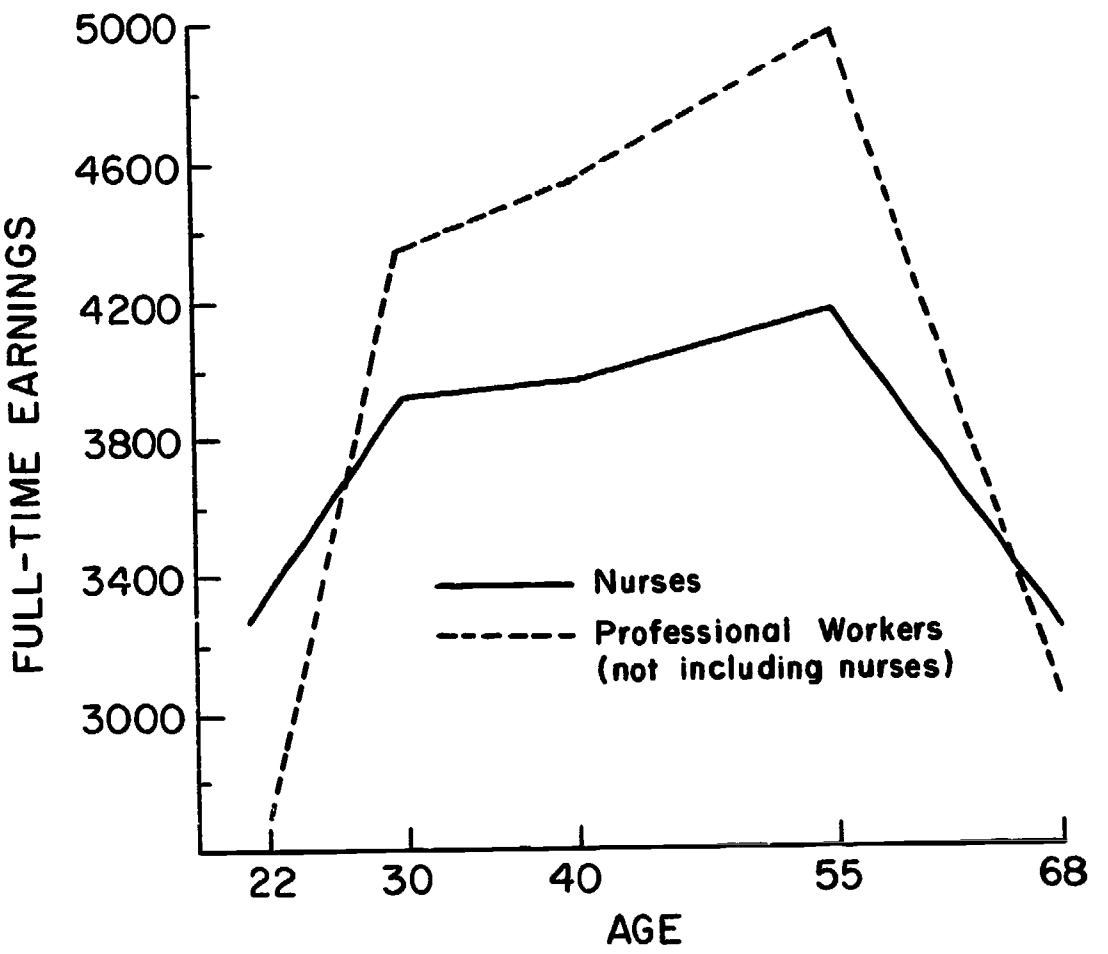
The failure of the nursing profession to attract back into the labor force women above the age of 45 gives some support to those who argue that one of the most efficient methods for increasing the number of active professional nurses in the short run is to recruit previously trained nurses. But in order to devise a technique to achieve this objective we must know why the inactive middle-age nurse does not return as readily to labor market activity as, for example, female college graduates, and why the participation rate among middle-aged nurses has not grown as fast as that for the other female labor force groups.

Two reasons for this behavior appear likely:

1. Greater degree of occupational obsolescence within the nursing profession due to inactivity;
2. Lack of sufficient economic incentives to attract previously trained nurses back into the labor market.

Nursing is an occupation that requires a deep sense of responsibility. Most nurses are required to care for ill and sometimes critically ill persons. Often the nurse stands between life and death for a patient. This aspect of nursing is an inherent part of the profession and for many it acts as one of the prime positive nonmonetary factors that initially attract them to nursing. But what of the nurse who has not been active for many years? How does she react to the possibility of being put into a very responsible position soon after returning to active nursing? Can she adjust quickly to the many changes that have taken place in medical technology? While it is not possible to quantify the importance of this aspect of the profession as an inhibitor to labor market re-entrance, there is a growing conviction on the part of many analysts that it is far from insignificant. As part of a study in 1961 to determine why trained nurses are inactive, the Division

Chart 5.—Full-time earnings for professional workers and professional nurses by age, 1960



of Nursing, U.S. Public Health Service, conducted a survey in 12 States.[7] Those surveyed were asked to state whether they planned to return to nursing and why they were inactive. As might be expected, the major reason preventing those who planned to return from returning immediately was the presence of children (59.5 percent). For those who did not plan to return, the reasons were more varied. One possible reason listed, "I am reluctant to return because I have not engaged in nursing practice for a while." Although only 4.6 percent of those not planning to return indicated this as their major reason, it did account for a more significant proportion of those whose reasons were such as to be influenced by changes in labor market conditions.[2]

Another reason for the relatively low participation rate of nurses, age 35 to 64, at least through the mid 1960's, was the lack of a strong incentive. In chapter III the relationship between the earnings and costs of training

[2] Such answers are "I believe a mother should be home while her children are young" or "my husband prefers that I do not work," embody factors that are much more difficult to influence. It should be recognized, however, that just because a woman says her husband prefers that she not work, it does not mean that she would not enter the labor force under any circumstances. Significant increases in her earning potential may indeed force the husband to rethink his previous position.

in nursing teaching and office work was discussed. This discussion was meant to provide a representative picture of differential earnings in contrasting types of female occupations. In this chapter, nurse earnings is compared to those of their closest major occupational group—other female professional and technical workers. In chart 5, full-time earnings in 1960 are shown for nurses and other female professional and technical workers by age. The calculations are based on the assumption that nurses in 1960 entered the labor force 1 year earlier than other female professional and technical workers, the vast majority of whom spent 4 years in college. Using the procedure outlined in the third section of chapter III, chart 5 shows that for the first year or two a nurse earns more than her chief occupational rival. By the late twenties, however, the trend clearly favors females in other professional or technical occupations, and by age 30 the earnings differential is slightly more than $400. Of even greater importance, the differential continues to grow at an increasing rate and by age 55 a difference of about $800 exists. That is, not only were nurses in the early 1960's earning less than that of the other female professional and technical workers for most years except the first few, but nurses' earnings appear to increase at a much slower rate than those of the other competitive workers.

Table 33.—Present value of training as a professional nurse as opposed to other female professional and technical occupations, 1960[1]

Earnings	Discount rate		
	0	5 percent	8 percent
Actual	−$14,588	−$1,421	$1,079
Expected[2]	−$7,316	$24	$1,373

[1] The earnings figures used were estimated full-time earnings based on 1960 median earnings and the average number of weeks worked of each age group as derived by the U.S. Bureau of the Census (see Chapter II).

[2] Full-time earnings were adjusted for expected labor force participation using the same labor force participation rates for professional and technical workers as for nurses.

Labor Force Participation Rates of Professional Nurses

Age	*Rate*
20–24	72.4
25–34	48.9
35–44	54.5
45–64	56.1
65 and over	34.9

NOTE: The present value estimates assume that a nurse enters the labor market at age 21 and other professional and technical workers at age 22. It is further assumed that the direct costs of both types of education are zero and that there are no opportunity costs while both groups are in school. (During the last year of college, however, for other professional and technical workers, there is an opportunity cost equal to the earnings of a nurse.)

For those females who expect to be in the labor force for just a few years after graduation and who desire some type of professional training, the relative economic incentive of nursing is not too unfavorable. This can be seen by looking at table 33, where the difference in the two earning streams which appear in chart 5 are discounted back to the present at various discount rates. As discussed in the third section of chapter III, the reason for using the present value technique is to acknowledge the fact that income earned today is more valuable today than income earned in the future. The higher the discount rate the more the present is valued over the future, and consequently the less valuable is income earned in the future. In table 33, three discount rates are used: zero, for those who consider income earned in the future as worth the same as income earned today; 5 percent, a discount rate roughly equal to the market rate of interest; and 8 percent, a rate higher than the market rate of interest for those who have a stronger personal preference for income in the present rather than in the future. Actually, for those women who expect to spend only a brief period of time working after leaving school, a discount rate as high as 20 percent is not inappropriate.

What these present value calculations show is that for those who have no preference for a dollar in the present, and who remain in the labor force from age 21 to age 68, the negative lifetime earnings differential of selecting nursing as a career at 1960 rates equals $14,588. As the discount rate rises nursing becomes relatively more attractive (because of higher earnings in the first few years) and at about a 6 percent rate the differential approaches zero. Above the 6 percent, nursing is actually a relatively more attractive occupational choice at least with respect to the average for other professional and technical occupations. This is a quite different result than that reported in the third section of chapter III. There nursing had a lower present value of monetary earnings at all time preference (discount) rates. The reason given to justify the choice of many girls for nursing over teaching or office work was that for them the positive value of the nonmonetary or nonpecuniary aspects of nursing relative to these other occupations was sufficient to compensate for lower earnings. When the choice is between occupations more similar in attributes the nonpecuniary value of one versus the other are much smaller and monetary factors loom larger.

One interpretation of these present value results is that for girls planning a brief stay in the labor force (high discount rate), nursing is a relatively attractive professional occupation, while for those whose career plans are more long term another professional or technical occupation is to be preferred. This in part would account for the relatively low labor force participation rate of nurses after age 35. That is, many girls choose nursing who do not plan to spend their entire life in the labor force or do not expect to return to the labor market after raising a family.

Although we usually speak of an increase in participation rates of women after age 35 resulting from a return to the labor force of previously

inactive workers, we should also consider the dropoff in the flow of individuals out of the labor force. In other words, labor force participation for any female group is very volatile and is composed of large numbers of women entering and leaving the labor market at any moment in time.[1] An increase in the overall rate can result either from an increase in the inflow rate or a decrease in the outflow rate, or some combination of the two. The shape of the nurse age–earnings profile would argue that one of the incentives for remaining in the labor force (increased earnings) is smaller for nurses than for other professional occupations. Therefore, not only do a smaller number of nurses return to the labor market, but it is quite possible that a larger proportion of active nurses both married and single leave the field (see the third section of chapter V).

There were several reasons for the relatively flat age-earnings profile of nurses in the early 1960's. In the past, the job of a nurse was narrowly defined and her training (usually within a hospital school) was oriented to performing these limited tasks. There is little doubt that with experience she became more proficient thereby warranting a higher salary. But this growth in efficiency peaked after a relatively short time period. Advancement often required returning to school to earn a baccalaureate or higher degree and undertaking some type of administrative work. Within the usual scope of a general duty nursing, advancement and commensurate salary increases were small.

But what of the present and the future? There are two changes taking place, both of which should act to increase the overall level of nursing salaries and allow more room for advancement within the salary structure. First, the public is increasingly aware of the need to pay nurses a competitive wage so as to eliminate the often publicized shortages of hospital nurses. Pressure exerted on hospital administrators within the last few

Table 34.—Labor force activity rates for diploma and baccalaureate program by age, 1962

Age	Diploma (percent)	Baccalaureate (percent)
Under 25	83.53	84.75
25–29	65.54	64.30
30–34	61.75	56.21
35–39	67.17	59.47
40–44	73.81	67.85
45–49	79.15	79.05
50–54	81.17	80.04
55–59	81.70	78.73
60–64	81.04	66 06
65 and over	64.37	56.98

SOURCE: American Nurses' Association, *The Nation's Nurses: Inventory of Professional Registered Nurses*, New York, the Association, 1965, p. 37.

years to alleviate the problem has resulted in annual salary increases of 10 to 15 percent (see table 28). Prior to this, yearly increases were much closer to the national norm for all workers of from 3 to 5 percent. Second, the growing differential in salaries paid to different types of trained professional nurses—associate degree graduates, diploma school graduates, baccalaureate graduates—is spilling over to salary differentials for nurses performing different tasks. The relatively small pay differentials for different shift assignments are also beginning to increase; and finally, the willingness of hospitals to adjust part-time employment to the needs of the nurse as well as to the hospital is another way of making active nursing a more attractive economic opportunity. The importance of earnings on the labor force participation rates of professional nurses is discussed in section three of chapter V and appendix V-A.

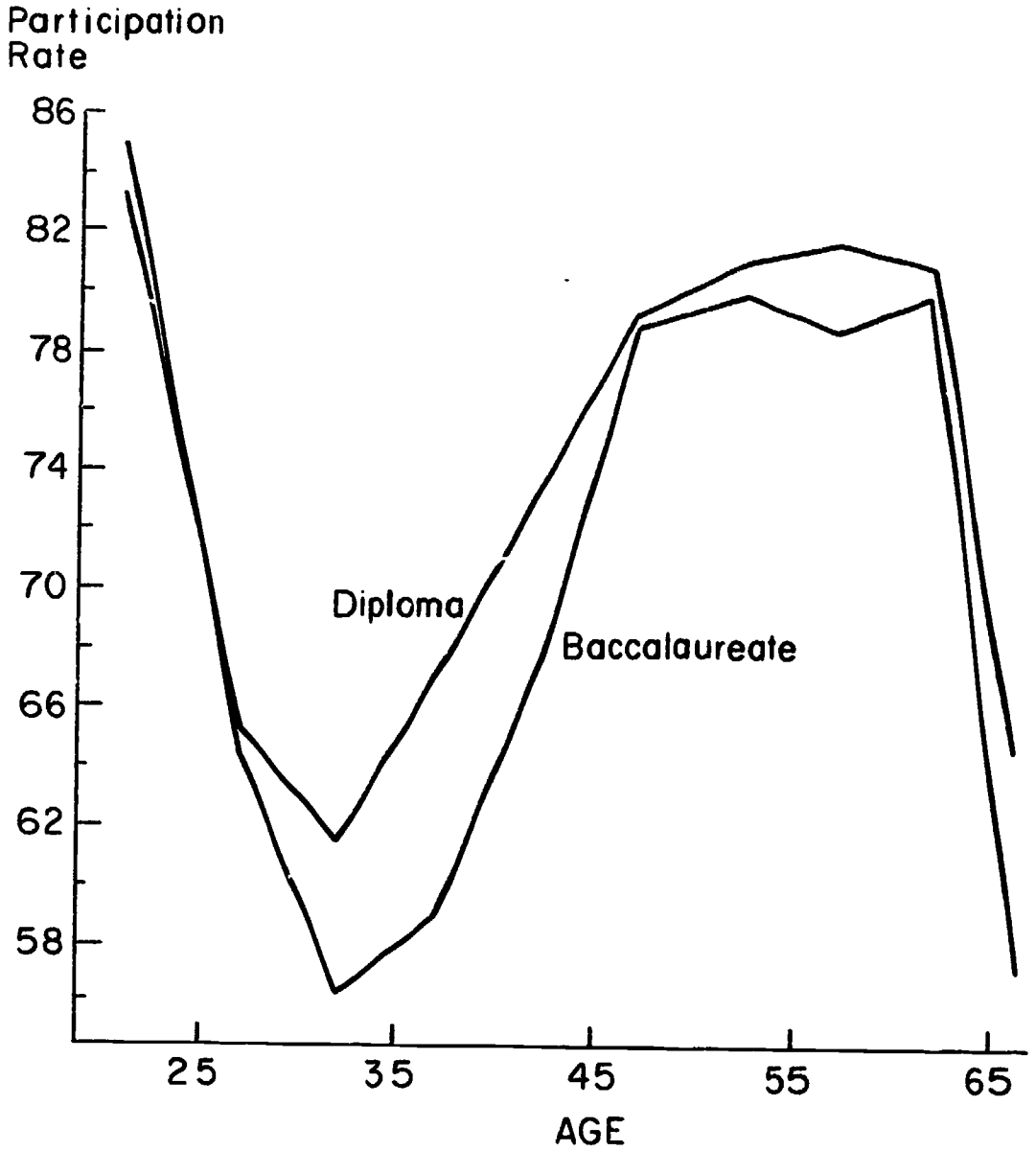
Activity Rates of Diploma and Baccalaureate Trained Nurses

So far the comparison has been between the work habits of all nurses and those of other female occupational groups. Another important comparison is that between graduates from different nurse training programs. Although it is still early to make definitive statements about variations in labor force participation rates by type of training program, preliminary information is available to compare the proportion of licensed baccalaureate and diploma nurses participating in the labor force by age (table 34). These proportions are not the same as the Census participation rates previously discussed. The rates calculated by training program include only those nurses who maintain their affiliation with professional nursing by continuing to be licensed. To distinguish between the participation rates for licensed nurses and for all nurses, we refer to the proportion of licensed professional nurses actively participating as nurses as "Labor Force Activity Rates" and maintain the term "Labor Force Participation Rate" for the participation of all potential nurses.

Except for nurses under age 25, diploma graduates consistently have a higher labor force activity rate than baccalaureate graduates. The drop in activity between ages 25 and 44 for baccalaureate graduates is particularly noticeable. Other than this, however, the difference in activity rates at each age between the two groups is small. At least for the present, therefore, the use of a single age-specific participation rate for both groups does not seem unreasonable.

There is the possibility that differences between the diploma *participation rate* and the *baccalaureate participation* rate may be greater than that reported here for activity rates. Any diploma or baccalaureate graduate who left nursing completely would cease to maintain her registration and therefore would not be counted as an inactive licensed nurse. Since the baccalaureate degree offers its holders greater flexibility in the selection of an occupation (discussed in chapter III), it is more likely that a larger

Chart 6.—Labor force activity rates by age and education, 1962



SOURCE: American Nurses' Association, *The Nation's Nurses: Inventory of Professional Registered Nurses*, New York, the Association, 1965, p. 37.

percentage of baccalaureate graduates would leave nursing. Hence, the size of the denominator in the baccalaureate activity rate would be smaller than that for the overall participation rate, resulting in a larger labor force activity rate.

Factors Affecting Labor Force Participation

The theory of labor force participation as formulated by economists draws a three-way distinction between the allocation of an individual's

time: (1) labor market activity, (2) work in the home, and (3) leisure time.[6] The impact of home work on labor market activity is particularly important for secondary family earners (married nurses) and is discussed in detail in appendix V-A. Based upon this formulation, a number of studies have been undertaken to investigate the labor force behavior of the professional nurse (*3, 4, appendix V-A*). The principal findings of these studies are that a nurse is more likely to be working if she is single or married without young children and lives in an area paying higher than average wages; conversely, she is less likely to enter the labor force if her husband is earning a high salary and if she has a child under age 6.

Personal Characteristics

Of the 879,000 registered nurses in 1966 (who maintained their license), 149,000 were single, 624,000 were married and living with their husbands, and 85,000 were widowed, divorced or separated (see table 35). Information on marital status for the remaining 21,000 was not known. While the proportion of single nurses working reached almost 90 percent, the rate for married nurses was about 60 percent.

The greater proportion working among single nurses can be attributed to three major factors: (1) they are somewhat younger; (2) they are less likely to have an alternative means of support (no husband's income); and (3) they do not have young children to care for.

The age-participation rate profile shown in chart 4 clearly indicates the extent to which the existence of young children in a family has a negative influence on the labor force participation of the married nurse. One important reason for this is that with young children in the family the value placed on the nonmarket work of the wife is substantially higher and, as explained in appendix V-A, this results in a reduction of

Table 35.—Marital status of active and inactive registered nurses, 1966

Marital status	Total		Active		Inactive	
	Number	Percent[1]	Number	Percent[1]	Number	Percent[1]
Total	879,485	100.0	593,694	67.5	285,791	32.5
Single	149,293	100.0	133,125	89.2	16,168	10.8
Married	624,279	100.0	377,117	60.4	247,162	39.6
Widowed, divorced, separated	84,973	100.0	68,413	80.5	16,560	19.5
Unknown	20,940	100.0	15,039	71.8	5,901	28.2

[1] Percent distribution of the proportion of each marital status group in each activity classification.

SOURCE: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Health Manpower Source Book, Section 2, Nursing Personnel*, Washington, D.C., 1969, p. 22.

both market work and leisure. The results of studies by Lee Benham[3] and Mario Bognanno[4] tend to confirm this negative relationship. Bognanno observed that after accounting for other important factors, the married nurse with a child under 6 worked about 8 hours per week less than a married nurse without a young child.[4] Bognanno's results also suggest a further dropoff in work time as the number of young children in the family increases.

While the age-participation profile is heavily influenced by the child-bearing cycle of married nurses, all the life-cycle effects are not due to changes in the market behavior of married nurses. Mario Bognanno's results indicate that a single nurse increases her labor market activity through age 41 and thereafter there is a tendency to reduce full-time work as she becomes older.[4]

Economic Factors

In discussing the importance of economic factors on labor market activity, two principal effects have been found by economists to be important—the income effect and the substitution effect. The income effect implies that by increasing an individual's wage and thereby her income, more of all goods that give pleasure will be demanded.[6] Since leisure is usually assumed to be one of those goods providing positive pleasure, as wages increase more leisure is demanded. Therefore, less market and nonmarket work are offered. Hence, the income effect suggests that as the wage rate increases less time is offered by the individual to the market. The substitution effect, on the other hand, suggests that as the wage rate increases, the cost of not working rises (leisure becomes more expensive) and individuals will substitute market bought goods for leisure. Hence, as the wage rate increases, more time will be devoted to market work. Any study wishing to estimate the impact of an increase in the wage on labor force participation must determine which force dominates and by what magnitude.

In a study by Lee Benham,[3] and in a study conducted as part of this report (described in appendix V-A), the results suggest that more nurses do work when wages are higher (holding other important factors constant). Using similar aggregative State data but different models, both studies estimate that the labor force participation rate in a given State would increase by between 5 and 6 percent for an increase in the nursing wage rate of 10 percent; i.e., a nursing supply elasticity of 5 to 6 percent. These studies therefore suggest that the positive power of the substitution effect more than outweighs the negative influence of the income effect. On the opposite side, as the income (wage rate) of a nurse's husband increases, the studies indicate that less work will be offered by the nurse.[6] The value of the nurse supply elasticity with respect to the husband's income is also in the 5 to 6 percent range for a 10 percent change in the husband's earnings (*4, appendix V-A*).

The existence of a significant positive relationship between labor force participation and wages is by no means shared by all researchers who have analyzed nursing supply. Mario Bognanno, in his study of the labor market behavior of Iowa registered nurses, reported no significant relationship between the labor market participation of a nurse and her wage rate.[4] For the single nurse, in fact, Bognanno estimated a negative supply elasticity; i.e., less market work as the wage rate rises; with the elasticity for married nurses being positive but very small—.02.[4] As Bognanno stated, "this implies that married nurses having more substitutes for their time than single nurses, therefore are more responsive than single nurses to wage changes."[4]

The lack of a clear consensus about the impact of wage rates on labor force participation is by no means unique to the nursing labor market. But as suggested by Mincer and others, we must draw a distinction between the short-run response of individuals to wage changes and a more long-term response.[5,6] The short-run elasticity as measured by Bognanno implies that very little immediate response can be expected on the part of previously trained nurses to a change in the nurse wage rate. In the longer run, as individuals adjust their behavior to a different economic environment, a more positive labor market response to higher wages is likely. It is this longer-run response which is measured by the Benham study and by the results of the model estimated in appendix V-A.

State Variations in Labor Supply

Thus far we discussed why the proportion of potential nurses working can vary from State to State. But the supply of practicing nurses in a State or community is also related to the total number of nurses residing in that community. As can be seen in table 36, the number of nurses reported to be living in each State in 1966 closely parallels the population size of the State. California and New York, which rank 1 and 2 in the country in terms of population and account for 20 percent of the country's population, also account for 22 percent of all registered nurses. At the other end of the scale, low population States like Alaska and Wyoming have the smallest number of registered nurses. Clearly, the population size of a community strongly influences the number of available RN's.

But population alone cannot account for all State variations. This can be seen in column 6 of table 36, which shows the variation in the number of nurses per 100,000 population in each State. Whereas Massachusetts, for example is number 10 in population, it is number five in the supply of nurses and its nurse-to-population ratio is correspondingly the highest in the country. After a series of preliminary estimates, Benham concentrated on three important variables to explain per capita differences in the number of nurses in each State.[5] These are (1) wages paid to RN's; (2) median income of male heads of families; and (3) per capita number of nursing school graduates from the State 10 years previous. All

Table 36.—Supply of professional nurses and population by State, 1968

State	Nurses[1]		Population		Nurses per 100,000 population
	Number	Rank	Number (000's)	Rank	
Top five					
1. New York	110,495	1	18,205	2	607
2. California	93,649	2	18,802	1	498
3. Pennsylvania	75,353	3	11,601	3	650
4. Illinois	54,777	4	10,786	4	508
5. Massachusetts	45,731	5	5,403	10	846
Lowest five					
46. South Dakota	2,907	46	679	43	428
47. North Dakota	2,889	47	643	45	449
48. Vermont	2,813	48	411	48	684
49. Wyoming	1,621	49	319	49	508
50. Alaska	873	50	265	50	329

[1] Total active plus inactive living registered nurses in each State.

SOURCES: Total nurses: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Health Manpower Source Book, Section 2, Nursing Personnel*, Washington, D.C., 1969, table 5a, p. 13.

Population: U.S. Department of Commerce, Bureau of the Census, *Statistical Abstract of the U.S., 1968*, Washington, D.C., table 11, p. 12.

of these variables were shown to be positively related to the per capita number of RN's in the State, although the relationship between available stock and graduates from the State was surprisingly small. The positive relationship of the nursing wage and the male head of household income variables suggests that registered nurses do concentrate in States where their wages are higher and where there is a potential for their husbands or future husbands to earn a high income.

An important justification often given for a State supported nursing school is that the existence of the program provides the State with the valuable services of new nursing personnel. Of course, implicit in such a justification is that many, if not all, the graduates of the program will remain in the State. Benham's results, while corporating this, indicate that for every 100 graduates from a nurse training program in 1940 in a State, the stock of nurses in 1950 in that State was higher by about 40 and the number of working nurses was larger by about 20.[3] In 1960 the positive relationship was even weaker, with the total supply higher by fewer than 10 for every 100 graduates of that State 10 years previous. If correct, this analysis indicates that the geographical distribution of registered nurses is much more responsive to shifting patterns of demand and wages paid than to the location of nursing schools. Much caution, however, should be taken in interpreting these results, as the data are quite poor. What is really needed is a longitudinal study of the education, work history, and changing place of residence of several classes of nursing school graduates. While such a study is now in progress by the NLN (see chapter III), it will be some time before the groups surveyed have had sufficient time to build up a work history after graduation.

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APPENDIX V-A

DERIVATION OF A NURSING LABOR SUPPLY FUNCTION

In recent years there has been a proliferation of labor force data and a growing interest in measuring the responsiveness of the labor force to changes in wage rates. This interest has been focused primarily on measuring labor supply functions for certain segments of the labor force; e.g., married women, teenagers, and older workers. While there is little doubt that these studies have greatly added to our knowledge of the labor market, there is also the nagging feeling that too much reliance has been placed on purely statistical results and on very fragile measures of statistical significance. Here we offer an approach that rests much more heavily on a theoretical model of individual behavior, using *a priori* conjectures of the values of underlying behavioral parameters in addition to statistical results to construct estimates of labor supply and wage elasticity. For example, by employing plausible ranges of values for such factors as a wife's relative valuation of leisure, market goods, home goods, and her husband's leisure, we are able to construct a labor supply function for nurses, where the wage elasticity is restricted to a rather narrow range. The statistically estimated elasticity is marginally below this range.

Since almost all nurses are women, a major portion of whom are married, we first concentrate on deriving a theoretical model to explain labor force behavior of women in general, and married women in particular. In section 2, of this appendix, the actions of individual women are combined into an aggregate labor supply function. In section 3 the supply function is placed in the form of a standard regression equation, but rather than estimate the equation from labor supply data, we utilize information on plausible ranges of the underlying behavioral parameters to construct *a priori* estimates for the regression coefficients. These *a priori* estimates are then utilized directly in deriving a labor supply function. In section 4 the model is statistically estimated using cross-State data from the 1960 census and a 1962 survey of nursing personnel.

1. Theoretical Model of Family Labor Supply[1]

General Form

In the basic model we consider a family which has two potential income-earners; a "husband" and a "wife." While the husband is assumed to allocate his time between two activities: market work ($T_{h,m}$) and leisure ($T_{h,l}$), the wife has a choice among three activities: market work ($T_{w,m}$); "nonmarket" or home work ($T_{w,n}$); and leisure ($T_{w,l}$). We further assume that there are three kinds of "goods:" (1) a first type of market good (Q_1), whose consumption provides direct utility to the family; (2) a second type of market good (Q_2) which is used as an input for the production of domestic (nonmarket) goods, but which provides no direct utility;[2] and (3) domestic goods (Q_d), which provide direct utility in a similar manner as Q_1-type market goods. The inputs to the production of domestic goods are the nonmarket work of the wife and the quantity of Q_2-type market goods. In the form of a production function:

$$Q_d = F(T_{w,n}; Q_2) \tag{5A-1}$$

where, the function is assumed to satisfy the derivative conditions:

$$F_1, F_2 > 0; \qquad F_{11}, F_{22} < 0; \qquad F_{12} > 0.$$

The first four conditions indicate that both factors have diminishing positive marginal products. The fifth condition signifies that an increase in the quantity of the market input (Q_2) raises the marginal product of wife's labor and vice versa.

As we have indicated, the family's utility depends on its consumption of market and domestic goods, and on the portions of time allocated to leisure.[3] In the form of a utility function:

$$U = U(Q_1; Q_d; T_{w,l}; T_{h,l}) \tag{5A-2}$$

where, the marginal utility of each "good" is positive ($U_1, U_2, U_3, U_4 > 0$).

The basic family optimization problem is to allocate the time of the husband and wife among the available activities and to determine relative purchases of Q_1 and Q_2 so as to maximize family utility. The maximization is subject to the constraints on total time available, to the domestic production function, to a market budget constraint on purchases of Q_1

[1] A theoretical procedure similar to the one adopted in this study was used by Mario Bognanno[6] in his study of hours worked by registered nurses in Iowa.

[2] Q_2 comprises (at least) two types of goods. First, there are tool-type goods (such as, vacuum cleaners and sewing machines) that generally provide no direct utility and fit readily into a production function concept. Secondly, if Q_d is to encompass a class of goods and services that are homogeneous from a utility standpoint, it should also include such market-provided services as laundering and eating-out which are direct substitutes for domestic products. Formally, the model includes this second type of good in Q_2, and assumes that no utility is provided until the transformation of Q_2 into Q_d [through F in equation (5A-1)] occurs.

[3] The wife's time allocation between market and nonmarket work is assumed to have no direct effect on utility.

and Q_2, and to the constraint that all time allocations and goods quantities be nonnegative. Formally:

Maximize: $U(Q_1; Q_d; T_{w,l}; T_{h,l})$

(5A-3)

Subject to:
$$T_{w,m}+T_{w,n}+T_{w,l}\equiv 1$$
$$T_{h,m}+T_{h,l}\equiv 1$$
$$Q_d=F(T_{w,n}; Q_2)$$
$$P(Q_1+Q_2)=Y+W_hT_{h,m}+W_wT_{w,m}$$
$$(\text{all } T\text{'s and } Q\text{'s}\geq 0)$$

where, P is the money price of market goods (assumed to be equal for units of Q_1 and Q_2), W_h is the husband's market wage (dollars per day), W_w is the wife's market wage, and Y is nonwage income (dollars per day), which is assumed to be independent of the time-allocation decision.

If the husband and wife both work in the market, the first-order optimization conditions can be reduced to the following system of equations:

(5A-4)
$$F_1=\frac{W_w}{P}F_2$$
$$U_1=F_2U_2$$
$$\frac{W_w}{P}=U_3/U_1$$
$$\frac{W_h}{P}=U_4/U_1$$
$$Q_d=F(T_{w,n}; Q_2)$$
$$P(Q_1+Q_2)=Y+W_h\cdot T_{h,m}+W_w\cdot T_{w,m}.$$

The first marginal condition implies that an additional hour of the wife's work has the same impact on home production whether she works directly in the home, or works in the market and uses the wage payment to purchase Q_2 as an input to home production. The second condition equates the direct marginal utility of market goods (Q_1) to the indirect utility obtained by using Q_2 as an input to Q_d production. The third condition equates the wife's real wage to the utility rate of substitution between market goods and wife's leisure. Similarly, the fourth condition equates the husband's real wage to the utility rate of substitution between market goods and his leisure. The final two conditions are the domestic production function and the market budget constraint.

The specific properties of the solution depend on the forms of U and F, and a simple special case will be discussed in the next section. The

general time allocation decision may be analyzed without reference to the particular forms of these functions, if it is assumed that all goods which enter the utility function are "normal;" i.e., an increase in nonwage income (Y) increases consumption of each good. In this case, an increase in Y leads, in a straightforward fashion, to an increase in husband's leisure and a decrease in his market work. The wife's response is more complicated, because part of her work time is devoted to production of nonmarket goods, whose consumption also tends to be positively related to Y.[4] Since we have assumed that the consumption of Q_d increases with higher levels of income and that no change in the relative prices of $T_{w,n}$ and Q_2 has occurred, both of these inputs to home production increase with Y. Therefore, if all goods are normal and if the wife works in the market, a rise in nonwage income induces the wife to reduce time spent in market work and to balance this reduction partly by an increase in leisure and partly by an increase in nonmarket work. The rise in nonmarket work derives from the higher family demand for domestic goods, which is served partly by an increase in market-goods input and partly by a rise in the wife's labor input.[5]

For those wives not working in the labor force, the model indicates an inverse relationship between income and nonmarket work. Since there is a positive association between nonwage income and domestic goods consumption, a rise in nonwage income will in this case induce a greater increase in the market goods input to home production.

Explicit Form of the Model

While the above results are interesting, the major purpose of this study is to measure the explicit trade-offs between various uses of the husband's and wife's time at different levels of family income and market wages. Hence, it is necessary to specify more precisely the forms of U and F. Without much prior information about the forms of these functions, we have made the rather arbitrary simplifying assumption that both are of the familiar *Cobb-Douglas* type. Accordingly:

$$U = Q_1^{\alpha} Q_d^{\beta} (T_{w,l})^{\gamma} (T_{h,l})^{\delta} \tag{5A-5}$$

$$Q_d = A (T_{w,n})^{\Phi} Q_2^{\psi} \tag{5A-6}$$

---

[4] The impact of this can most clearly be seen by differentiating the first marginal condition of equation (5A-4) and rearranging terms:

$$\frac{dT_{w,n}}{dY}\left[\frac{W_w}{P} F_{12} - F_{11}\right] = \frac{dQ_2}{dY}\left[F_{12} - \frac{W_w}{P} F_{22}\right]$$

From the assumed signs of the second partials of F, it follows that $T_{w,n}$ and Q_2 respond in the same direction to changes in Y.

[5] Other analysts seem to argue the opposite. Mincer[8,p.87] states that, "even with relative prices fixed and a positive income elasticity for domestic products it may be that market work will decrease by less than the increase in leisure, with part of the extra leisure coming at the expense of reduced nonmarket work." In our model nonmarket work increases (*cet. par.*) with income and market work decreases by more than the increase in leisure.

where, all exponents are positive and we prescribe the normalization $\alpha+\beta+\gamma+\delta\equiv 1$.

Using the above representations for U and F, the first-order conditions [eq. (5A–4)] can be solved explicitly. Defining:

$$Y^* = Y + W_h + W_w = \text{total potential income}^6.$$

and:

$$1-\epsilon = \alpha+\beta(\Phi+\psi)+\gamma+\delta.$$

If home production is subject to constant returns-to-scale, $\Phi+\psi=1$ and $\epsilon=0$. ϵ will be greater than or less than zero depending on whether decreasing or increasing returns to scale apply. Using these definitions we obtain:[7]

(5A–7) (a) $$Q_1 = \frac{\alpha}{1-\epsilon}\left(\frac{Y^*}{F}\right)$$

(b) $$Q_2 = \frac{\beta\psi}{1-\epsilon}\left(\frac{Y^*}{P}\right)$$

(c) $$Q_d = A\left(\frac{\beta}{1-\epsilon}\right)^{\Phi+\psi}[\Phi^{\Phi}\psi^{\psi}]\left(\frac{P}{W_w}\right)^{\Phi}\left(\frac{Y^*}{P}\right)^{\Phi+\psi}$$

(d) $$T_{w,l} = \frac{\gamma}{1-\epsilon}\left(\frac{P}{W_w}\right)\left(\frac{Y^*}{P}\right)$$

(e) $$T_{h,l} = \frac{\delta}{1-\epsilon}\left(\frac{P}{W_h}\right)\left(\frac{Y^*}{P}\right)$$

(f) $$T_{w,n} = \frac{\beta\Phi}{1-\epsilon}\left(\frac{P}{W_w}\right)\left(\frac{Y^*}{P}\right)$$

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[6] This term corresponds to total potential income since each component of Y^* is defined in terms of dollars per amount of time; e.g., per day. Y is income received per day independent of market activity. W_h and W_w are the amounts of income that would be received if the husband and wife each worked 100 percent of their time in the market. Actual income $[Y+W_hT_h+W_wT_w]$ is less than total potential income by the amount of time spent by each spouse on leisure and nonmarket activities. The formulation has the advantage of clearly establishing the opportunity cost of each activity.

[7] Given the properties of U and F, demands for market goods and leisure are unit elastic in total real potential income. The income-elasticity of domestic goods in terms of physical units depends on the degree of homogeneity $(\Phi+\psi)$ of the domestic production function. If $\Phi+\psi<1$ (as seems likely) domestic goods have an elasticity below one. However, the income fraction spent on Q_d depends also on the price ratio of domestic and market goods: P_{Q_d}/P. The (equilibrium) price of Q_d is given by:

$$P_{Q_d} = \frac{W_w}{F_1} = \frac{P}{F_2}$$

Using equations (5A-6) and (5A-7f), we obtain:

$$Q_d\left(\frac{P_{Q_d}}{P}\right) = \frac{\beta}{1-\epsilon}\left(\frac{Y^*}{P}\right)$$

Therefore, if $\Phi+\psi<1$, the increasing relative price of domestic goods just balances the relative decline in physical units, and the fraction of income spent on Q_d remains constant.

$$\text{(g)} \qquad T_{w,m} = 1 - \frac{\beta\Phi+\gamma}{1-\epsilon}\left(\frac{P}{W_w}\right)\left(\frac{Y^*}{P}\right)$$

$$\text{(h)} \qquad T_{h,m} = 1 - \frac{\delta}{1-\epsilon}\left(\frac{P}{W_h}\right)\left(\frac{Y^*}{P}\right)$$

As can be seen from equation (5A–7), an increase in the husband's wage increases his supply of labor to the market at the expense of his leisure (backward-bending supply curves are ruled out by the form of the utility function). Further, since his wage contributes to total potential income, a rise in W_h increases the family's demand for both market goods and domestic goods, and reduces his wife's market work. The reduction in the wife's market work is balanced partly by an increase in her leisure, and partly by a rise in her nonmarket work (in order to assist in the production of the larger quantity of Q_d).

For the wife, a rise in her wage increases her market work at the expense of both leisure and nonmarket work. The existence of the nonmarket work category provides a basic distinction between wives and husbands in terms of their respective labor supply functions, in particular with respect to their relative responsiveness to changes in market wages. Differentiating the respective labor supplies [equations (5A–7g) and (5A–7h)] with respect to own-wages, we obtain:

(5A–8)

$$\text{(a)} \qquad \frac{\partial T_{w,m}}{\partial W_w} = \left(\frac{\beta\Phi+\gamma}{1-\epsilon}\right)\left(\frac{Y+W_h}{W_w^2}\right)$$

$$\text{(b)} \qquad \frac{\partial T_{h,m}}{\partial W_h} = \left(\frac{\delta}{1-\epsilon}\right)\left(\frac{Y+W_w}{W_h^2}\right)$$

If husband and wife have the same taste for leisure ($\gamma=\delta$) the wife's response to changes in the market wage will be larger than the husband's on two counts. First, if, as is likely, $W_w<W_h$, then the second term in equation (5A–8a) will be larger than the comparable term in equation (5A–8b). Second, and most important, because the wife's market work can be raised at the expense of nonmarket work, as well as of leisure, her response will be larger than the husband's.[8] In equation (5A–8a) the wife's reaction coefficient $[(\beta\Phi+\gamma)/1-\epsilon]$ contains the extra term $\beta\Phi$ (the product of family taste for domestic goods and the wife's productivity in the home) because nonmarket work is an additional source of the wife's time.

Finally, the model suggests that since a rise in the wife's wage increases Y^* it will also increase the husband's demand for leisure and lead to a reduction in his labor supply.

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[8] This conclusion is similar to saying that the more substitutes available for one's time, the more likely one is to move into or out of an activity with a change in its relative price. This result is similar to that obtained by Mincer[6] and Cain[7] in their earlier work on the labor force participation of married women.

2. Construction of an Aggregate Labor Supply Function for Women

The usual procedure in estimating labor supply functions is to jump from the theoretical model explaining individual behavior directly to the estimating equation for the market. This procedure is unsatisfactory for two reasons. First, it excludes the many problems of aggregation. Second, it does not permit the specification of the model in a manner that confines the range of acceptable statistical results (other than positive or negative regression coefficients). In this section a method is presented that permits us to derive an aggregative labor supply function from the model of individual behavior.

So as to avoid unduly complicating the remainder of the paper and since we are primarily interested in estimating a supply function for nurses (almost all of whom are women) the following analysis concentrates on the derivation of a labor supply function for women. We can analyze both married women (husband present) and unmarried women by including a positive value for husband's wage and husband's leisure for the former, and by setting these values equal to zero for the latter.[9]

If we define:

(5A–9) $Z = Y + W_h$ = "other income" [total potential income (Y^*) minus wife's wage (W_w)]

$$\theta = \left[\frac{1-\epsilon}{\beta\Phi+\gamma} - 1\right] = \frac{\alpha+\beta\psi+\delta}{\beta\Phi+\gamma} > 0$$

(Qualitatively, θ is positively related to taste and productivity factors which stimulate an increase in the wife's market work.[10])

Then for those families where the optimal time-allocation plan involves the provision of a positive amount of the wife's time to the market we have from equation (5A–7g):

(5A–10) $$T_{w,m} = \frac{\theta}{1+\theta} - \frac{1}{1+\theta}\left(\frac{Z}{W_w}\right).$$

In a relatively homogeneous sample of women it does not seem unreasonable to assume that no (or very limited) variation occurs in the market wage rate (W_w) or in the relevant combination of taste and productivity factors (θ). Hence, the sole source of labor supply differences

[9] These two groups are ultimately combined so as to predict average hours of work and the wage elasticity for all nurses.

[10] Using $1-\epsilon = \alpha+\beta(\Phi+\psi)+\gamma+\delta$, we have:

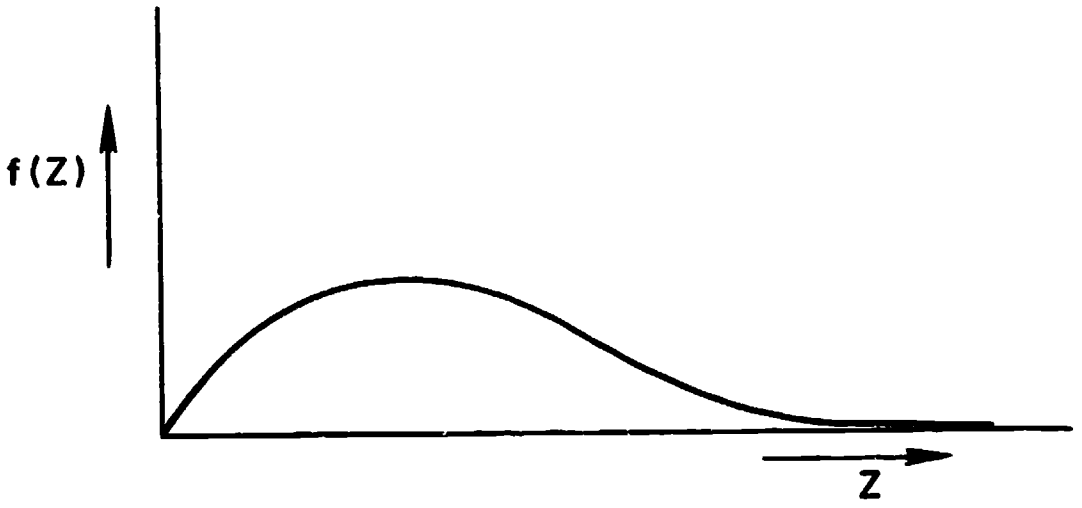
$$\theta = \frac{\alpha+\beta\psi+\delta}{\beta\Phi+\gamma} > 0;$$

where, $\alpha, \beta, \gamma, \delta$ are utility elasticities for market goods, home goods, wife's leisure and husband's leisure, respectively; and Φ and ψ are home production elasticities for labor and goods. Therefore, increased desire for market goods (α) or husband's leisure (δ) or a rise in the home-productivity of market goods (ψ) raises θ, while an increased valuation for wife's leisure (γ) or a rise in the wife's home productivity (Φ) reduces θ. The impact of an increased valuation of home goods (β) depends, in general, on the relative factor intensities in home production, but the expectation is that an increase in β reduces θ.

within the group results from variations in other income (Z). The average labor supply for the group is, therefore, determined by the distribution of other income. An important systematic influence on other income and on θ is marital status, since other income of unmarried women (primarily husband's earnings) will be concentrated near zero. Therefore, we initially analyze labor supply of married women and unmarried women separately.[11]

Viewing income distribution as a probability density, we expect: (1) the density is (approximately) zero for incomes equal to or less than zero; (2) the density increases with income until some peak density is attained; (3) the density decreases beyond some peak value, possibly becoming approximately exponentially-declining at high income levels. Graphically, the expected distribution is of the form:

Figure A4.—General form of income distribution



Two familiar distributions that reflect this general behavior are the log-normal and (higher order) gamma.[12] However, the cumulative log-normal distribution is not integrable in closed form, and the gamma distribution, while integrable, yields aggregate supply functions that are difficult to interpret. Therefore, we propose to approximate the income-distribution described in figure A4 by a quadratic distribution. Assuming that the distribution has zero origin, the quadratic density may be written solely in terms of average income ($\bar{Z}$) (see appendix V–A.1).

$$(5A\text{–}11) \qquad f(Z) = \frac{3}{2\bar{Z}}\left[(Z/\bar{Z}) - \tfrac{1}{2}(Z/\bar{Z}^2)\right]; \qquad (0 \leq Z \leq 2\bar{Z})$$

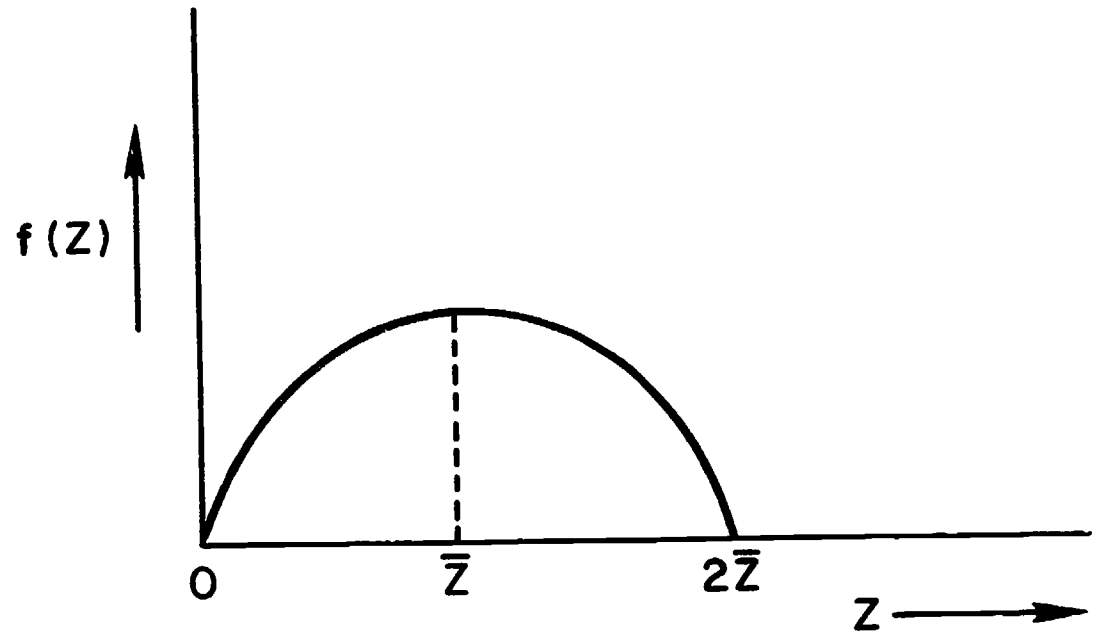
---

[11] This separation is likely to be guaranteed, in any case, by the assumption that the taste-productivity coefficient, θ, is equal for all members of the group.

[12] Becker[4] and others have observed that the overall distribution of income appears to have the shape of a log-normal distribution. In figure A4 a log-normal distribution would actually have an additional inflection point to the left of the peak.

Equation (5A–11) may be depicted graphically as:

Figure A5.—Quadratic income distribution



In comparison with the distribution of figure A4, the quadratic distribution involves mostly a loss of the tail (that is, the omission of the small probability of unusually high other income). Since the expected shape is retained over a considerable range, and since the resulting aggregation problem is manageable, the use of the quadratic distribution will be used as an operational description of income distribution.

Given an individual's other income position along the distribution depicted in figure A5, the amount of labor supplied to the market is determined (as a function of W_w and θ) from equation (5A–10). If other income is sufficiently high ($Z \geq \theta W_w$) the labor supply indicated in equation (5A–10) becomes negative, in which case the actual labor supply is zero. Since the maximum possible other income under the quadratic distribution is $2\bar{Z}$, there will be some women in this situation only if $2\bar{Z} \geq \theta W_w$. Using this inequality condition and equations (5A–10) and (5A–11), we can derive the average labor supply for a group of women as a function of W_w, θ and $\bar{Z}$. The details are described in appendix V–A.2. Since the above inequality condition ($2\bar{Z} \gtrless \theta W_w$) is involved, the aggregate labor supply function involves two segments, as indicated below.

Segment 1: $\left(\frac{W_w}{\bar{Z}}\right) \leq \left(\frac{2}{\theta}\right)$

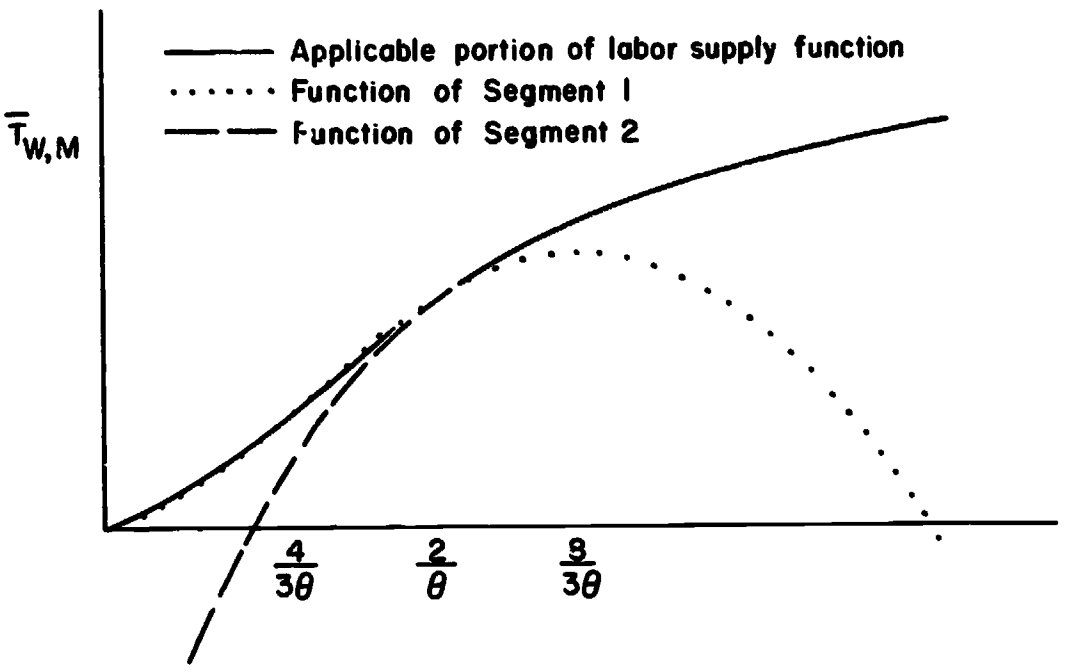
(5A–12) $$\bar{T}_{w,m} = \frac{1}{4}\frac{\theta^3}{1+\theta}\left[\left(\frac{W_w}{\bar{Z}}\right)^2 - \frac{\theta}{4}\left(\frac{W_w}{\bar{Z}}\right)^3\right];$$

Segment 2: $\left(\frac{W_w}{\bar{Z}}\right) \geq \left(\frac{2}{\theta}\right)$

(5A–13) $$\bar{T}_{w,m} = \frac{\theta}{1+\theta} - \frac{1}{1+\theta}\left(\frac{\bar{Z}}{W_w}\right).$$

A graphical description of the aggregate labor supply function is the following:

Figure A6.—Average labor supply function



As long as

$$\frac{W_w}{\bar{Z}} \leq \frac{2}{\theta},$$

increases in the wage income ratio will have two types of effects on average labor supply: (1) an increase in the percentage of women who enter the labor force; and (2) an increase in the time supplied by those already in the market. The combined impact of these two effects is reflected in the first segment of the aggregate function [equation (5A-12)]. In the very low wage region,

$$\frac{W_w}{\bar{Z}} < \frac{4}{3\theta},$$

women enter the labor force at a relatively high rate, so that average labor

supply responds at an increasing rate. If

$$\frac{W_w}{\bar{Z}} > \frac{4}{3\theta},$$

the relative flow of new entrants is reduced and most of the increased supply is due to the extra hours worked of those already in the labor market. In total, labor supply responds at a decreasing rate in this region. Finally, if $W_w/\bar{Z}$ exceeds $2/\theta$, all women have entered the labor market, and the only positive response to higher wages is extra hours worked of labor force participants. This behavior is described by the second segment of the aggregate function [equation (5A–13)].[13]

In terms of wage elasticities, we have:

$$\frac{\partial \log (T_{w,m})}{\partial \log (W_w)} = 2\left[1 - \frac{\theta W_w/\bar{Z}}{8[1-\frac{1}{4}\theta(W_w/\bar{Z})]}\right]; \quad \text{(Segment 1)}$$

(5A–14)

$$\frac{\partial \log (T_{w,m})}{\partial \log (W_w)} = \frac{1}{\theta(W_w/\bar{Z})-1}. \quad \text{(Segment 2)}$$

From equation (5A–14) it can be seen that the wage elasticity attains a peak value of 2 at $W_w=0$, and declines steadily as $W_w/\bar{Z}$ increases. The elasticity equals 1 at the junction point between the two segments ($W_w/\bar{Z}=2/\theta$), remains positive throughout and approaches zero as $W_w/\bar{Z}\to\infty$.

3. *A Priori* Estimation of a Labor Supply Function for Nurses

Given the rather poor quality of data that are often employed to estimate labor supply functions, we offer in this section a method of estimation that may seem rather arbitrary at first, but which we believe can be used to estimate supply functions and wage elasticities within rather narrow limits.

As indicated above, separation of nurses by marital status permits us to define two groups that are likely to have significantly different distributions of Z (and values of θ) and therefore different supply functions. A further subdivision among married nurses according to the presence or absence of young children is also useful, since families with young children are likely to have an increased desire for home goods relative to market

[13] If a log-normal or gamma distribution had been employed, the possibility of income far out in the tail of the distribution would rule out a situation where all women enter the market, so that no second segment would be involved. Since the quadratic distribution is only an approximation to this more complicated type of distribution, the first segment of the aggregate supply function [equation (5A-12)] is likely to be the interesting section of the curve.

goods. Therefore, we construct the tripartite division: single nurses (s), married nurses without young children (μ), married nurses with young children (c); and denote the taste-productivity coefficient for each division by θ_s, θ_μ, θ_c. Within each division, it is assumed that we are dealing with a homogeneous group of nurses, for which W_w can be taken as a single number. We assume further that other income of single nurses is approximately zero, and that average other income for the μ and c groups are equal.

The labor supply function for each subgroup can be derived by estimating equations (5A–11) and (5A–12). To do so requires information about the wage-income ratio (W_w/Z) and the combined taste-productivity factor (θ). While the wage-income ratio can easily be derived from existing data,[1] the combined taste-productivity factor requires knowledge about a number of factors that are difficult, if not impossible, to measure. We have, therefore, chosen a procedure for estimating θ based on deriving *a priori* conjectures of its component parts. As indicated in equation (5A–9), the combined taste-productivity factor is defined as:

$$\theta = \frac{\alpha+\beta\psi+\delta}{\beta\Phi+\gamma}$$

where, α, β, γ, δ are the respective utility elasticities for market goods, home goods, wife's leisure, and husband's leisure; and Φ, ψ are the respective home production elasticities for home work and Q_2 type market goods. For single nurses, $\delta=0$, and for married nurses we assume that wife's and husband's leisure are equally weighted: $\gamma=\delta$. Since the normalization, $\alpha+\beta+\gamma+\delta\equiv 1$ applies, θ may be viewed as dependent on: (1) the relative "valuation" of market goods to home goods ($\alpha/\beta=k_1$); (2) the relative valuation of leisure (wife's and husband's) to all goods

$$\frac{\gamma+\delta}{\alpha+\beta}=k_2;$$

and the two production elasticities (Φ, ψ).

For the three subgroups of nurses θ can be defined in terms of k_1 and k_2:

$$\theta_s = \frac{k_1+\psi}{k_2(1+k_1)+\Phi}$$

$$\theta_\mu=\theta_c=\frac{k_1+\psi+\frac{1}{2}k_2(1+k_1)}{\Phi+\frac{1}{2}k_2(1+k_1)}$$

Since hours worked is positively related to θ and the wage elasticity negatively related, we can bracket our estimates of these variables by establishing upper and lower limits of k_1 and k_2. High values for k_1 and low values for k_2 lead to high estimates of hours worked and low estimates of wage elasticities and vice versa.

Table A3.—Derivation of the relative value of market goods to home goods (k_1), and leisure to all goods (k_2)

Type of nurse	Utility elasticities					
	A priori estimates				α/β (k_1)	$(\gamma+\delta)/(\alpha+\beta)$ (k_2)
	α	β	γ	δ		
Single:						
High[1]	.50	.20	.30	.00	2.5	0.43
Low[1]	.35	.25	.40	.00	1.4	0.67
Married (no children):						
High	.40	.20	.20	.20	2.00	0.67
Low	.25	.25	.25	.25	1.00	1.00
Married (children):						
High	.40	.40	.10	.10	1.00	0.25
Low	.30	.40	.15	.15	0.75	0.43

[1] High and low are defined in terms of θ and $T_{w,m}$ (hours worked).

Table A4.—*A priori* conjectures of underlying parameters of nursing labor supply model

Type of nurse	k_1	k_2	Φ	ψ	θ^1
Single:					
High	2.5	0.43	0.25	0.50	1.71
Low	1.4	0.67	0.50	0.25	0.78
Married (no children):					
High	2.0	0.67	0.25	0.50	2.60
Low	1.0	1.00	0.50	0.25	1.29
Married (children):					
High	1.0	0.25	0.50	0.375	1.93
Low	0.75	0.43	0.75	0.20	1.18

$^1\theta_e = \dfrac{k_1+\psi}{k_2(1+k_1)+\Phi}$; $\quad \theta_\mu = \theta_c = \dfrac{k_1+\psi+\frac{1}{2}k_2(1+k_1)}{\Phi+\frac{1}{2}k_2(1+k_1)}$.

We assume that single nurses place a somewhat higher relative value on market produced goods to home produced goods than the other two groups. (Being single is in part a self-selected group.) We also assumed that while a single individual would place a higher relative value on leisure than each marriage partner, the combined relative value for leisure of the married couple would exceed that of the single individual. For the married couple with children, however, leisure would have to be substituted for market and home goods; i.e., k_2 would be relatively low.

Within these assumed constraints on k_1 and k_2, it was rather simple to derive a matrix of somewhat arbitrary values for the utility elasticities. As can be seen in table A3, k_1 ranges from 1.4 to 2.5 for single nurses; from 1.0 to 2.0 for nurses married without children; and from 0.75 to 1.0 for married nurses with children. k_2 has the highest range for married nurses without children, 0.67 to 1.0; next for single nurses, 0.43 to 0.67; and lowest for married nurses with children, 0.25 to 0.43.

In estimating the production elasticities, $\Phi+\psi$, we made the following assumptions: (1) that domestic production is subject to decreasing returns to scale ($\Phi+\psi<1$); (2) that single and married nurses without children have the same production elasticities; and (3) that married nurses with children are relatively physically more productive in the home.

On the basis of these assumptions our conjectured range of production elasticities for the three groups along with the derived estimates of θ are shown in table A4.

In addition to the above, derivation of hours worked ($T^{-\mu}_{w,m}$) and the wage elasticity (η_l) for married nurses requires information concerning ($W_w/\bar{Z}$). Using 1960 Census data we derived estimates of the level of average full-time earnings of nurses ($3,830), and average full-time earnings of the husband's of nurses (as an estimate of $\bar{Z}$) ($5,142).[1] [14] Hence:

$$\left(\frac{\bar{W}_w}{\bar{Z}}\right) \approx \frac{\$3,830}{\$5,142} = .745$$

Labor Supply Function

Hours Worked

Using our estimates of θ and $\bar{W}_w/\bar{Z}$ we derived a range of average hours worked for each of the subgroups (table A5). For single women ($\bar{Z}\approx 0$), we have from equation (5A–10):

$$T^{-\epsilon}_{w,m} \approx -\frac{\theta_\epsilon}{1+\theta_\epsilon}. \qquad \text{(5A–15)}$$

[14] There are reasons to expect that the census data used to estimate average full-time earnings of nurses is an underestimate of "true" full-time earnings.[1] To counter this, however, the use of husband's earnings as the sole source of other income is clearly an underestimate of $\bar{Z}$. While it is unlikely that these two measurement errors perfectly counter each other, the resulting error in the estimate of ($W_w/\bar{Z}$) is likely to be small.

For married women ($\bar{Z}>0$), with ($W_w/\bar{Z}<2/\theta$) equation (5A–12) applies and, therefore,

$$(5A\text{–}16) \qquad T_{w,m}^{-\mu} = T_{w,m}^{-c} = \frac{1}{4}\frac{\theta^3}{1+\theta}\left[\left(\frac{W_w}{\bar{Z}}\right)^2 - \frac{\theta}{4}\left(\frac{W_w}{\bar{Z}}\right)^3\right].$$

To obtain an aggregative estimated supply function for all nurses we obtained the fraction of single nurses (0.41); the fraction of married nurses without young children (.39); and the fraction of married nurses with young children (.20).[1]

Interpretation of Results

As expected, single nurses recorded the largest number of average hours worked, between 49 and 71 per week. Included in our estimate of hours worked is not only actual work time but also time devoted to preparation for work and travel. In total, we assume a "full-time" work week is 60 hours. In column 2 of table A5, average hours of work are shown as a fraction of full-time work. The mean value between the high and low estimates suggest that single nurses work approximately full-time, married nurses without children somewhat less than half time (.42),

Table A5.—Estimated average hours of work and labor supply elasticities

Type of nurse	Mean hours of work[1] (per week)	Percentage of full-time[2] work week	Wage elasticity of supply
Single:			
High	71	1.18	≈0
		> (1.00)	
Low	49	.82	≈0
Married (no children):			
High	39	.65	1.06
		> (0.42)	> (1.37)
Low	11	.18	1.68
Married (children):			
High	25	.41	1.43
		> (.28)	> (1.55)
Low	9	.15	1.71
Total:			
High	.49	.81	0.70
		> (.62)	> (.85)
Low	26	.43	1.00

[1] Derived from equations (5A-15) and (5A-16), appendix V-A, with the assumption that the maximum number of hours in a week which could be worked in 112 (7 days, 16 hours per day).
[2] Full time is assumed to be equal to 60 hours per week. (See text.)

and married nurses with children about one-quarter time (.28).[15] This implied work behavior could manifest itself in several ways with some nurses working full time, others part time and some not at all. In total, the model predicts that all nurses combined work more than half a full-time work week (.62). Considering that the estimated labor force participation rate; i.e., percentage of living professional nurses working, was estimated to be 55.4 percent in 1960.(1) An estimate of .62 does not seem out of line.[16]

Wage Elasticity

In estimating the wage elasticities given that segment 1 of the supply function applies, we used segment 1 of equation (5A–14). As can be seen in column 3 of table A5 the elasticity estimates are highest for married women with young children, between 1.43 and 1.71; next highest for married women with no young children, between 1.06 and 1.68; and assumed to be approximately zero for single nurses. Combining the groups suggest that the overall elasticity for nurses is slightly less than 1.0 (.85), with an estimated range between 0.70 and 1.00. Such an estimate accords well with those obtained using statistical data for other occupations.(3)

4. Statistical Estimate of a Nursing Labor Supply Function

Our statistical estimate of a nursing labor supply function relies primarily on data obtained from the 1962 Inventory of Professional Registered Nurses(2) and the 1960 Census of Population.(9) [17] The dependent variable (L^s) is an estimate of the average time worked of registered nurses in each State in 1962. Unlike the previous section, an aggregate supply equation is estimated for all nursing personnel. State differences in the proportion of single nurses, however, are incorporated into the supply function.[18]

An attempt also was made to include the influence of young children in the family on the market labor supply decisions of trained professional nurses. This variable, however, proved to be statistically insignificant and was excluded from the final estimating equation. This does not mean that the statistical results necessarily reject the hypothesis that nurses with young children have a relative preference (utility) for nonmarket goods as opposed to market goods, and therefore exhibit different labor

[15] A labor force participation rate of .90 was found by Bognanno(6) in his study of Iowa registered nurses.

[16] While it is true that many of the working nurses included in the 55 percent participation rate worked part time, an almost equal number worked in excess of full time (more than 40 hours on-the-job).

[17] This measure is said to include a number of student nurses who work less than full year.(1)

[18] In 1969 the labor force participation rate for 25 to 34-year-old widowed and divorced females was 63.5 percent compared to a rate of 36.9 percent for those who were married and living with their spouses, and 80.9 percent for those single.(10)

supply behavior than other groups of nurses. Rather the lack of statistical significance appears to be more the result or lack of State-by-State variation in the proxy used to estimate the proportion of nurses with young children (percent of married women, husband present with children under 6 years of age). Fortunately, in the case of the other variables, sufficient variability exists to adequately measure their importance.

For each State, W_{ni}* and X_{ni} were obtained from the 1960 Census along with the ratio of the earnings of part-year nurses to full-year nurses for the United States as a whole (R). Using this information, full-year equivalent nurse earnings were derived for each State and ranged from a low of $2,910 per year in Mississippi to a high of $4,656 per year in California.

Husbands' Earnings (Y_n)

Ideally, the data needed to estimate this variable as defined previously is total family income excluding the earnings of the nurse. In studies that rely on data obtained from individual families, it is sometimes possible to estimate such a detailed variable. For across-State studies, however, such detailed information is not obtainable. Nor is it possible to obtain information directly on the earnings of husbands of nurses. We therefore used as a proxy for nonwage family income, the full-time earnings of all husbands living with their spouses in each State. While this is clearly an inadequate family income measure, information for the United States as a whole suggests that the occupational distribution of the husbands of nurses does not differ significantly from the occupational distribution of all husbands, and it is hoped that State variations in the earnings of husbands of nurses will show up in State variations in the earnings of all husbands.

Combined Supply Equation

Equation (5A–17) is a total supply equation combining supply estimates for single nurses (α_1) and married nurses

$$[\alpha_2(W_n/Y_n)^2+\alpha_3(W_n/Y_n)^3].$$

To produce this overall estimate of nursing supply it is necessary to weigh each factor by the proportion of nurses falling in each category. Therefore the first term is multiplied by S and the second by M.

Combining equation (5A–15) (single nurses), and equation (5A–16) (married nurses), the form of the statistically estimated nurse labor supply function is the following:

$$L_i^s=\alpha_1 S_i+\alpha_2 M_i\left(\frac{W_{ni}}{Y_{ni}}\right)^2+\alpha_3 M_i\left(\frac{W_{ni}}{Y_{ni}}\right)^3$$

where

L^s = total "full-time equivalent" labor supply of registered nurses in the ith State;
S_i = proportion of single nurses in the ith State under age 65;
M_i = proportion of married nurses in the ith State under age 65;
W_{ni} = average full-time equivalent earnings of registered nurses in the ith State;
Y_{hi} = average full-time earnings of married males, wife present in the ith State (proxy for income of husbands of registered nurses).

Estimate of the Variables

Labor Supply of Registered Nurses (L^s)

To derive an estimate of the proportion of the potential work week of nurses in each State actually worked (L_i^s), it was necessary to adjust the reported number of working registered nurses in each State (A_{ni}), for the proportion working less than a full year ($.65\ (1-X_{ni})$), and the proportion of a potential full working week (112 hours) which is considered full time (60 hours). The dependent variable was therefore defined as:

$$(5A\text{-}18) \qquad L_i^s = \frac{60}{112}\left[\frac{A_{ni}\cdot X_{ni}+.65\,(1-X_{ni})A_{ni}}{N_i}\right]$$

where

L_i^s = "full-time equivalent" labor supply of registered nurses in the ith State or the proportion of the potential work week of nurses in State i which is actually worked.

Results

Using the variables described above for 49 States (excluding Alaska and Hawaii), the following single equation supply function was derived.[19]

$$(5A\text{-}19) \qquad \underset{(7.7)}{L^s = 0.575S+0.612M_i\left(\frac{W_{ni}}{Y_{hi}}\right)^2 - 0.398M_i\left(\frac{W_{ni}}{Y_{hi}}\right)^3}$$

$$R^2=0.37$$

$$\eta_w \text{ (at sample mean)} = .86 \text{ (married nurses)}$$

$$= .61 \text{ (all nurses)}$$

Figures in parentheses are t statistics.

[19] Preliminary equations were estimated using weighted variables to adjust for differences in the size of each State's population. In all cases the weighted results were similar to the unweighted results. In this section, therefore, the more easily understood unweighted results are presented.

The estimated coefficients of equation (5A–19) are all statistically significant and of the correct sign. The coefficient of .575 for S indicates that the average unmarried nurse works 64 hours per week (.575×112) or 4 hours more than a 60-hour, full-time work week (including preparation time). That is, a full-time equivalent participation rate of 1.07. The combined impact of the positive and higher value of α_2 and the negative value of α_3 leads to an estimated average hours worked for a married nurse of 15 hours (.136×112) or 25 percent of a full-time work week. These results also suggest a wage elasticity at the sample mean for married nurses of .86 and for all nurses of .61. That is, a 10 percent increase in a nurse's wage or a 10 percent decrease in the earnings of husbands in a State would lead to an 8.6 percent increase in full-time labor supply of married nurses. With married nurses accounting for 71 percent of the potential available supply, the increase in the full-time labor supply of all nurses would be 6.1 percent.

The value of 0.61 falls somewhat below the 0.7–1.0 elasticity range estimated using *a priori* conjectures and is slightly above the wage elasticity estimated by Lee Benham using similar data and a more comprehensive nursing labor market model.[4]

Supply-Demand Equations

There is a possibility that the single equation supply estimates are biased downward because of the failure to account for the interaction of supply and demand. We therefore attempted to adjust for this possible simultaneous equation bias by adding a demand for nursing services equation and estimating the supply equation using a two-stage least squares procedure. In the first stage of the procedure we estimated the following demand type equation to obtain a consistent estimate of W_n.

$$\begin{aligned}(5A\text{–}20)\quad \log (W_n^*) = {} & \underset{(-3.4)}{-1.73} + \underset{(1.5)}{.072} \log (\text{Pop}) + \underset{(4.9)}{.360} \log (y/P) \\ & - \underset{(-3.4)}{.208} \log (\text{Age}) - \underset{(-.025)}{.001} \log (\text{Doc}) + \underset{(2.2)}{.124} \log S \\ & - \underset{(-1.3)}{.045} \log (\text{RN}) - \underset{(-0.32)}{.010} \log (\text{PRAC}) \qquad R^2 = .70\end{aligned}$$

where

W_n^* = nurse wage adjusted for price index of the State;
Pop = State population;
y/P = State per capita real income;
Age = percent of State population less than 1 year old or over age 65;
Doc = number of practicing doctors in the State;
S = percent of unmarried nurses in the State;
RN = total potential availability of RN's (active plus inactive);
PRAC = supply of practical nurses.

The signs shown above each variable indicate the expected direction of the effect of that variable on nurses' earnings. Population, per capita income and high medical demand age groups should have a positive impact on the demand for nursing services and hence nurse wages. On the other hand, larger supply through either a greater proportion of single nurses (greater labor market participation) or more total supply of RN's or the greater availability of substitutes should work to reduce wages. Whether doctors are net complements (+) or substitutes (−) will determine its expected impact. The two estimated coefficients that are inconsistent with expected behavior are for Age and *S*. Both are statistically significant but have opposite signs to what was expected. The net impact of doctors was negative but statistically not different than zero. A number of attempts were made to determine why the results failed to match expected behavior but with no success.

Recognizing the limited value of the demand equation, we nevertheless used the estimated value for W_n to re-estimate equation (5A–19). The results are shown in equation (5A–21):

Two-Stage Supply Equation

$$(5A\text{–}21) \qquad L^s = \underset{(7.6)}{.578S} + \underset{(6.6)}{0.587M}\left(\frac{W_n}{Y_h}\right)^2 - 0.370M\left(\frac{W_n}{Y_h}\right)^3$$

$$R^2 = 0.35$$

$$\eta_w \text{ (at sample mean)} = .89 \text{ (married nurses)}$$

$$= .64 \text{ (all nurses)}$$

The two-stage supply equation estimates are quite similar to the single equation estimates and the wage elasticity at the sample mean is slightly higher for the two-stage equation. The change is therefore in the hypothesized direction, but it is still possible that the use of more refined data would lead to estimates similar to that derived using the *a priori* conjecture approach.[8]

Summary and Conclusion

Some may consider sections of the paper reactionary, in that an attempt is made to turn the clock back to a time when limited statistical data were available and analysts were compelled to make predictions solely on the basis of the theoretical implications of their model. No doubt there is some validity in such a criticism. Our purpose, however, in emphasizing the predictive implications of the labor supply model using as little statistical data as possible and relying more on a set of *a priori* estimates was to highlight the predictive power of what we hope is a well-designed theoretical model. Naturally, the value of the model depends on its ability to predict labor force behavior; to test its predictive powers we also subjected

the implications of the model to statistical testing. It is important, however, to realize that a predictive labor supply model can be designed and utilized that does not rely completely on statistical estimation.

To summarize briefly, a labor supply model was developed for women in the context of a joint family utility function. The model implies that while a husband and wife both tend to reduce their hours of market work with an increase in nonwage income, for the wife only part of the freed hours go for an increase in leisure time and part for the production of nonmarket goods.[20] Since her utility is increased on both counts, the wife's supply of market work will be more income elastic than her husband's. So too with changes in the market wage rate. Whereas the husband can only increase his market work through a reduction in leisure time, the wife can increase her market work from both her leisure time and nonmarket work; again resulting in a more elastic supply function.

By establishing a Cobb-Douglas type form for the utility and production functions and assuming a quadratic distribution of family income among an otherwise homogeneous sample of women, the resulting supply function is seen to be positively related to the ratio of wage income to other family income (nonwage income plus husband's earnings). When the wife's earnings are relatively low in comparison to other family income, a change in her wage elicits a relatively strong positive impact on her market supply. At high values of the wage-income ratio the impact is reduced. For married nurses the ratio in 1960 was moderately high (.745), leading to our *a priori* prediction of a supply elasticity somewhat below 1.0 and to our statistical prediction of 0.6.

To arrive at the *a priori* supply elasticity estimate it was necessary to make several conjectures concerning the values of the utility elasticities for market goods, home goods, husband's leisure and wife's leisure and for the production elasticities of the wife's home work and market goods used in the production of home goods. The estimated supply elasticity was found to be relatively insensitive to rather significant variations in these underlying parameters and more closely related to the level of the wage-income ratio. This was not true, however, in the estimate of average hours worked. Here the overall estimate could be predicted only within a rather wide margin. Nevertheless, using mid-range estimates the derived supply function suggests that, in total, nurses devote about 62 percent of a potential full-time work week to labor market activities. These predictions accord reasonably well with other estimates of labor force participation rates of nurses, and with wage elasticities for other occupations.

Using cross-sectional data from the 1960 Census and a 1962 survey of nursing personnel, the same labor supply model was estimated statistically (weighted and unweighted) and found to conform quite well to that derived using the *a priori* conjecture approach. The statistical results

[20] This conclusion would be modified or even reversed if the women's liberation movement is successful in changing the production function for home produced goods.

indicate a wage elasticity of supply at the sample mean of about 0.6, which is not significantly below the 0.7–1.0 hypothesized interval using the *a priori* conjecture approach. In total, nurses in 1962 were estimated to work .49 percent of a full-time work week. This statistical estimate of hours worked was also somewhat below the 62 percent using the *a priori* conjecture approach.

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APPENDIX V-A1: QUADRATIC DISTRIBUTION

The positive portion of a quadratic function with zero origin is:

$$f(Z) = aZ - bZ^2 \qquad (0 \leq Z \leq a/b) \qquad (5A\text{–}a1)$$

Since the function is to represent a probability density, it must integrate

to one over the applicable range:

$$\int_0^{a/b} f(Z)dZ = a^3/6b^2 = 1 \qquad \text{(5A-a2)}$$

The expected value of Z is:

$$\bar{Z} = \int_0^{a/b} Z \cdot f(Z)dZ = \frac{1}{2}\frac{a}{b} \qquad \text{(5A-a3)}$$

Equations (5A-a2) and (5A-a3) may be combined to yield:

$$a = \frac{3}{2\bar{Z}^2}\,; \qquad b = \frac{3}{4\bar{Z}^3} \qquad \text{(5A-a4)}$$

Using equation (5A-a4), equation (5A-a1) may be rewritten in the form of:

$$f(Z) = \frac{3}{2\bar{Z}}\left[\left(\frac{Z}{\bar{Z}}\right) - \frac{1}{2}\left(\frac{Z}{\bar{Z}}\right)^2\right] \qquad (0 \leq Z \leq 2\bar{Z}) \qquad \text{(5A-a5)}$$

APPENDIX V-A2: DERIVATION OF AVERAGE LABOR SUPPLY

If $2\bar{Z} \geq \theta W_w$, we have (from equations (5A-10) and (5A-11)):

$$\bar{T}_{wm} = \int_{Z=0}^{\theta W_w} T_{wm} \cdot f(Z)dZ$$

$$= \int_0^{\theta W_w} \left[\frac{\theta}{1+\theta} - \frac{1}{1+\theta}\frac{Z}{w_W}\right]\left[\frac{3}{2\bar{Z}}\left(\frac{Z}{\bar{Z}} - \frac{1}{2}\left(\frac{Z}{\bar{Z}}\right)^2\right)\right]dZ \qquad \text{(5A-a6)}$$

By straightforward integration and simplification we obtain the first segment of the labor supply function, equation (5A-12).

If $2\bar{Z} \leq \theta W_w$, the relevant upper limit on income is changed from θW_w to $2\bar{Z}$:

$$\bar{T}_{wm} = \int_{Z=0}^{2\bar{Z}} \left[\frac{\theta}{1+\theta} - \frac{1}{1+\theta}\frac{Z}{W_w}\right]\left[\frac{3}{2\bar{Z}}\left(\frac{Z}{\bar{Z}} - \frac{1}{2}\left(\frac{Z}{\bar{Z}}\right)^2\right)\right]dZ \qquad \text{(5A-a7)}$$

Integration yields the second segment in equation (5A-13). This analysis neglects the fact that a sufficiently high wife's wage will eventually cause the husband to stop working entirely ($T_{h,m}$ in equation (5A-7h) becomes negative for sufficiently large W_w).

The two segments coincide at the junction point ($2\bar{Z} = \theta W_w$) in terms of function values and first and second derivatives. However, the third derivative of the first segment is negative at the junction, while that of the second segment is positive.

CHAPTER VI

SUPPLY OF NURSES IN THE DECADE OF THE SEVENTIES

In this concluding chapter those factors found to influence nursing supply are incorporated into a projection of the supply of practicing nurses in the 1970's. The procedure used to arrive at these projections is outlined in figure 6. The estimates of admissions and graduates from nurse training programs are adopted to provide estimates of the future stock or potential supply of professional nurses. A range of possible future labor force participation rates are then applied to these stock estimates to derive the number of nurses expected to be in practice in 1975 and 1980. As a rough guide to the adequacy of these future supply estimates, they are compared to the expected growth of the U.S. population and the future "need" for nursing manpower.

Potential Supply of Future Nurses

The potential supply of nurses in the future in each age group can be derived from the formula outlined in equation (6–1) below. The number of graduate professional nurses of 1960 (G) and the cumulative survival rates applicable for each age group (S) are shown in table 37.

Figure 6.—Projections model of the supply of professional nurses

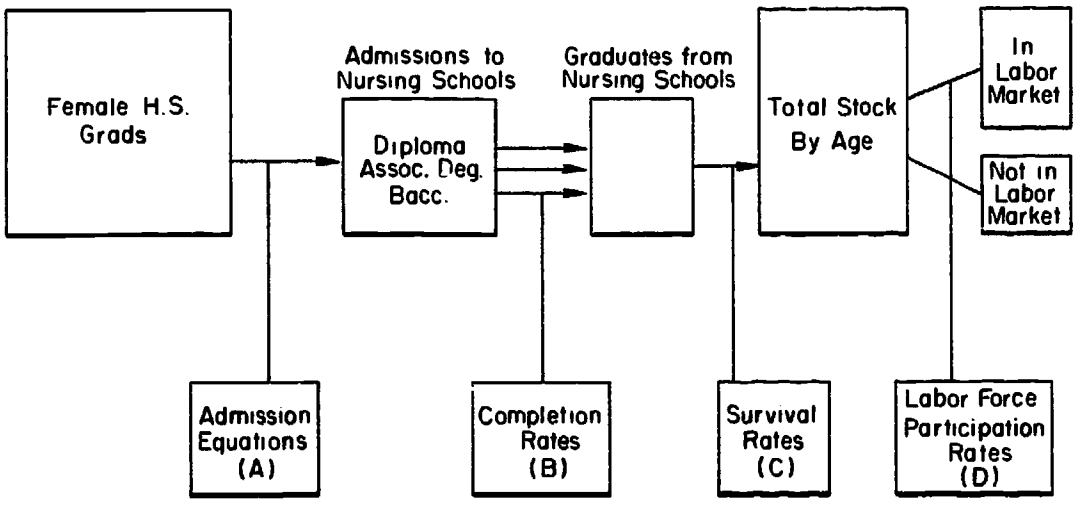

Table 37.—Estimated labor force participation rates of female professional nurses by age, 1960

Age group 1960	Active 1960 (1)	Year of graduation[1] (2)	Number of graduates (3)	Survival rates—1960[2] (4)	Living 1960 3×4 (5)	Percent active of living 1/5 (6)
Total	576,205	1907–60	1,148,519	.90660	1,041,252	55.3
20–24	87,379	1957–60	120,768	.99949	120,706	72.4
25–34	144,097	1947–56	296,803	.99397	295,013	48.8
35–44	138,460	1937–46	260,660	.97410	253,909	54.5
45–64	187,026	1917–36	379,020	.84143	318,919	56.6
65 and over	19,243	1907–16	91,268	.57748	52,705	36.5

[1] Assumes that nurses graduate at age 21. Based on expected average age at graduation of entering nursing students in 1962–63 as given in *Nurse-Career Pattern Study*, 1962–63, National League for Nursing, New York.

[2] Assumes that all professional nurses graduate from nursing school at age 21 and that within each age grouping the graduation year is the midpoint year between the earliest and latest year of graduation. For a detailed description of how the survival rates were calculated for each age grouping, see table 39 and appendix table A6.

SOURCES: Active nurses: U.S. Department of Commerce, Bureau of the Census, *U.S. Census of Population*, 1960, Washington, D.C., subject report on Characteristics of Professional Nurses.

Number of graduates: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Toward Quality in Nursing: Needs and Goals*, Washington, D.C., 1963.

Survival rates: *Statistical Bulletin*, Metropolitan Life Insurance Company, New York.

The estimate of 1,041,000 living nurses in 1960 is far in excess of the number classified by the American Nurses' Association as registered professional nurses. In their inventory of professional registered nurses for 1962—2 years after our estimate—the ANA reported a total of 848,000 active plus inactive professional nurses.[3] The inventory estimates include only those U.S. and foreign trained nurses who become registered to practice nursing in the United States and who maintain an up-to-date license. The figures in table 37 are for all previous graduates of basic nursing schools in the United States estimated to be living in 1960. Adjustments are made later in the chapter for those U.S. graduates who never become licensed, and the entry of foreign trained nurses who obtain a U.S. license.

$$S_{ti} = x \cdot [G_{t-(i-21)} \cdot s_{t-(i-21)}] + F_{t-(i-30)} s_{t-(i-30)} \tag{6-1}$$

where

S_{ti} = the stock of living professional nurses in year t; e.g., 1950; in age group i;
x = the proportion of graduates of U.S. schools of nursing licensed to be registered nurses;
$G_{t-(i-21)}$ = graduates of U.S. schools of professional nursing in year $(t-(i-21))$. Assumes age at graduation of 21;
$s_{t-(i-21)}$ = cumulative survival rate of all females between year $(t-(i-21))$ and year t, who were age 21 at $t-(i-21)$;
$F_{t(i-30)}$ = number of foreign trained professional nurses who entered U.S. labor force in year $t-(i-30)$. Assumes age at entry of 30;
$s_{t-(i-30)}$ = cumulative survival rate of all females between year $t-(i-30)$ and year t, who were age 30 at $t-(i-30)$.

The advantages of using the more inclusive base are that it permits an investigation of the work behavior of all potential professional nurses and allows the projected number of future nursing school graduates to be directly incorporated into future supply estimates. Although the stock figures derived from equation (6–1) are quite different from the ANA or Census counts of registered nurses, by using the same estimate for the stock projections as for the denominator of the LFPR, the resulting supply of active nurses is the same. That is,

$$\frac{A}{S} \times S = \frac{A}{R} \times R \tag{6-2}$$

where

A = number of active registered nurses;
S = stock of all living graduates of professional nursing schools;
R = ANA or Census estimates of registered nurses.

Table 38.—Actual and projected supply of practicing nurses trained in foreign countries

Year 1	Number foreign 2	Number U.S. graduates 3	Estimated rate[1] 4	*T*
Actual				
1950	661	25,790	1.717	1
1951	601	28,794	2.205	2
1952	845	29,016	2.693	3
1953	987	29,308	3.181	4
1954	1067	28,539	3.669	5
1955	1128	28,729	4.157	6
1956	1217	30,236	4.645	7
1957	1690	29,933	5.133	8
1958	1761	30,410	5.621	9
1959	1810	30,312	6.109	10
1960	1854	30,113	6.597	11
1961	1794	30,267	7.085	12
1962	2303	31,186	7.573	13
1963	2421	32,398	8.061	14
1964	2850	35,259	8.549	15
1965	2939	34,686	9.037	16
1966	3498	35,125	9.525	17
1967	4604	38,237	10.013	18
Projected[1]				
1968	4637	40,838	11.477	19
1969	4637	42,196	10.989	20
1970	4687	40,838	11.477	21
1971	5064	42,324	11.965	22
1972	5541	44,493	12.453	23
1973	5935	45,863	12.941	24
1974	6379	47,502	13.429	25
1975	6708	48,200	13.917	26
1976	7047	48,921	14.405	27
1977	7337	49,266	14.893	28
1978	7535	48,991	15.381	29
1979	7738	48,760	15.869	30
1980	7978	48,773	16.357	31

[1] The estimated rate is based on the following projection equation: estimated rate $=1.229+.488(T)$. The actual rate for 1950–67 can be calculated from columns 2 and 3.

SOURCES: Actual numbers: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Toward Quality in Nursing: Needs and Goals*, Washington, D.C., 1963 appendix table 12, p. 70; U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Health Manpower Source Book, Section 8: Nursing Personnel*, Washington, D.C., 1969, table 7, p. 16; and American Nurses' Association, *Facts About Nursing: A Statistical Summary*, New York, the Association, annual eds.

Foreign Trained Registered Nurses

The annual flow of licensed registered nurses trained in foreign countries (F_t) was quite small before 1960 (fewer than 2,000 a year). Recently, however, the number has grown quite rapidly, reaching 4,604 in 1967, or 12 percent of the total output of all U.S. schools.[12] The size of this annual foreign input is now of a magnitude that cannot be ignored in projecting future availability of nursing manpower in the United States. With only very limited information available on why these nurses enter the United States,[1] we simply anticipated that the upward trend in the ratio of foreign trained nurses to U.S. graduates (F_t^*) will continue, and the following linear trend equation was estimated from the period 1950–67.

$$F_t^* = 1.229 + \underset{(15.017)}{0.488(t)} \qquad R^2 = .925 \tag{6–3}$$

Equation (6–3) was projected through 1980, and the number of foreign trained nurses was estimated by multiplying the projected ratio by the expected number of U.S. graduates (see table 38). It is expected that foreign graduates licensed in the United States will reach a level of 16.3 percent of U.S. graduates by 1980.

The estimated number of professional nurses in 1970 and that projected for 1975 and 1980 is shown in table 39. Between 1960 (table 37) and 1970, the potentially available supply grew by 192,000 from 1,149,000 to 1,341,000, an increase of 16.7 percent. In the decade of the 1970's the growth will range between 340,000 and 367,000, a growth of between 25.4 and 27.4 percent. In the next section we will examine the extent to which this increase in potential supply is expected to be turned into increases in actual supply.

Future Labor Force Participation Rates

At the time of this writing, information is not yet available from the 1970 Census on the occupational composition of the labor force. It is therefore necessary to make a series of assumptions so as to estimate 1970 labor force participation rates. Starting with the knowledge that approximately 700,000 registered nurses are active participants in 1970 (ANA Inventory Definition),[3] and that in 1960 the Census count of active RN's was 14.1 percent higher than the estimated ANA figure, the base used for the 1970 LFPR estimate is 798,500; i.e., 700,000×114.1 (see table 39). If the age-specific participation rates had remained the same, the 1970 Census count would have been 731,000. Approximately 70 percent of the increase in the number of working nurses therefore can be

[1] By far the largest increase in the number of foreign trained nurses entering the United States is from the Philippines; many are wives of U.S. servicemen. This factor seems to have pushed the rate in the last 2 years above the long-term trend line.

Table 39.—Supply of professional nurses: estimated 1970; projected 1975, 1980 (in thousands)

Age	Yrs. of grad.	No. of grads.		Survival rate	Est. living nurses		Labor force part. rates		Supply—Proj. I		Supply—Proj. II	
		Proj. I	Proj. II		Proj. I	Proj. II	A	B	A	B	A	B
					1970							
										(700.0)		
Total	1917–70	1,442.0	—	.92961	1,340.5	—	54.5	59.6	731.1	798.5	—	—
20–24	1967–70	162.9	—	.99950	162.8	—	72.4	81.8	117.9	133.2	—	—
25–34	1957–66	341.5	—	.99460	339.6	—	48.8	54.8	165.7	186.1	—	—
35–44	1947–56	317.4	—	.98020	311.2	—	54.5	59.8	169.6	186.1	—	—
45–64	1927–46	488.9	—	.87043	425.5	—	56.6	60.7	240.9	258.3	—	—
65+	1917–26	156.1	—	.64886	101.3	—	36.5	34.4	37.0	34.8	—	—
					1975							
									(784.6)	(804.1)	(788.9)	(808.6)
Total	1922–75	1,656.1	1,662.1	.91456	1,514.3	1,520.4	59.2	60.6	895.3	917.6	900.3	922.7
20–24	1972–75	179.9	185.9	.99950	179.8	185.8	81.8	84.6	174.1	152.1	152.0	157.2
25–34	1962–71	403.4	—	.99460	401.3	—	54.8	56.6	219.9	227.1	219.9	227.1
35–44	1952–61	339.3	—	.98100	332.8	—	59.8	61.3	199.0	204.0	199.0	204.0
45–64	1932–51	533.7	—	.87469	466.8	—	60.7	61.9	283.4	289.0	283.4	289.0
65+	1922–31	199.8	—	.66888	133.7	—	34.4	34.0	46.0	45.4	46.0	45.4

							1980					
									(863.8)	(905.9)	(881.0)	(924.3)
Total	1927–80	1,823.5	1,851.3	.92199	1,680.3	1,708.0	58.8	61.6	985.7	1,033.8	1,005.2	1,054.8
20–24	1977–80	179.7	196.2	.99940	179.6	196.1	81.8	87.4	146.9	156.9	160.4	171.4
25–34	1967–76	466.4	477.6	.99370	463.5	474.6	54.8	58.4	254.0	270.7	260.1	277.2
35–44	1957–66	371.1	—	.97959	363.5	—	59.8	62.8	217.4	228.3	217.4	228.3
45–64	1937–56	583.4	—	.88430	515.9	—	60.7	63.0	313.1	325.0	313.1	325.0
65+	1927–36	222.9	—	.70783	157.8	—	34.4	33.5	54.3	52.9	54.3	52.9

NOTES: Labor force participation rates:

1970 column A: 1960 rates, see table 37 in text;
1970 column B: 1960; ×105.4 (based on growth in active nurses due to increased labor force participation, see equation (5A-10) appendix VA.
1975 and 1980 column A: 1970 rates;
1975 and 1980 column B: half the yearly growth in participation rates between 1970 and 1975 and 1975 and 1980 as recorded for the 1960 to 1970 period.

Figures in parentheses represent estimates of practicing registered nurses as defined by ANA. ANA estimate equals 87.63 of projected total. Derived from relationship between number of 1960 actual nurses and the number derived from using U.S. Census estimates of labor force participation rates.

SOURCES: Numbers of graduates: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Nursing, *Toward Quality in Nursing: Needs and Goals*, Washington, D.C., 1963, appendix table 4; American Nurses' Association, *Facts About Nursing: A Statistical Summary, New York*, the Association, annual eds.
Survival rates are based on figures from the Metropolitan Life Insurance Company, *Statistical Bulletins*.

attributed to a growth in the stock and the change in their age composition, the remaining 30 percent to an increase in the proportion working. This is equivalent to a growth of 9.2 percent in active nurses as a result of increased participation.

This overall increase in participation is estimated to be distributed among the age groups in accordance with the following formula:

$$(6\text{–}4) \qquad (P^N_{70})_i = (P^N_{60})_i \cdot \left[1 + \frac{(\Delta P^A)_i}{(\Delta P^A)_t} \cdot (\Delta P^N)_t\right]$$

where

$(P^N_{70})_i$ = the participation rate of the ith age group of nurses in 1970;
$(P^N_{60})_i$ = the participation rate of the ith age group of nurses in 1960;
$(\Delta P^A)_i$ = the percentage change in the participation rate of the ith age group for all white females between 1960 and 1969;
$(\Delta P^A)_t$ = the percentage change in the participation rate of all white females ages 20–70 between 1960 and 1970;
$(\Delta P^N)_t$ = the percentage change in total active nurses between 1960 and 1970 due to increased participation.

The basic assumption underlying equation (6–4) is that the change in the age-specific participation rates for nurses will be the same as the change in the age-specific rates for all white females.[2] This assumption may appear inconsistent with the information presented in table 37 since the participation rate for 20 to 24-year-old nurses in the 1950's grew substantially, while the rate for all women remained almost the same. Several differences, however, are likely to be true for the 1960–70 comparison:

(1) The proportion of women ages 20–24 who have graduated from high school has grown rapidly in the 1960's (high school graduates had the largest percentage change in participation in the 1950's);
(2) A much larger proportion of 20 to 24-year-old registered nurses are graduates of 2-year associate degree programs. The labor force behavior of AD graduates is likely to be closer to that of high school graduates than college graduates.

The second term under the parenthesis in equation (6–4) is included to distribute the overall percentage growth in the supply of RN's due to increased participation in accordance with the relative growth of the age-specific rates for all women. For example, the growth in the participation rate for 25 to 34-year-old white females from 1960 to 1970 was 133.7 percent higher than 19.0 percent for all white females. By multiplying 133.7 by the growth rate for all nurses (9.2 percent) we arrive at a growth rate for 25 to 34-year-old nurses of 12.3 percent. The 1970 labor force participation rate for 25 to 34-year-old nurses is thus 54.8 percent (48.8·112.3).

[2] As shown in Chapter III, over 93 percent of all RN's in 1967 were white.

Future changes in labor force participation will be strongly influenced by four factors: (1) the age composition of the stock of nurses; (2) the proportion of potential labor force participants not working; (3) the level of nurses' earnings in relation to other family income; and (4) the career preferences, or taste for market work versus home work and leisure of future graduate nurses. Lack of year-by-year information prevents an estimation of a model that could measure the unique contribution of each factor. We can, however, bracket estimates of future participation by determining the general direction and impact each factor will have. In comparison to the 1960–70 change, except for the age composition of the stock (which will get younger), the remaining three factors are likely to reduce the growth in participation. It is even possible that certain age-specific rates, in addition to the over 65 rates, will fall.

As explained in appendix V-A., as the proportion of the potential population in the labor force increases beyond some point, additional increases in participation are more difficult to achieve; i.e., the labor supply elasticity falls. As discussed previously, labor force participation rates for nurses are as high or higher than those of other female occupational groups. Most likely, therefore, these rates are at a stage of decreasing supply elasticity. This declining responsiveness of nurse participation to positive stimuli; e.g., increasing wages and greater availability of jobs, is reinforced by the narrowing of the gap between the earnings of a married nurse and the income earned by other members of her family. As is shown in appendix V-A., the ratio of nurse earnings to other family income is a significant factor influencing the participation of a married nurse; as the ratio increases the participation rate increases, but at a declining rate. Although we have projected that nurse earnings will continue to grow both in amount and relative to other female occupations during the 1970's, the rate of growth, particularly in the latter half of the decade, will be less than that of the 1960's. This too will tend to retard the growth in participation.

Perhaps the most important factor that will affect the overall participation of nurses adversely is the changing career aspirations of future associate degree and baccalaureate nurses in relation to hospital trained diploma nurses. The 4-year college trained nurse, while likely to be more career motivated than the diploma nurse, has more flexibility as to the kind of work she can do and whether she will work only in nursing. The 2-year associate degree nurse, on the other hand, has limited flexibility but also is less likely to be career motivated.[1] Preliminary information suggests that these factors lead to higher turnover and reduced participation on the part of non-diploma trained nurses.[4] Unfortunately, it is still too early to tell just how significant the impact of the changing composition of nursing education will be on participation. The fact that the nurse participation rate has not grown as rapidly in the 1960's as that for all women, even though (1) employment opportunities were readily available for them; (2) their wages grew rapidly; and (3) several Federal programs

Table 40.—Projected supply of practicing registered nurses: 1975 and 1980[1]

Year	Projection procedure I		Projection procedure II	
	1970 Age-specific LFPR	Growth in LFPR	1970 Age-specific LFPR	Growth in LFPR[2]
1975[3]	784,600	804,100	788,000	808,600
1980[3]	863,800	905,900	881,000	924,300

[1] Actual supply of practicing registered nurses, 1960 and 1970:

1960	504,928
1970	700,000

Figures for 1970 were estimated by the U.S. Public Health Service on the basis of 1966 Inventory of Professional Nurses.

[2] Assumes 50 percent of the 1960–70 annual growth rate in age-specific labor force participation rates.

[3] Projected estimates adjusted to conform with definition of professional registered nurses as used by ANA in their Inventory of Professional Nurses.

SOURCES: Table 39, text.

were introduced to facilitate the return to the labor force of inactive nurses,[14] suggests that this changing composition already has had a negative impact.

Together, these factors suggest that the rate of growth of age-specific participation rates of professional nurses during the 1970's will not match the record of the 1960's. In projecting future supply, therefore, two estimates of the change in age-specific participation rates are used: (a) no change in participation from that estimated in 1970; and (b) half the rate of growth that occurred between 1960 and 1970 distributed evenly throughout the 1970's.

Using 1970 participation rates the supply of registered nurses (consistent with ANA definition) can be expected to grow from 700,000 to 785,000–789,000 by 1975; and to 864,000–881,000 by 1980 (table 40). If growth in participation rates matches half that recorded for the 1960's, supply in 1975 will be higher, between 804,000 and 809,000. By 1980, growth in participation will produce between 906,000 and 924,000 active registered nurses.

Contribution of Part-Time Nurses

Throughout the study we have concentrated primarily on measuring the number of professional nurses that will be available in the future. No attempt was made to distinguish between those working full time and those working part time. One phenomenon of the post-World War II period has been the increasing proportion of nurses working part time.[8]

The proportion of general duty hospital nurses working part time has increased from 14.6 percent in 1945 to 41.9 percent in 1968. There seems to be a growing use of part-time nurses in administrative and supervisory positions in hospitals as well. In 1957 the rate was 6.9 percent and by 1968 it had grown to 11.6 percent. Although hospital nurses are more likely to work part time than other nurses and hence this is an over-estimate of the percentage of all professional nurses working part time, hospitals do employ close to 70 percent of all working nurses and therefore a dramatic trend such as this can not be ignored.

The use of increasing numbers of part-time nurses has been attributed to two factors: (1) they provide hospital managers with needed flexibility to meet fluctuations in demand for nursing care; and (2) they can be used in full-time positions that are difficult to fill; e.g., evening and night shifts in high shortage areas.[8] With the demand for nursing services expected to continue growing in the 1970's and total supply estimated to fall below the growth trend of the 1960's, the trend toward more part-time workers will probably continue. To obtain an estimate of the impact of the increasing proportion of part-time workers on the future supply of nursing services, the following procedure was adopted:

(1) Given that the increasing trend in proportion of nurses working part time has been operating for 25 years and that as a practical matter it is highly unlikely that the part-time rate will continue to grow at the rate it has been growing or exceed 50 percent, we projected the part-time rate for 1975 and 1980 using the following logistic growth function:[3]

$$PT = \frac{50.00}{1.00 + .192^{e-1/10(t)}} ; \tag{6-5}$$

(2) Setting the full-time rate $(100.00 - PT)$ in 1950 equal to 100, a full-time index (I) for 1970, 1975, and 1980 was calculated;

(3) The number of full-time equivalent nurses (FT) was then computed for $i = 1962$, 1970, 1975, and 1980 using equation (6–6);

$$FT_i = (T_i \cdot I_i) + .5(T_i \cdot (1 - I_i)) \tag{6-6}$$

where T_i = active RN's in year i.

By making 1950 the base $(I = 100)$, we assume for comparison purposes *only* that the part-time to full-time relationship that existed in 1950 is the standard and is defined as total full time. It is assumed further that changes in the part-time rate for general duty nurses after 1950 are representative of changes in the part-time rate for all professional nurses and that part-time workers work half of a 40-hour full-time work week.[8]

[3] See Chapter IV for a discussion of the logistic curve.

Table 41.—Impact of part-time nurses on supply of full-time nursing manpower, selected years: 1950–80

Year	Percent working full-time[1]	Full-time index 1950=100	Active RN's[2]	Full-time equivalent[1]
1950	84.68	100.00	-----	-----
1962	65.18	76.97	532.1	470.8
1968	58.08	68.59	659.0	555.5
1975	53.84	63.58	[2] 796.6	651.5
1980	51.75	61.08	[2] 893.2	719.3

[1] Based on equation (6-6).
[2] Average of projections I and II.

As shown in table 41, the percentage of general duty hospital nurses working full time can be expected to fall to just over 51 percent by 1980 or an index of .61 as compared to the 1950 base. In comparison the index in 1968 equals .69. Using this index to derive the number of full-time equivalent nurses, the growth in full-time nursing services between 1968 and 1980 will not be 36 percent as shown by a comparison of total active RN's, but closer to 29 percent. That is, the growth of active RN's exaggerates the growth of full-time nursing manpower by seven percentage points. Another way of looking at the situation is that almost 20 percent of the expected growth of all RN's will not materialize in the form of increased nursing manpower.

Relationship of Future Supply to Expected Demand

The measure of relative availability often used to describe the general situation in health manpower is the number of workers per 100,000 resident population. As shown in table 42, during the 1960's this relationship climbed from 282 to 341 registered nurses per 100,000 population, or an increase in relative availability of about 20 percent. Based on our estimates of future supply, by 1975 there should be between 364 and 375 practicing nurses per 100,000 population; and by 1980 the nurse to population ratio will reach a level between 379 and 406. That is, in the next decade the nurse per population ratio will grow between 11 and 19 percent.

Throughout the 1960's, the annual change in nurses per population has grown at a relatively constant rate of about 6.0 per 100,000. The growth rate in the 1970's will be somewhat smaller with an estimated range of 3.8 to 6.5 RN's per 100,000 population per year. If estimated future nursing

Table 42.—Registered nurses in relation to population: selected years 1954–70; projected 1975 and 1980

Year	Resident population (in thousands)	Nurses in practice (in thousands)	Nurses per 100,000 population	Annual change
1954	159,825	402	252	
				+3.5
1956	165,931	430	259	
				+4.5
1958	171,922	460	268	
				+7.0
1960	178,729	504	282	
				+8.0
1962	184,598	550	298	
				+4.0
1964	190,169	582	306	
				+6.5
1966	194,899	621	319	
				+6.0
1968	199,017	659	331	
				+5.0
1970	205,395	700	341	
:				+4.6 +6.8
1975	215,588	785–809	364–375	
				+3.0 +6.2
1980	227,510	863–924	379–406	

SOURCES: American Nurses' Association, *Facts About Nursing: A Statistical Summary*, New York, the Association, 1968 ed.; 1970 estimate of nurses in practice obtained from the Division of Nursing, U.S. Public Health Service. Population estimates for 1970, 1975, and 1980 are U.S. Census Series D projections, see U.S. Bureau of the Census, "Population Estimates and Projections," Current Population Reports, Series P-25, No. 448, August 6, 1970.

Table A6.—Estimated survival rates for age groups in 1960

Age of nurse[1]	Year	Yearly mean mortality rate[2]	Yearly mean survival rate	Mean total survival rate for period
Age 65 and over				
21	1911			
22–30[9]	1912–20	.00510	.99490	.95502
30–40[10]	1920–30	.00600	.99400	.93595
40–50[10]	1930–40	.00740	.99260	.92154
50–60[10]	1940–50	.01090	.98910	.88642
60–70[10]	1950–60	.02110	.97890	.79090
Total	—	—	—	.57748
Age 45–64				
21	1926			
22–30[9]	1927–35	.00318	99682	.97174
30–40[10]	1935–45	.00308	.99692	.96665
40–50[10]	1945–55	.00385	.99615	.95845
50–55[10]	1955–60	.00613	.99387	.93460
Total	—	—	—	.84143
Age 35–44				
21	1941			
22–30[9]	1942–50	.00119	.99881	.98934
30–40[10]	1950–60	.00141	.99859	.98460
Total	—	—	—	.97410

Age 25–34				
21	1951			
22–30[3]	1952–60	.00067	.99933	.99397
Total	—	—	—	.99397
Age 20–24				
21	1959			
22	1960	.00051	.99949	.99949
Total	—	—	—	.99949

[1] Assumes that nurse is alive at age 21 and remains alive throughout the 21st year.
[2] Mortality rate for white females of mean age within group taken from appropriate monthly *Statistical Bulletin* of the Metropolitan Life Insurance Company.

supply is reduced by the 20 percent factor due to an increased proportion of part-time workers, the expected range of annual growth in the 1970's will be closer to 3.0 to 5.2. Hence, while the supply of nurses will continue to grow in absolute numbers and relative to population growth, the per capita growth rate in the 1970's will be less than that recorded for the 1960's.

The use of changes in nurse-to-population ratios is indeed a very rough guide to determining whether future supply conditions will more adequately meet the future demands for nursing services. Demand for nursing manpower is closely related to the demand for medical care and the technology of producing medical care. Both have changed substantially in the 1960's, and will no doubt continue to change in the coming decade. Unfortunately, health analysts have had limited success in accurately predicting the impact of these changes on manpower requirements. Even if one is able to estimate future consumer demands for health care (which is highly doubtful), analysts have never been able to adequately account for: (1) the substitution that can occur among different types of nursing personnel; e.g., professional nurses, practical nurses, nurses aides, etc. (see section 4 of chapter II); (2) the flexibility in the availability of alternative types of health practitioners; e.g., physicians, LPN's, physician assistants; and (3) possible changes in the average input of manpower needed to serve the average consumer of medical care. As Lee Hansen has pointed out with respect to projected demands for physician manpower, "Given these substitution possibilities and the failure to incorporate them into projections (of physician requirements), it is little wonder that past projections have been so far off the mark and that future projections are often viewed with skepticism."[5]

While an attempt is made in this chapter to match expected changes in supply with proxy measures of future changes in demand; e.g., population growth, the criterion on which the worth of this exercise is based, should not rest too heavily on its ability to predict the existence or the size of future nursing shortages. Rather, simple demand proxy estimates are shown only as a guide to determining whether, on a relative (to population) basis, future supply conditions in the nursing labor market have improved or deteriorated.

Another measure of demand for nursing manpower is that established by the U.S. Public Health Service. In 1962, the U.S. Surgeon General's Consultant Group on Nursing estimated that 850,000 professional nurses would be needed by 1970 to provide optimum nursing care for the American people.[12] There has been much discussion about whether the difference between actual supply (700,000) and this professional estimate of demand (850,000) can be considered a "shortage."[15] Such a term as a "need shortage" does have some value as a measure of the extent to which the system is generating manpower in conformance with the goals of knowledgeable professionals in the field. This may be particularly useful when a comparison is made at different points in time. The "need shortage

rate" (*NR*); i.e., percentage of estimated need not met by actual supply, in 1970 is 17.6 percent. A recent update of the estimated need for professional nurses in 1975 by the U.S. Public Health Service put the figure at 1,000,000.[5] Using the midpoint of our 1975 estimates of supply, the *NR* would increase to 20.6 percent. That is, on a need basis the nursing labor market would lose some ground in the next 5 years.

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[5] The procedure used by the U.S. Public Health Service to estimate need was to analyze separately each field of nursing employment and determine the number of nurses needed primarily to maintain existing health standards given expected changes in the size and composition of the population and the expected number of patients that would flow from this population. Little attempt was made to estimate the impact of likely changes in medical care technology on the demand for nursing services, or the extent to which greater demands for medical care on the part of low income families would result in increased needs for nursing services.[11]

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