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ABSTRACT

A primary reason for increased government involvement in health care delivery resides in the acknowledged difficulty of the poor in obtaining adequate care. However, in the absence of knowledge about how health, health care, socio-economic status, race, ethnicity, and geographic location are related, policies aimed at implementing right to health care concepts threaten to squander resources without achieving any benefit for the poor. The approach taken here revolves around the specification of a model relating the health status of a population to its demand for care, and the various ways in which this demand can be satisfied or left unsatisfied. With the aid of the model, an attempt is made to differentiate between the medical professional's concept of need and the economist's concept of demand. This leads to examining the variables influencing the decisions of individuals to seek care, to accept care, and to follow through with care as well as the efficacy of care. Several research projects bearing on these relationships have been done. These include a model relating health status to demand for health care, analyses of urban physician office distribution, the efficacy of comprehensive care, the effects of air pollution and radiation on health, and the role of paramedics in the delivery of primary care. (Author/JM)

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STUDIES IN THE DELIVERY OF AMBULATORY CARE

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ABSTRACT

A primary reason for increased government involvement in health care delivery resides in the acknowledge difficulty of the poor in obtaining adequate care. In the absence of knowledge about how health, health care, socio-economic status, race, ethnicity and geographic location are related, however, policies aimed at implementing right to health care concepts threaten to squander resources without achieving any benefit for the poor. Summaries of several research projects bearing on these relationships are reviewed. These include a model relating health status to demand for health care, analyses of urban physician office distribution, the efficacy of comprehensive care, the effects of air pollution and radiation on health, the role of paramedics in the delivery of primary care, and a three tiered model for an urban medical care delivery system.

Health care has been identified as a right of citizenship in recent federal legislation, in the speeches of prominent politicians and in the professional writings of numerous researchers and academicians. The health of the poor is at the center of the controversy. The poor are seen to be captured in a perverse cycle: because they are poor they are unhealthy, because they cannot afford high quality care or cannot locate it easily they remain unhealthy, being unhealthy they cannot work or learn, are therefore forced to remain poor, and the cycle is closed--poverty yields ill health, ill health perpetuates poverty.[1/]

That health and income are associated has been amply demonstrated. We know that the poor have worse health than the nonpoor and that the nonpoor receive different medical care than the poor. But we have no idea of which is cause and which is effect. We don't know how health and health care interrelate with socio-economic status, race, and ethnicity or what policies hold the greatest promise of improving health. Policies whose objectives are implementation of the right to health care have assumed that increased medical care is critical to attain better health. There is little evidence that radically increasing medical care for the poor will result in major improvements in health. There is even the possibility that policies whose goals are the equilization of health can have a counter productive effect and lead to a lowering of health levels. This will be the case if they involve taking resources away from one group, such as children, and reallocating them to another, such as the aged as has occurred with medicare. Without a clear understanding of the processes prompting demand for medical care and of the non-medical factors influencing the effectiveness of care, attempts at implementing a public right to medical care concept will be hit or miss operations.

Their efficiency and long range effects upon the overall well being of the population will be impossible to predict. Unless we can determine the components crucial to the attainment of health and can estimate their role in attaining and preserving health, we run the risk of squandering our resources and making no progress. Medicare and Medicaid caused large scale changes in health care delivery, with effects on overall health and the cost of health. Before initiating changes of such a magnitude, it behooves us to examine the nature of the change we can expect from these alterations and how much we are willing to allocate to achieve a given change in the distribution of health via this mechanism.

Improving health may be only one objective for medical care policy decisions. Redistributing income to the poor as part of a medical care program is another perfectly reasonable objective. However, more efficient techniques exist to achieve such goals, e.g., graduated taxes or income subsidies. Here we limit our concern to the goal of improved health.

In our research we have been concerned with clarifying these issues. We have attempted to determine what variables effect health and what variables effect the delivery of health care. In the following sections, we review some of our recent work. Our approach revolves around the specification of a model relating the health status of a population to its demand for care and the various ways in which this demand can be satisfied or left unsatisfied. With the aid of the model we have attempted to differentiate between the medical professional's concept of need (the objective medical state of an individual) and the economist's concept of demand (the individual's request for care at some institution). We have been led to examine the variables influencing the decisions of

individuals to seek care, to accept care and to follow through with care as well as the efficacy of care. We have operated under the assumption that it is important to attack the health problems of the poor from a unified framework. We believe that it can be misleading to consider separate aspects of the problem and treat each in an ad hoc fashion, e.g., to relocate physicians so they are closer to the poor in no way guarantees that the poor will come to these relocated providers to receive care. Often achieving the subgoal has little effect on improving health status. In what follows we describe our model of the delivery system briefly and then amplify portions in terms of research in ambulatory care which we have accomplished.

A Model of the Delivery of Medical Care

A population can be characterized in terms of its underlying health status, i.e., the distribution of the kinds and severity of illnesses present in the population at some given moment.[2/] The National Health Survey is one attempt to specify the underlying health status of the entire nation. This health status is dependent on several factors. It is likely that the most important non-medical factors are the population's genetic makeup, personal habits and life style, demographic and socio-economic characteristics, the nature of the physical environment and the prevalence of pathologens. There have been attempts to characterize the nature of this dependence and to isolate the effects of the crucial variables and to identify the ways in which health status would be expected to change if one or another of the factors were manipulated.[3/]

In our model health status depends on these background variables and the amount of medical intervention. If medical care is more effective than all other variables, bringing middle class medical care to the poor should cause their health status to approximate that of the more affluent. Alternatively, if these other variables tend to reduce the effectiveness of care or are in themselves more important than direct medical care, the provision of facilities comparable to those servicing the nonpoor will have little effect on health status.

It is important to distinguish between facilities and actual receipt of care. One can provide facilities, but it is more difficult to ensure that the people needing care get it. For example, while innoculations might produce large reductions in morbidity, they are useless unless a way can be found to gain the cooperation of the people. We cannot force care upon recipients. Rather, we must wait for care to be demanded.

Most medical care delivered to individuals, especially preventive and acute care, is active--it requires some action on the part of the recipient of care. For example, the patient must seek care, must decide whether to accept the care prescribed, and, frequently, must decide whether to adhere to an extended care regiment. A population's underlying health status, socio-cultural variables (such as attitudes towards medical care) will interact with the general cost of attaining medical care and lead to a proportion of the population seeking medical care by presenting themselves at physicians offices, emergency rooms and clinics. For example, where attitudes towards medical care are contrary, i.e., when the efficacy of medical care in curing or preventing illness is questioned, fewer individuals will appear at a physicians' office seeking care.

Variations in the underlying health status will effect both the quantity and quality of the care demanded. Some of the individuals seeking care will have severe medical problems and will be in danger of dying unless sophisticated and costly techniques are quickly brought to bear; most will have relatively minor, easily treated symptoms, or be seeking preventive care; and some will simply be in need of information having no treatable medical problem. In general, the greater the incidence of severe symptoms the greater the expected demand and the more elaborate the treatment facilities which will be required to treat the presentations adequately.

Given some level of health status or distribution of symptoms severity, the expressed demand for care will be dependent not only upon the payment to the provider of care but also the associated time, transportation, lost wages, and fees paid to traverse the distance and to receive the care, as well as the psychological cost associated with the process. Thus, individuals are more likely to seek care at an institution which is geographically accessible, does not inconvenience them with long waits or poorly scheduled hours, is inexpensive, presents an encouraging milieu, and provides hospitable patient-provider encounters.

Although most conditions are self-limiting, many become more severe when treatment is delayed and require more expensive and elaborate treatment because of their advanced nature or the onset of complications. In the extreme, the system can be so inaccessible that people literally die without seeking care or can be so accessible that few severe medical problems are ever presented.

This model is essentially one of patient flow. The objectives need for care or underlying distribution of symptom severity is only one factor influencing this flow. It stresses the relevance of factors which affect the underlying health status of the population and those characteristics of the institutions providing medical care which effect demand, including those which determine whether an individual with this set of symptoms will seek care. Finally, the model can describe a system where patients with minor symptoms (or who are seeking preventive care) are treated or one where patients with very severe symptoms are seen. It is a consequence of the model that a system geared to treating patients with minor symptoms or who are seeking preventive care must treat many more patients than a system which is so inaccessible that it sees only patients with exceedingly severe symptoms.

Our work has been designed to explore the important factors isolated by this model of the delivery of medical care. We have examined factors which determine the basic health status of the population; we have examined factors affecting access constraints such as physician office location; we have examined the effect of removing almost all access constraints while providing comprehensive care; we have contrasted the effect of comprehensive care with that of other policies; and we have examined the efficacy of providing a new health professional, the paramedic, to deliver primary care in ways that lower access barriers and costs. Some of this work will be summarized below in the context of exploring aspects of this general model of the delivery of medical care.

Factors Affecting the Underlying Health Status of the Population

There have been numerous studies examining the effect of nonmedical factors on health. Their general import has been that a large component of the factors determining health are not related to the availability or receipt of medical care. In a recent study carried out in New Haven under the auspices of the Census Bureau 114 socio-economic, demographic and environmental variables were examined to determine their relationship to health and to explore the utility of employing composite indices of these variables as indicators of community health status.[4/] Significant relationships between numerous nonmedical factors and health were observed. Auster, Leveson and Saracheck studied the relationship between environmental variables and health and the relationship between medical care and health by performing a regression analysis across all states in 1960.[5/] Examining white mortality alone and comparing across income levels they concluded that "Environmental variables are far more important than medical care." There have also been studies which attempted to differentiate the effects of different categories of care. For example, Stewart, in a cross national study, examined the different effects of treatment and preventive care.[6/] He found that while the surrogates for preventive care were significantly related to life expectancy those for treatment were not. Glaser has discussed the rising quantiative similarity between medical care received by the poor and the nonpoor, an increase which has not apparently effected the differing health status of these groups.[7/]

Our contribution to this work appears in several studies we have carried out on the effect of air pollution and low level environmental radiation on health.[8/] We have used multivariate statistical analysis to determine the factors affecting the mortality rate in U.S. cities.

A number of mortality rates have been investigated, including the total mortality rate, age-sex-race specific death rates, and disease specific death rates. Although medical care does not appear as a variable in these analyses, explanatory variables did include general socio-economic variables, variables characterizing the style of living (such as types of equipment and fuels used for home heating, fuels used for water heating, prevalence of air conditioning), and occupation mix in the city. Sociocultural and environmental variables have turned out to be quite important in these investigations. We consistently found that the most important variables effecting the mortality rates are the socioeconomic and demographic ones related to income, age, race, and crowded living conditions.

The basic regression is shown in equation (1) where MR is the total mortality rate in 117 U.S. Cities in 1960, Mean P is the average of 26 biweekly readings on suspended particulates in the city, Min S is the smallest of the 26 biweekly readings, P/M^2 is the populations density, %NW is the percentage of the populations which is nonwhite, and $\%\geq 65$ is the percentage of the population 65 and older. The relationship is a linear equation which predicts the mortality rate for a city on the basis of air pollution and socioeconomic variables. Almost 83% of the variance in the mortality rate across cities is explained

The implication of this regression is that abating air pollution by 50% is estimated to decrease the total mortality rate by 4.5%. An equivalent result is that this abatement would increase life expectancy by 3-5 years, a gain greater than has occurred since 1950 will all of

$$(1) \qquad MR = 19.607 + \underset{(2.53)}{.041}\ \text{Mean P} + \underset{(3.18)}{.071}\ \text{Min S} + \underset{(1.76)}{.001}\ P/M^2$$

$$+ \underset{(5.81)}{.041}\ \%NW + \underset{(18.94)}{.687}\ \% \geq 65 + e \qquad R^2 = .827$$

the improvements in medical knowledge and medical care. We have also found that low level radiation from manmade sources such as nuclear explosions is a significant contributor to mortality. Both of these environmental variables as well as others may be expected to interact with low level medical care in that the environmental insult probably does not lead to a specific ailment such as cancer. Instead, there may well be an overall degeneration in the ability to resist disease. We hypothesize that persons with adequate medical care will suffer less from this effect than those with inadequate medical care. Thus a large portion of the burden may be transferred to the poor. The poor may bear an additional burden because market decisions on the value of land and housing may locate them closer to the sources of pollution. The question that must be answered is whether reducing pollution is a more reasonable way of improving the health of the poor than is increasing medical care.

Physician Office Location and Other Access Constraints

Having determined that environmental variables and other nonmedical factors strongly influence the distribution of health status, our model led us to an examination of the factors which perturb equality of access to the current medical care delivery system. Geographical access constraints are often felt to play a principal role in the maldistribution of health care. Policies aimed at decreasing the disparity between the health of the poor and of the nonpoor frequently attempt to redistribute resources to overcome this constraint.

However, most documentations of geographical maldistribution within cities fail to consider the overall locational process for urban medical resources. Instead, most studies examine only a portion of a city employing only one or two explanatory variables such as race or income. Consequently, one cannot determine whether other variables act on locational decision making or whether race and income are really surrogate variables masking the relation to other factors. To pursue this issue we constructed a model of the factors influencing the office location decisions of physicians.[9/] Using data from Pittsburgh on the census tract location of physician's office we employed multiple regression techniques in which the location of an office was expressed as a function of the median income level of a census tract, its racial composition, the degree to which it was zoned commercial, the number of hospital beds it contained and the number of hospital beds in adjacent census tracts. We reasoned that, while it was possible that physicians consider the income

level of a census tract and its racial composition when making a locational decision, it was likely that they considered other factors as well. Among these we hypothesized were the legal restrictions imposed by zoning regulations, the nearness of colleagues and specialists, the convenience of access of distant patients, (e.g., parking lots and transportation routes), the specialization and nearness of other medical facilities such as laboratories and x-ray equipment and the nearness of hospitals in which they had privileges. Our analysis of Pittsburgh indicated that when income level and race alone were considered it appeared that, contrary to the common notion, physicians were more plentiful in poorer tracts, tracts which were frequently black. Those Pittsburgh census tracts which in 1960, had median family incomes of under $5,000 contained 78% of all the physician offices, 68% of the offices of primary physicians, 44% of the city's population and 85% of its black residents.

When we examined these data more deeply by introducing the other variables and carrying out a multiple regression procedure this effect was neutralized. We found that physicians tend to concentrate in commercially zoned areas and near hospitals and that the income level of a tract was not a significant variable in the explanation of physician office location once these other factors were controlled. We did observe a tendency for physicians to avoid locating near populations of blacks though this effect was small. The result, which we note are specific to Pittsburgh, indicate that rather than acting out of bias against poor areas physicians are responding to a

rational locational choice model in which recent professional trends towards increased dependence on medical technology and specialization of practice have led to clusterings of physicians in office buildings near urban medical centers. The location of hospitals in Pittsburgh, city planning policies and historical accident have interacted with these trends to lead physicians into census tracts where the poor happen to reside.

We are in the process of carrying out a survey which will supply data on where the poor in Pittsburgh receive their medical care. It is apparent from preliminary analyses that their primary source of care is not the physicians offices near them. Apparently, these clusterings of physicians service the nonpoor populations who travel from more affluent suburban areas and have little difficulty with the office buildings, forms, questionnaires and specialization of the physicians. In fact, it is highly likely that these indications of professionalization are positively regarded and sought out by the more affluent.

Thus, it would appear that policies which simply aim to relocate physicians so that they are physically nearer to the poor populations of urban areas may be misdirected. Tendencies towards physician concentration mean that these policies would probably succeed only in establishing more medical office buildings in ghettos--office buildings that in all likelihood would fail to service the local population.

In our analysis of the costs of care delivered at a major outpatient clinic in Pittsburgh, we have found that the cost of an additional visit was

much smaller than the total cost per visit.[10] In other words, there is excess capacity and the cost of treating one extra patient is much lower than either the average cost per patient or the average revenue received from treating a patient. Thus, further expansion of clinics and similar facilities may be another misguided policy. Although the cheapest way of running the clinic is to insure it is fully utilized, this can be done only by serving a large patient population. (Another alternative would be to cut back on capacity, an unlikely occurrence in a large scale organization which believes it is filling an insatiable need.) This can only mean drawing patients from great distances and making access so difficult that many patients put off visits until quite late. The result is that efficient operation of a large scale clinic may actually promote inequality in health.

The Efficacy of Comprehensive Medical Care for Poor Children.

Our studies of physical and social environmental variables indicate that they have significant effects on health, effects which may be more critically felt by the poor who are less likely to be receiving high quality medical care. The cycle of poverty model mentioned earlier argues that this differential receipt of care is not only a consequence of socioeconomic status but a factor affecting the prospects of mobility. The implication which many draw from the model is that only the provision of the highest quality care can right the social injustice perpetrated by this cycle and give the poor an opportunity to develop. In an attempt to determine the change in social behavior that could be expected were high quality care

available to the poor, we investigated the efficacy of a comprehensive care project located in a lower income (essentially black) housing project in Pittsburgh.[11/] The facility gives free comprehensive care to the children of one half of a 2,000 unit housing project. An identical population in the adjacent section of the housing project could not receive care at the facility having recourse only to traditional medical resources. Every conceivable effort was made by the project's staff to involve all eligible children in the project. A highly active resident advisory committee was organized, hours were made convenient, door to door visits were carried out, and advertising was employed along with numerous other marketing techniques. Even with access constraints reduced to a minimum a large portion of the children never received care at the facility and others only participated to the extent of being signed up. We studied the school attendance of the children receiving care in the facility and compared this with the attendance records of children in the adjacent project and with children living outside of the project. Our findings indicate that for those enrolled the comprehensive care project did lead to a statistically significant decrease in days absent but the actual number was small, on the order of 3 days. Much greater effects were estimated for sex (males were absent 1.4 fewer days than females), race (whites were absent 2.5 fewer days than blacks), and proximity to school (those closer to school were absent fewer days than those further away).

These results raise several questions, some of which we are currently pursuing. If the objective of providing medical care is to alter various forms of behavior such as those involved in labor or in public education,

there are several variables such as proximity, transportation and pupil peer mix which are more relevant. Furthermore, the level of care provided at the comprehensive care facility was quite high and quite costly. We did not determine whether some components of this care were more important than others in effecting school attendance, but it is certainly possible that a much lower level of resource utilization could have had the same effect. The question raised here is whether a pediatric nurse practitioner, for example, could have had the same effect as the highly diversified staff of the center. Although we did not examine the actual change in health which resulted from the provision of comprehensive care we did look closely at a form of behavior similar to attendance at a job which very likely to have some dependence on health. Indeed, finding this small indirect effect may have meant that there had actually been a large improvement in health status. Nonetheless, the fact remains that other nonmedical factors play so strong a role in determining behavior that one must be extremely cautious when using non-health type objectives to rationalize health care policy.

A New Health Professional to Provide Primary Care

We have found the poor to be in greater need of care but unlikely to demand it from the institutions supplying care to the more affluent. It thus appears that relocating sources of primary care will have at best a small effect on the well being of the poor, no matter how costly and sophisticated the resources and reallocation process. Moreover, the trends towards medical specialization suggest that the isolation of the poor from primary

care physicians may forebode a situation soon to be faced by the entire population. American medical education has increasingly turned out specialists rather than physicians trained and willing to deliver primary care. Although the number of physicians has increased the number providing primary care has actually fallen in the postwar period.[12] Even attempts to get physicians interested in primary care are turning out primary care specialists, with the attendant additional training and higher income expectations. Since our ability to train physicians is severely limited, and since physicians have certain expectations about income, it seems evident that they are never going to take over the burden of primary care.

We have pursued this issue in a review of the literature on paramedical personnel.[13] There is much evidence that this burden can be taken over by paramedics--physician's assistants, pediatric nurse practitioners, etc. Their lesser training means that the number of people delivering primary care can be greatly expanded quickly and at low cost. It means that they can be used to significantly lower access costs, including travel, waiting time and price. Incidently, cost of their time and nearer social status implies that psychological costs incurred during patient-practioner encounters are likely to be reduced. Indeed, studies in Denver by Dr. Henry Silver have shown that patients often prefer non-physicians because of their willingness to spend time and greater rapport.

This might appear to some as a proposal for a two class medical care system. However, since patients often seem to prefer PNPs or chronic care

nurses to physicians, this judgement may be premature. Besides, as MDs take on the specialist tasks they were trained for they will become unwilling to provide primary care to their middle class patients, and actively support the development of these new categories of medical care providers.

A System for Delivering Care to the Poor

Our conclusions have lead us to specify a plan for a system to deliver medical care to the poor.[14/] This system is designed simultaneously to decrease and increase access constraints to care because it segregates care into levels--levels of sophistication and cost--in an attempt to funnel the flow of patients so as to optimize the degree to which the system improves their health rather than delivers care. We then assume that the goal of the system's implementation is the provision of some level of health, some change in the underlying health status of the population.

The system is detailed elsewhere and we are currently completing a formal specification. Briefly, we envisage three tiers of delivery, one for primary care, one for speciality--clinic type care and one for inpatient hospital type care. This breakdown is, of course, similar to what has existed in the past but we would rather enter into the system to be completely monitored at the primary care level of sophistication. (It is also similar to a system currently operational in Denver, Colorado.) The primary care level would be storefront-type satellite units using paramedical personnel. These units would be equipped at a low level and would be numerous requiring only local

penetration for full utilization. Contact would be retained with clinics, fewer in number where speciality care would be provided on a referral basis. The hospital would thus regain its more traditional role rather than the role it now plays as provider of primary and non-crucial care. Although not a unique proposal the essential ingredients of our system lie in its specificability and its capability of resisting flows of patients to inappropriate components. We believe that the transition probabilities for the components can be estimated and that a system can be configured to deal optimally with the medical care delivery demands of specific populations. It is on these areas that we are now working.

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