Educational Status and Health

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Some of the problems with the traditional measures of socioeconomic status include (1) the loss of information resulting from combining different factors that have varying associations with health problems; (2) the reverse causal pathway that exists from health and illness to income and occupation; and (3) a number of particular problems with deriving socioeconomic status from census tract information. In contrast there are clear advantages to using educational status as the primary socioeconomic index. A wide variety of literature is reviewed pointing to a strong positive relationship between years of schooling and health. Three models that attempt to account for this association are described. It is suggested that the educational status of patients should be part of their data base.

As part of the basic demographic information on all registered patients at the Rochester Family Medicine Program, census tract has been used since 1969 to estimate socioeconomic status (SES) as well as to define area of residence. Recent studies have suggested that educational level alone may be a more accurate indicator of health and health behavior than many earlier SES scales which relied on other modalities either singly or in combination. In an effort to maintain a more precise and useful socioeconomic index, this program has introduced educational level as an additional item in the computerized patient data base.

In conjunction with this innovation, a review of the pertinent literature was undertaken concerning the relationships between health and health behavior to years of schooling. The rationale for using educational level as the primary socioeconomic index is examined, and possible causal relationships between education and health are discussed. Also included is a description of various SES scales which have been used here and elsewhere with discussion of their advantages and limitations.

Determinants of Socioeconomic Status

Antonovsky, in an historical review published in 1967,[1] indicated that social stratification has been the traditional approach to demographic data on life expectancy since 1851 when the systematic study of occupational mortality was first introduced in Britain. More recent attempts to define relationships between socioeconomic status and mortality and/or morbidity have led to development of a variety of SES scales which range in number and content of included parameters. Those currently in most widespread use include the indices of Duncan, Hollingshead, and the US Census Bureau.[2] A fourth, the Willie-Wagenfeld Index,[3] is presently in use at the Rochester Family Medicine Program.

Duncan's socioeconomic index relates income, occupational prestige, and education. Hollingshead's Two Factor Index of Social Position utilizes only occupation and education and correlates only moderately (r=0.74) with Duncan's socioeconomic index. The US Census SES Score is a multiple-item measure derived from occupation, education, and family income, and correlates well (r=0.97) with Duncan's socioeconomic index,

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but is available only for the United States as a whole.[2] The Willie-Wagenfeld determination of census tract-socioeconomic status was derived for Monroe County, New York, using a five-part composite index of the following items: median value of owned homes; median rental value; percentage of skilled, semiskilled, and unskilled workers; median years of education; and percentage of sound dwelling units. Each census tract received a score, and five levels of socioeconomic status were categorized on the basis of a 10-20-40-20-10 percentile distribution of scores. This index was found, in 1972, to correlate well with that of Hollingshead ($r=0.84$).[3]

While socioeconomic status has been a central variable in sociology and has been used extensively in medical demography, there are major theoretical and practical limitations to its use. Socioeconomic status is not a unitary factor, and with ever increasing computer capabilities, there is little need for simplification by arbitrary classification. On the contrary, retention of the individual units of the components of SES scales (income, education, occupation) allows greater precision and specificity of analysis.

A number of recent studies have analyzed those separate components and their effects on health and health behavior. In general, since the introduction of Medicaid and Medicare, income has become a less significant factor in health seeking behavior than it had been in the past. Occupation has exhibited an inconsistent relationship with health, and is probably important only in those areas of employment where measurable exposure to health hazards exist. For example, Welner et al[4] studied the prevalence of psychiatric disorders among professional women. Prevalence was found to be 51 percent among physicians vs 32 percent among PhDs. Among physicians, psychiatrists exhibited a 73 percent prevalence of psychiatric disorders compared to 46 percent among nonpsychiatric physicians.

There is a fundamental problem in using current income and occupation as variables related to health factors, particularly if a causal interpretation is sought. A complex interrelationship exists between occupation, income, age, and the presence of illness. As individuals become older, an initial increase and subsequent decrease occurs in their income and occupational status. On the other hand, with increasing age, the prevalence of illness increases, and illness itself will tend to decrease income and occupational status. This reverse causal pathway raises questions about using current income and occupation in medical demography.

There are particular problems with extrapolation of individual socioeconomic status from census tract information. Currently available data are based on the 1970 census, and with migration of selected population groups over the past decade (ie, the "white flight") out of some census tracts, a systematic bias occurs. Largely due to the exodus to the suburbs, census tracts are no longer of equal population, so that the original percentile categorization varies from that of the current population. Furthermore, it is possible that patients at any given health care facility may not be representative of the census tract of their residence. In addition, a large random error occurs due to averaging of SES scores of families within census tracts. The primary justification for use of the census tract as a determinant of socioeconomic status is the unavailability of more specific individual information.

Education and Health

Inclusion of years of schooling within the data base provides useful, easily obtained individual information and circumvents problems inherent in the more arbitrary census tract classification. A reverse causal pathway is unlikely to be a major factor, since morbidity and mortality which might otherwise interfere with schooling is more likely to occur some years following termination of formal education. Gathering educational information is relatively non-invasive, and number of years of school completed is more stable than either occupation or income. It is also a pure number which requires little interpretation, making it simple to obtain, record, and add to a computer data base. Furthermore, since years of schooling is a continuous variable it lends itself easily to parametric statistical techniques.

There is a wide variety of studies demonstrating a relationship between years of schooling and health/health seeking behavior. This communication will focus, in turn, on overall mortality, cardiovascular disease, other medical problems of adults, maternal and child care, and utilization. Where possible the relative roles of education and other SES scale variables will be examined.

Mortality

Kitagawa and Hauser,[5] in a study of mortality risk, used 1960 United States census and death certificate data and found an inverse relationship between mortality and level of education. Blacks educated four years or less compared with those with nine or more years of schooling had a 31 percent (for males) and a 71 percent (for females) higher mortality ratio. Among white males aged 25 to 64 years, there was a 59 percent differential in mortality ratio for those living in the North and West and a 29 percent differential for those residing in the South. For white females aged 25 to 64 years, the figures were 74 percent and 42 percent, respectively by region. Over age 65 years, the relationship persisted in white females but in no other group. Less detailed, but comparable, results were obtained for infant mortality which correlated inversely with parental education.

A similar, but less marked, inverse relationship was found between income and mortality. The relationship persisted when income was controlled for education, and when education was controlled for income. Inadequate sample size precluded analysis of the effect of occupation on mortality but inversions occurred, pointing up differences in the effects of education, income, and occupation on mortality. For example, "service workers"* had more education than "operatives,"* but experienced higher mortality. The authors concluded that since both occupation and income change with advancing age and illness, the most satisfactory socioeconomic variable was level of education.

Cardiovascular Disease

In a well-controlled study, men enrolled in the Health Insurance Plan of Greater New York who had complex ventricular premature beats following myocardial infarction were followed over a three-year period.[6] Those with eight or less years of education had a 3.3 times greater risk of sudden cardiac death than their more educated controls. The difference could not be explained either on the basis of coronary heart disease risk factors, or by clinical characteristics affecting prognosis. This interesting result did not apply in the absence of arrhythmia, in which case additional education was not associated with any change in mortality. Although blue collar occupations were more frequent among the less educated group, occupation did not contribute significantly to outcome. Possibly related to these observations is a retrospective study[7] of men following myocardial infarction in which those with less education reported warning symptoms (particularly chest pain) less frequently, and those few who did report symptoms often related them to the gastrointestinal system.

Data from the Hypertension Detection and Follow-Up Program[8] confirm earlier reports[9,10] that the prevalence of hypertension is inversely related to educational level across race and sex. In fact, differences in education partially accounted for observed difference in prevalence of hypertension between blacks and whites. The National Health Examination Survey[11] in its 1960-1962 sample, also found a weak inverse association between the blood pressures of white children ages 6 to 11 years and parental education.

Other Medical Problems of Adults

A recent study by Gann et al[12] reports on the relationship between level of education, income, and fatness in adults. These authors found that women with more than 12 years of schooling averaged 19 percent thinner skinfolds than those with less than nine years. The difference was greater when measured against the subject's own educational level, rather than that of her husband. In contrast, male obesity exhibited a positive but less marked correlation with education. These opposing trends highlight the importance of cultural effects on obesity. A similar increase in obesity was noted with increasing income. There was, however, no statistical analysis to determine the relative importance of the two variables, nor was the possible effect of occupation considered.

Lebowitz[13] investigated the relationship of socioenvironmental factors to the prevalence of chronic lung disorders. When a composite socioeconomic index was used, no significant correlation was found with the various disorders. However, educational level correlated inversely with productive cough, emphysema, chronic bronchitis, asthma, and pneumonia. These relationships persisted but were progressively less significant for smokers, ex-smokers, and non-smokers,

*As defined by the authors

respectively. Income exhibited a parallel, but less significant relationship, while no significant relationship was found between occupation level and respiratory disease. Lebowitz also found an inverse relationship between educational level and the prevalence of both arthritis and peptic ulcer disease, whereas arthritis had a weaker inverse relationship with income and none with occupational level.

Relatively little could be found in the psychiatric literature relating educational level to emotional problems although there is a great deal on socioeconomic status and mental illness. Craig and Van Natta[14] examined the association of educational level with prevalence and persistence of depressive symptoms. Individuals with less schooling were more likely to exhibit the depressive syndrome (persistence of symptoms requiring treatment) and were likely to express this distress in physiological rather than psychological terms. In a community study, Ilfield[15] found a significant trend for those with lower levels of education, occupation, and current income to have more psychiatric symptomatology. This relationship was most marked for current income level, and least significant for education; however, here the reverse causal path may apply—in that psychiatric morbidity may reduce earning capacity.

Maternal and Child Health

Schaefer and Hughes[16] examined the effect of maternal and paternal education and income on planned parenthood, family planning behavior, prenatal care, and care of the infant. Maternal education was most highly correlated with all aspects of care, followed by paternal education. Income correlated significantly only with poliomyelitis immunization and breast feeding. Other studies confirm various aspects of this investigation.

Gispert and Falk[17] studied sexual experimentation and pregnancy in black adolescents. Those whose educational goals included college were less likely to get pregnant and, if pregnant, were more likely to have an abortion. Approaching the question retrospectively, Moore and White[18] showed that early childbearing is strongly associated with decreased eventual educational attainment while Fielding et al[19] found that women with less education delayed seeking abortion advice. Eisner et al[20] found that decreased maternal education in whites was associated with an increased risk of low birthweight in their offspring.

Halpin and co-workers[21] made a careful investigation of risk factors associated with failure to receive vaccination. They found paternal education to be the best predictor of vaccination rate. With maternal education level held constant the rate varied from 54 percent for the least educated fathers to 91 percent for those most educated. A less marked differential (62 percent to 83 percent) was found for maternal educational level. Socioeconomic status based on census tract revealed a much less significant trend.

Utilization

The study by Bombardier et al[22] on variables affecting utilization of surgical operations is an example of the differential effect of socioeconomic factors. These investigators examined data from the National Health Interview Surveys of 1963 and 1970, and found that surgical utilization increased with increasing income, but that the effect was less marked in 1970 than in 1963. Conversely, increasing education had a negative effect on utilization. This latter finding is consistent with the hypothesis that schooling has a beneficial effect on health and this reduces the need for surgery. Another hypothesis would be that those with more education comply better with alternative medical programs, and thus avoid surgery. The findings of Berki and Kobashigawa[23] are in line with both propositions. These authors found that education had a positive effect on utilization of ambulatory services, but those with more education had less need in terms of acute and chronic illness. In addition, they found that the earlier (prior to Medicaid and Medicare) negative effect of low income on utilization had largely disappeared by 1970. These findings are consistent with those of Bice and co-workers[24,25] who also demonstrated that health care utilization in those with higher educational attainment was concentrated more upon preventive medical services.

Bachrach[26] examined male admissions to state and county mental hospitals. She found a tendency for diagnosed alcoholic admissions to increase in age as they increased in educational level. The explanation suggested was that the better educated may utilize public facilities only later in life when their financial resources are exhausted. Conversely, for all other psychiatric

diagnoses, there was a trend for a decrease in the median years of schooling completed with increasing age at admission. Since none of the data were analyzed statistically, and because only state and county institutions were examined, interpretation must be guarded.

Discussion

The Health-Schooling Relationship: Why?

What is the basis for a relationship between health and years of schooling? In general, it seems likely that people with similar educational levels will also have similar tastes, attitudes, and behavior patterns (Hollingshead[27]). A partial explanation of how this may influence health and health behavior is suggested by the economist, Grossman.[28] He proposes, in a mathematical model, that schooling increases the individual's efficiency in producing health. Thus, those with more education are capable of becoming more aware of health risks, better able to adjust their behavior accordingly, and also use medical care more effectively. Much of the evidence cited above appears to point in that direction.

Additional support for this explanation includes the trend toward increased prevalence of breast feeding over the last seven years, cited by Pursall et al,[29] which parallels the dissemination of information on the advantages of breast feeding. In a study of three separate maternity units it was shown that the percentage of mothers breast feeding correlated positively with years of schooling for each time period studied. Also, Fuchs[30] reports a study documenting the decline in proportion of smokers between 1958 and 1975 in the United Kingdom. A 50 percent decrease in smokers was found among the most educated, whereas the proportion of people smoking changed insignificantly in those least educated.

In the same article,[30] Fuchs refines the explanation offered by Grossman. He suggests that "... both schooling and health are manifestations of differences among individuals in the willingness and/or ability to invest in human capital" (p 159). It is suggested that those who elect to incur the costs of education and health oriented behavior do so for potential future benefits. Such a value system, however, appears not to depend upon IQ since this parameter was not found to correlate with health.[28]

These economic models are similar in some respects to the Health Belief Model which derives from social-psychological theory. The Health Belief Model, originally proposed to predict preventive health behavior, has been extended to predict patient compliance with prescribed therapies. Under the Health Belief Model, the behavior of an individual is predicted from the value of the outcome to the individual and the individual's expectation that the suggested outcome will proceed from a given action. Under this model the patient must perceive the threat of the disease (or of poor compliance), and the perceived benefits of the prescribed action must outweigh the perceived barriers to action in order that the recommended health behavior be followed. The Health Belief Model has been found to predict behavior toward a wide range of screening programs and compliance with therapy.[31]

In summary, it is suggested that formal education facilitates responsiveness to health education efforts which encourage appropriate health behavior.

Use of the Health-Education Relationship

As stated at the beginning of this paper, educational level has recently been incorporated into the computerized data base at this program. Each patient is requested to complete a self-administered questionnaire documenting their total years of formal education (excluding business, vocational, and technical school).* In addition, each patient is asked to provide (if known) the same information concerning both his/her parents. Thus, a six-digit number (two for self, two for father, two for mother) is generated and stored in the computer with other pertinent demographic information.

Inclusion of the educational level of the individual patient's parents is exploratory. Since changes in patterns of educational levels have emerged over the past 20 years (Table 1), the significance of various levels of education, as discussed above, may change. Through gathering educational information over two generations a better perspective on the effects of those changes may be gained. A later report will outline some of the preliminary demographic findings.

It is anticipated that the addition of years of schooling to the data base will be useful for: (1)

*The exclusion assures comparability to other published studies

Table 1. Percent of Population 5 to 34 Years Old Enrolled in School by Age[32]

Year	Total 5 to 34	Age in Years 5	6	7-9	10-13	14-15	16-17	18-19	20-24	25-29	30-34
1947	42.3	53.4	96.2	98.4	98.6	91.6	67.6	24.3	10.2	3.0	1.0
1957	53.6	60.2	97.4	99.5	99.5	97.1	80.5	34.9	14.0	5.5	1.8
1967	60.2	75.0	98.4	99.4	99.1	98.2	88.8	47.6	22.0	6.0	4.0
1976	54.2	89.6	98.7	99.2	99.2	98.2	89.1	46.2	23.3	10.0	10.0

Note: Although the proportion increased up to 1967, it has remained stable since then

outreach—in selecting high-risk groups; (2) *education*—in supplying more appropriate patient education materials; and, (3) *research*—by using educational level as a control variable and by exploring the relationship of education to problems in family medicine.

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