Health Status Of Illiterate Adults: Relation Between Literacy And Health Status Among Persons With Low Literacy Skills

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Abstract: ***Background:*** **In nonindustrialized nations, illiteracy is independently associated with poor health. The objective of this research was to determine whether such a relation exists in the United States.**

Methods: **One hundred ninety-three persons were randomly selected from a group of adult students enrolled in a publicly funded literacy training program. Subjects' health status was measured with the Sickness Impact Profile (SIP), a behaviorally based measure of sickness-related dysfunction. Subjects' literacy skills were also measured. Multivariate statistical techniques were then used to evaluate the relation between health status and literacy level and to adjust for confounding sociodemographic factors.**

Results: **The physical health (measured by the SIP) of subjects with extremely low reading levels was poor compared with that of subjects with higher reading levels. The relation between reading level and physical health was statistically significant ($P < 0.002$), even after adjusting for confounding sociodemographic variables. Psychosocial health (measured by the SIP) was poor across all levels of reading skills and was comparable with the psychosocial health of populations with severe psychosocial disability. The relation between reading level and psychosocial health was statistically significant ($P < 0.02$) after adjusting for confounding variables.**

Conclusions: **In the United States, illiteracy and poor health status are independently associated. (J Am Board Fam Pract 1992; 5:257-64.)**

Illiteracy is common in many nonindustrialized nations.[1] In those countries, health status indicators, such as life expectancy and infant-maternal survival rates, all improve as the population's literacy level rises.[2-11]

Illiteracy is also common in the United States. Up to 15 million persons in the United States (10 percent of the adult population) lack basic reading skills, and as many as 27 million more have only rudimentary reading skills that are not sufficient to permit full participation in society's economic and social activities.[12-21]

It is logical, therefore, to hypothesize that a relation between literacy and health status can exist also in the United States. No published studies in the United States, however, have evaluated such a relation. Thus, the goal of our research was to determine whether a relation exists between literacy and health status among a group of US adults with poor literacy skills. The effect of potentially confounding sociodemographic variables was evaluated with multivariate statistical techniques.

Methods

Subjects

Subjects for this research were adult students enrolled in the Pima County Adult Education Program (PCAE) in Tucson, AZ. PCAE is a publicly funded program that offers adult basic education, including literacy instruction, at more than 40 sites throughout Pima County. PCAE students are not a random sample of all illiterate adults in Pima County, but such a population is impossible to identify because no governmental or private agencies maintain registries of illiterate individuals. During the study there were 5536 enrollees in PCAE. Sociodemographic characteristics of the

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PCAE students studied in this research are shown in Table 1.

To be eligible for this research, potential subjects had to have reading skills at a grade-equivalent level between 0.0 (total inability to read) and grade 12.9. PCAE staff determined reading levels of all subjects using the Tests of Adult Basic Education.[22] In some cases, staff additionally used the Mott Basic Language Skills Program[23] as a supplemental test to clarify reading level.

There were also several language eligibility requirements. Subjects had to speak and understand English well enough to participate in the study. They also had to respond affirmatively when asked whether English had been spoken in their home when they were young children. Thus, individuals were eligible for the study even if other languages had been spoken in their childhood home, as long as English was one of those languages.

Table 1. Demographic Characteristics of Study Population, n = 193.

Demographic Characteristics	Mean (SD)
Age (years)	28.53 (±10.6)
Annual income ($ thousand)	7.61 (±7.02)
School grade completed	9.86 (±1.96)
	Percent
Sex	
Women	61.1
Marital status	
Married	29.0
Single	50.3
Divorced	20.2
Widowed	0.5
Ethnicity	
Hispanic	53.4
White	29.5
Black	9.8
Native American	6.7
Other	0.6
Occupation	
Blue collar	54.4
Unemployed	45.6
Country of birth	
United States	91.2
Mexico	6.7
Other	2.1
Languages spoken in childhood home	
English only	71.0
English and Spanish	26.9
Native American and English	1.6
Other and English	0.5

We excluded persons in whose homes English had not been spoken from early childhood regardless of their ability to read or write in another language. Such individuals could have been fully literate in Spanish, for example, despite poor reading skills in English. We excluded these persons to assure that literacy (and not English language literacy) was truly the variable being analyzed.

All PCAE students are at least 16 years old. We excluded the small number of PCAE students who are mentally retarded and those with known learning disabilities.

We selected subjects using stratified random sampling. Stratification was done by classroom (each class contained students of similar reading level) to assure that the final distribution of subjects would be representative of the overall distribution of reading levels among PCAE students.

Subjects were selected from within each class using a table of random numbers. If the chosen student met eligibility criteria, that student was asked to participate. If the individual was ineligible or unwilling to participate, the numbers table was used to select an alternate subject.

Subjects received a small payment for participation. The Human Subjects Committee at the University of Arizona College of Medicine reviewed and approved this research.

Health Status Measure

We used the Sickness Impact Profile (SIP) to measure health status.[24] The SIP has been used to quantify health status for a wide variety of populations and medical conditions, including healthy patients enrolled in prepaid health plans[25] and patients with chronic medical conditions, such as rheumatoid arthritis,[26] coronary artery disease,[27-29] cancer,[30,31] chronic obstructive pulmonary disease,[32-34] back pain,[35,36] and thyroid dysfunction.[37]

The SIP is a behaviorally based measure of sickness-related dysfunction. SIP includes 136 items covering 12 categories of daily activity: ambulation, mobility, body care, social interaction, communication, alertness, emotional behavior, sleep, eating, work, home management, and recreational pastimes. A person's SIP responses are scored to yield quantitative ratings for a "physical dimension" and a "psychosocial dimension" of health. A total composite (overall) score can also

be computed. SIP scores have a high interrater reliability (0.92), test-retest reliability (0.88 to 0.92), and internal consistency (0.96).[38]

There is no normal range for the SIP, but lower scores indicate better health. Persons from healthy populations typically have scores below 3.0, and patients with profound health-related disabilities often have scores as high as 20.0 to 30.0. It is unlikely, however, that a clinician would note an obvious difference between a patient with an SIP score of 2.0 and a patient whose score, for example, is 5.0. Both patients would appear healthy, even though the individual with the higher score can have some minor sickness-related limitation of activity. Reported scores on the SIP for persons in a variety of clinical conditions are provided in Table 2.

The SIP can be administered either orally or as a written questionnaire. For this research, we administered the SIP orally in one-on-one sessions with interviewers and subjects. Thus, no literacy skills were needed. Also, because the SIP is available in English only, non-English-speaking persons were excluded (as previously noted).

PCAE staff members served as the interviewers who administered the SIP. Each was trained in SIP administration techniques.[39] Interviewers did not necessarily test students known to them but rather tested students from various classes who had been identified by the study's sampling technique. After testing, SIP results were scored independently by other members of the project staff.

Other Variables

Interviewers also collected the following sociodemographic information from the subjects: age, marital status, ethnicity, place of birth, language(s) spoken in childhood home, educational attainment, income, health insurance status, and occupation. Occupations were categorized as either blue collar or white collar. We defined blue-collar occupations as those that involved manual labor, unskilled nonmanual labor (e.g., baby sitter, cashier), and nonsupervisory positions requiring technical skills (e.g., typing, driving).

Interviewers asked each subject for a self-assessment of health graded on a 4-point scale: excellent (1), good (2), fair (3), poor (4). In addition, interviewers collected information about the number of hospitalizations and physician office visits the subject had experienced during the past year and about the number of prescription medications taken on a daily basis.

Statistical Methods

The independent variable for this research was the grade-equivalent reading level. The dependent variables were the physical, psychosocial, and total SIP scores.

We examined the relation between reading level and SIP scores in two ways. First, we used standard linear models with reading level entered as a continuous characteristic. This analysis used both grade-equivalent reading level and log10 (grade-equivalent reading level +0.5).

For the second analysis, we dichotomized subjects into two groups: (1) those with reading levels at or below grade level 4, and (2) those with reading levels above grade level 4. We chose the 4th grade as the dividing point because this education level is used by the US Census Bureau to define literacy.[13] We used a general linear model

Table 2. Range of Mean (SD) Sickness Impact Profile (SIP) Scores Reported in the Medical Literature.*

Setting or Illness	Number of Subjects	SIP Score		
		Physical Mean (SD)	Psychosocial Mean (SD)	Overall Mean (SD)
Healthy enrollees in prepaid health plan[25]	144			2.6 (4.5)
Myocardial infarct survivors at 6 mo[27]	308	6.9 (11.2)	8.8 (1.2)	10.3 (10.8)
Patients undergoing cancer radiotherapy[31]	12			11.5
Rheumatoid arthritis ARA Class 2[26]	64	13.1 (9.1)	11.7 (9.8)	15.1 (8.8)
Chronic back pain[35]	80	18.3 (15.0)	18.8 (17.0)	18.7 (14.3)
Chronic lung disease, oxygen dependent[34]	66	19.8		20.5
Cardiac arrest survivors with cognitive defects[29]	10			18.0 (17.0)

*Blank cells indicate that no data were reported.

to test for differences in SIP scores between the groups and adjusted for confounding socio-demographic covariables (using dummy variables for categorical variables).

Power analysis, utilizing reported distributions of SIP scores and the known distribution of reading levels among PCAE students, indicated that at least 175 subjects were needed for this research. The Statistical Analysis System (SAS) and the Statistical Package for the Social Sciences (SPSS) were used for data analysis.

Results

Of the first 197 randomly selected individuals who met eligibility requirements, 193 agreed to participate.

Indicators of Health Services Utilization and Self-Evaluation of Physical Health

One hundred fifty-five (80.3 percent) of the subjects reported visiting a physician's office for health care during the past year. The average number of times these 155 subjects had been to a physician's office was 5.53 (± SD 11.92), range was 1 to 100 visits per year. The median number of visits was 3.0.

Thirty-two (16.6 percent) of the subjects had been hospitalized during the past year. The number of hospitalizations per subject among those 32 individuals ranged from 1 to 30; median was 1.0 and mean was 3.25 (± SD 6.81).

Fifty-seven of the 193 subjects (29.5 percent) reported taking prescription medication on a regular basis. Among these 57 subjects, the average number of medications taken per day was 1.98 (± SD 1.79).

Only 49 (25.4 percent) of the 193 subjects self-rated their health as excellent, whereas 92 (47.7 percent) rated their health as good, 45 (23.3 percent) rated it as fair, and 7 (3.6 percent) indicated poor health.

Reading Levels

The subjects' mean reading level was grade 7.17 (± 2.77). The assessment of reading levels had been made either at entry into PCAE or at the beginning of the current academic session; we accepted the most recent of the two assessments. The mean time interval between the subject's reading level assessment and SIP testing for this study was 2.2 (± 3.6) months. Figure 1 shows the distribution of the subjects' reading levels.

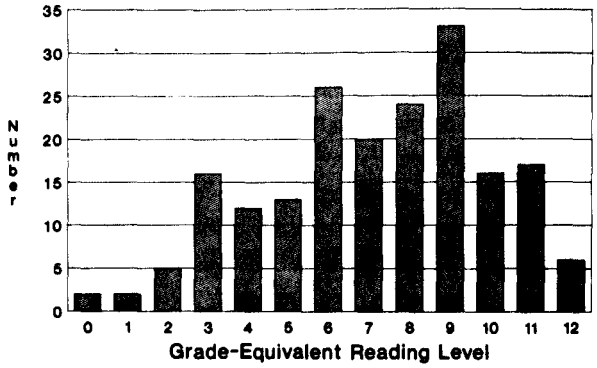

Figure 1. Frequency distribution of grade-equivalent reading levels among the 193 adults who participated in the study, with reading levels rounded to nearest integer grade level. All subjects were enrolled in a publicly funded literacy instruction program.

SIP Scores

Table 3 presents unadjusted and adjusted mean SIP scores according to reading level (divided at the 4th grade level). Physical, psychosocial, and total SIP scores were all related to reading level. The strongest relation, however, was between reading level and SIP physical score.

Table 3. Mean Sickness Impact Profile (SIP) Scores According to Reading Level.

SIP Scores	Subjects Who Read at or below 4th Grade Level (n = 37)	Subjects Who Read above 4th Grade Level (n = 156)	*P* Value
Mean physical score			
Unadjusted*	6.5	2.5	0.0008
Adjusted†	6.2	2.3	0.002
Mean psychosocial score			
Unadjusted*	17.8	12.8	0.10
Adjusted†	15.4	8.0	0.02
Mean total (overall) score			
Unadjusted*	11.7	8.3	0.04
Adjusted†	10.4	6.0	0.02

*No adjustment for covariables.

†Adjusted for age, sex, ethnicity, marital status, insurance status, occupation, and income.

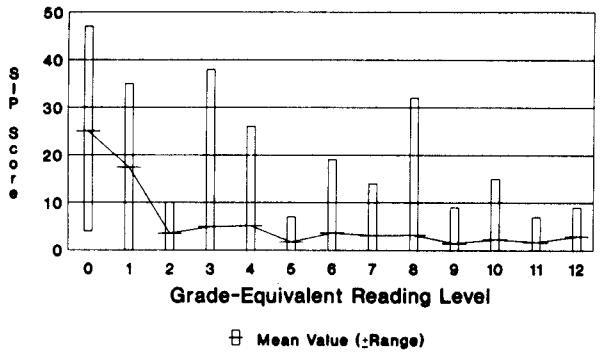

Figure 2. Frequency distribution of the Sickness Impact Profile (SIP) physical health scores among the 193 study participants. Higher scores represent a greater degree of sickness-related dysfunction.

SIP Physical Score

Figure 2 displays the distribution of SIP physical scores. The mean score was 3.25 (± 6.67). Subjects with very poor reading skills had higher mean physical SIP scores (greater degree of sickness-related dysfunction) than did subjects with more advanced literacy skills (Figure 3).

The mean physical SIP score for subjects with reading levels at or below grade level 4 was higher than the mean score of subjects who read at more advanced reading levels (6.54 versus 2.48, $P < 0.0008$). The relation remained significant ($P < 0.002$, Table 3) after adjusting for potentially confounding covariables. This statistical difference was primarily due to the effect of a small number of subjects with very poor reading levels (grades 0.0 to 1.9).

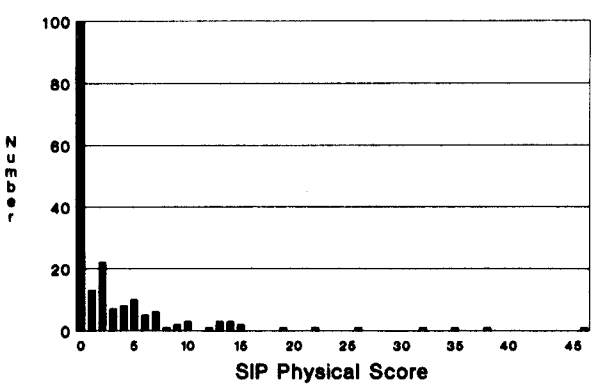

Figure 3. Sickness Impact Profile (SIP) physical health scores of subjects at each grade-equivalent reading level. Higher SIP scores indicate a greater degree of sickness-related dysfunction. Reading levels were rounded to nearest integer grade level. Both mean SIP score and range of SIP scores given for each grade level.

SIP Psychosocial Scores

Psychosocial SIP scores ranged from 0.0 to 68.0; the mean was 13.75 (± 16.41). This mean score is comparable with scores found among patients with significant medically related psychosocial dysfunction (Table 2). The relation between psychosocial SIP score and reading level was significant after adjustment for confounding variables ($P < 0.02$, Table 3).

Discussion

We initially considered two possible study designs for this research. One design involved comparing the health status of illiterate adults with the health status of adults with "normal" literacy. Because illiteracy occurs frequently among those of low socioeconomic strata, the two groups would have very different sociodemographic characteristics, thus threatening validity of comparisons between the groups.

The second study design, which was ultimately used, involved evaluating persons whose demographic characteristics were relatively homogeneous and determining whether their variations in literacy skills were associated with variations in health status. Thus, the study population itself provided some inherent control over sociodemographic covariables. Statistical methods were then used to provide additional adjustment for these covariables.

Physical Health

The results of this research suggest that there is a relation between poor literacy skills and poor health in the United States, just as there is in nonindustrialized nations. The relation was statistically significant even after controlling for confounding covariables. The relation of literacy skills to physical health was particularly strong ($P < 0.002$) and was due primarily to the poor health status of individuals with extremely poor reading skills.

The results are of even greater interest given a research design that could have biased the results against finding a relation between illiteracy and poor health. One example of this bias is that the study population consisted mostly of young adults, a group with a limited range of medical

problems and less severe illness in comparison with older populations. The smaller range of medical problems decreased the range of SIP scores and, therefore, lessened the ability of statistical tests to detect a relation between SIP scores and illiteracy.

A second factor that could have biased the study against detecting a relation between health status and illiteracy is that the SIP test seemed to lack sensitivity for demonstrating health status differences among subjects: more than one-half of the subjects had a physical SIP score of 0.0. Here again, the decreased variation in SIP scores reduced the ability of statistical tests to detect a relation between illiteracy and poor health.

A third methodological bias was right truncation of the study population (i.e., exclusion of persons with reading levels above grade 12). If such individuals had been tested, differences in SIP scores between high- and low-level readers might have been more marked.

Psychosocial Health

The apparent poor psychosocial health of study participants is worthy of special note. Our subjects' psychosocial SIP scores were in the range generally found among persons with serious psychosocial dysfunction (Table 2).

Previous research has shown that, in general, persons from lower socioeconomic strata are at higher risk for depression and other psychiatric morbidity.[40-46] The poor psychosocial health of subjects in this study thus could be partly attributable to their socioeconomic status. After adjusting for socioeconomic variables, however, psychosocial SIP scores were still related to literacy, suggesting that lack of adequate reading skills can itself play a role in poor psychosocial health.

The subjects in this study were a special group of self-selected adults who had the individual personal motivation to seek additional education. It is possible that psychosocial health impairment among other illiterate adults can be even more significant and contribute to their failure to seek remedial literacy education.

Implications for Clinicians

The mechanisms by which literacy and health are interrelated have not been clarified, nor has causation been established. That is, low literacy skills might or might not directly cause poor health status. Nonetheless, the results of this study indicate that patients with extremely poor literacy skills (particularly at grade levels 0–1) are at increased risk for poor health, regardless of other sociodemographic characteristics.

There are several plausible mechanisms by which illiteracy could affect health status.[47] Illiterate patients might fail to obtain or understand information regarding their personal medical care. Illiterate individuals also might not understand how to use the health care system properly, potentially resulting in inappropriate overuse or underuse of services. Both mechanisms could increase costs and rates of adverse medical outcomes.

The association between illiteracy and health status found in this research suggests that improving literacy skills of US residents might improve the population's health status. If confirmed by other studies, there would be medical justification for initiatives to improve the literacy skills of our populace.

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