Medical Conditions, Health Status, and Health Services Utilization

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Using data from the 1980 National Medical Care Utilization and Expenditure Survey (N = 11,530), four commonly used health status indicators are interpreted in terms of the underlying medical conditions they reflect. It is found that self-rated health status, role limitations, restricted activity days, and functional limitations measure similar conditions. These conditions tend to be chronic and severe; heart and cerebrovascular disease are especially associated with poor health as measured by all of the variables. Disability days is most likely to reflect acute, transitory morbidity. Practical suggestions for the appropriate use of the four variables are made. In addition, the conditions associated with the most ambulatory utilization of health services are identified. Among these conditions, those which are and are not measured adequately by the health status indicators are disclosed. It is concluded that the health status variables, either individually or as a group, do not measure many variations in health that are strongly related to utilization.

Measuring health status accurately is a prerequisite of much health-related research. It is a key descriptive quantity, outcome measure, and explanatory variable. Many different health status indicators have been developed (Brook et al. [1]). In particular applications, choosing an appropriate health status variable is crucial to obtaining meaningful results (Ware et al. [2]). The variable used to measure health should sensitively reflect those dimensions of health (or morbidity) of special concern for the purposes of the analysis.

Four of the most widely used health status variables are self-rated, or perceived health status (PHS), role limitations (RL), restricted

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activity days (RAD), and functional limitations (FL). This article offers specific guidance on times when use of these four popular health status measures is appropriate. We do so by comparing two alternative characterizations of a person's health, the health status indicators and the presence of any of a comprehensive list of medical conditions. The very detailed characterization of health provided by the medical conditions is used to analyze which variations in health the health status variables measure and which they do not. The results can be used to judge the usefulness of any one of these health status variables for particular applications.

One of the most important applications of health status measures is in explaining utilization of health care services [3, 4]. A second contribution of this article is to indicate which sorts of utilization the four health status measures explain well, and which they do not explain. We do this by estimating the ambulatory utilization associated with each medical condition, then analyzing which of the conditions accounting for the most utilization the health status variables measure. The result of the two lines of inquiry in this article is a better understanding of what the four popular health status indicators measure and of their limitations in explaining utilization of health services.

DATA AND METHODS

DATA

The data used in this study are from the 1980 National Medical Care Utilization and Expenditure Survey (NMCUES). The NMCUES obtained information on basic demographic characteristics, health, use of medical services, associated charges and sources of payment, and health insurance coverage from about 6,600 randomly selected households. It was cosponsored by the National Center for Health Statistics and the Health Care Financing Administration and sampled the civilian, noninstitutionalized U.S. population. Households were interviewed in five rounds at roughly three-month intervals from early 1980 to mid-1981. We restrict the sample to adults, defined as 17 years of age or older. The resulting sample size is 11,530 persons. Of this total, 53 percent are female, 14 percent are 65 years of age and older, 12 percent are nonwhite, and 29 percent have a family income exceeding $30,000 (1980 dollars).

VARIABLE MEASUREMENT

Health Status

The four health status variables analyzed here are described in Table 1. Perceived health status is a standard self-rated health status measure. The role limitations variable was constructed from a series of questions concerning ability to perform the usual activities of living (working, keeping house, and so on). The battery of functional limitations questions asked about ability to walk, drive a car, climb stairs, dress oneself, engage in vigorous activities, and so forth. These questions were adapted from those developed by the RAND Corporation for use in their Health Insurance Study [5]. Restricted-activity days is the sum of "bed-days," "work-loss days," and "cut-down days" minus "work-loss days in bed." Perceived health status and role limitations were measured at the beginning of the year of the NMCUES survey (round 1), while functional limitations was measured at the end (round 5). Restricted-activity days was measured in all five rounds of the survey.

Conditions

Medical conditions, defined as any departure from a state of physical or mental well-being, were mostly reported in the NMCUES as the cause of restricted activity or visits to medical providers. If a person reported, say, bed-days or a physician visit, he was then asked what condition caused the restricted activity or provider visit. Thus, conditions were not measured independently of health status or utilization. This may result in some upward bias in the estimated effect of the presence of a condition on poor health status or utilization. However, the *relative* ranking of conditions in affecting health status or utilization, the primary focus of this study, should be less affected.

The NMCUES collected information on each condition reported by a respondent. This information was used to code to the ninth revision of the *International Classification of Diseases* as adapted for use with household surveys by the National Health Interview Survey. The NMCUES aggregates the four-digit ICD-9 codes into 57 broader disease categories,[1] which we follow. Because of small numbers of cases in some classifications, we further collapsed some of the categories. The final result was 42 conditions. The 42 condition categories plus each one's ICD codes and its prevalence/incidence in our sample are given in Table 2.

The NMCUES diagnostic categories vary in homogeneity and meaningfulness. Some conditions are narrowly specified (for instance,

Table 1: Health Status Measures

Variable	*Number of Questions*	*Typical Item*	*Measurement*	*Scaling*	*Distribution of Responses*
Perceived health status (PHS)	1	Compared to other people (person's) age, would you say that (person's) health is excellent, good, fair, or poor?	Round 1	4-level categorical scale	45% excellent 38% good 12% fair 5% poor
Role limitations (RL)	7	Would (person's) health keep (him/her) from working on a job for pay now?	Round 1	4-level categorical scale	88.8% not limited .4% ltd. in outside activities 1.8% ltd. amount/kind usual activity 9.1% cannot perform usual activity
Functional limitations (FL)	15	Does (person) have trouble bending, lifting, or stooping because of health?	Round 5	8-level Guttman scale	76% level 1 (no limitation) 6% level 2 (minimal limitation) 4% level 3 5% level 4 4% level 5 3% level 6 1% level 7 1% level 8 (most severe limitation)
Restricted-activity days (RAD)	3	Since (reference date), how many days did illness or injury keep (person) in bed all or most of the day?	All 5 rounds	Continuous from 0 to 366 days	mean = 15.5 days; std. dev. = 37.7 days. 36% of the sample had 0 RAD.

hypertension, normal pregnancy and delivery). Others are more heterogeneous (tuberculosis, ricketosis, venereal and parasitic diseases). However, the categories that include a wider range of diagnoses are, in many cases, dominated by a few of the more frequently occurring diagnoses.

The NMCUES condition categories are based primarily on the body system affected. They generally do not distinguish acute from chronic morbidity. Nor do they identify the severity of illness within diagnostic category. However, some conditions are inherently or predominantly acute (for example, intestinal infectious diseases), while others are chronic (hypertension). Moreover, some conditions (malignant neoplasm) are clearly more severe and life-threatening than others (dislocations, sprains, strains). Comparison of the effects of different types of conditions on the health status measures gives some indication of the effects of the chronicity or severity of morbidity on measured health status.

Utilization

Utilization is defined as the weighted sum of visits to all medical providers, excluding only hospital inpatient and dental care. The NMCUES distinguishes six types of ambulatory visits: emergency room, hospital outpatient (MD seen), hospital outpatient (MD not seen), physician (MD seen), physician (MD not seen), and nonphysician (for example, chiropractor, podiatrist, optometrist, psychologist). Each respondent's visits to each type of provider were weighted by the mean charge for all sample visits of that type, then summed. The purpose of weighting by charges is to capture variations in the content of different types of visits so that they can be aggregated into a single utilization index. For example, the mean charge for a hospital outpatient visit ($65) is twice that for a physician office visit ($32), so that in the utilization index an outpatient department visit is regarded as equivalent to two physician visits. Weighting visits by charges is a standard procedure which has been used in other studies of utilization [6]. Mean ambulatory utilization for the sample is $192 (or the equivalent of 192/32 = 6 physician office visits). Twenty-one percent of the sample had no ambulatory utilization.

Table 2: Medical Condition Descriptions

Condition Number	*ICD-9 Code*	*Prevalence/ Incidence (%)*	*Description (Examples)*
1	001-009	2.0	Intestinal infectious diseases (salmonella infections, dysentery)
2	010-018, 080-139	2.2	Tuberculosis, rickettsiosis, venereal diseases, and parasitic diseases
3	020-041	1.6	Other bacterial diseases (scarlet fever, tetanus)
4	045-079	5.1	Viral diseases (measles, shingles, hepatitis)
5	140-165, 179-208, 230-239	2.2	Malignant neoplasm, carcinoma *in situ*, other neoplasm
6	170-175	.8	Malignant neoplasm bone, connective tissue, skin, and breast
7	210-229	1.4	Benign neoplasm
8	240-279	9.1	Endocrine, metabolic diseases, immunological disorders, nutritional deficiencies (diabetes, thyroid diseases)
9	280-289	1.4	Diseases of the blood and blood-forming organs (anemia, hemophilia)
10	290-319	6.6	Mental disorders (psychoses, neuroses, drug, alcohol abuse, mental retardation)
11	320-359	4.1	Diseases of the nervous system (epilepsy, multiple sclerosis, Alzheimer's disease)
12	360-379	20.0	Disorders of the eye and adnexa (myopia, farsightedness, astigmatism, cataract)
13	380-389	5.3	Diseases of the ear and mastoid process
14	390-398, 440-459	4.9	Rheumatic fever and rheumatic heart disease, other diseases of the circulatory system
15	401-405	13.2	Hypertensive disease
16	410-414	1.9	Ischemic heart disease (acute myocardial infarction, angina, atherosclerosis)

Continued

Table 2: Continued

Condition Number	*ICD-9 Code*	*Prevalence/ Incidence (%)*	*Description (Examples)*
17	415-429	3.5	Disease of pulmonary circulation and other forms of heart disease (congestive heart failure)
18	430-438	1.2	Cerebrovascular disease
19	460-478	25.5	Diseases of the upper respiratory tract (common cold, sore throat, allergies)
20	480-519	30.0	Other diseases of the respiratory system (pneumonia, influenza, emphysema, asthma)
21	520-529	5.3	Diseases of the oral cavity, salivary glands, and jaws
22	530-579	10.4	Diseases of other parts of the digestive system (ulcers, hernia, cirrhosis of liver)
23	580-599	5.8	Diseases of the urinary system (renal failure, bladder infection)
24	600-608	.9	Diseases of the male genital organs
25	610-629	7.8	Diseases of the female genital organs
26	630-648, 651-676	1.4	Abortion, obstetric causes
27	650	3.0	Normal pregnancy and delivery
28	680-709	9.8	Diseases of the skin and subcutaneous tissue (acne, eczema, dermatitis)
29	710-739	24.4	Diseases of the musculoskeletal system and connective tissue (arthritis, back problems, rheumatism, osteoporosis)
30	740-779	.7	Congenital anomalies, conditions originating in perinatal period
31	780-799	16.0	Signs, symptoms, ill-defined conditions
32	800-829	2.4	Fractures
33	830-848	5.5	Dislocations, sprains, and strains
34	850-869, 950-957	.7	Intracranial and internal injuries

Continued

Table 2: Continued

Condition Number	ICD-9 Code	Prevalence/ Incidence (%)	Description (Examples)
35	870-904	4.1	Open wounds and injuries to blood vessels
36	930-939	.7	Effect of foreign body entering through orifice
37	940-949	.6	Burns
38	960-995	.7	Poisonings and toxic effects
39	996-999	1.9	Complications of medical and surgical care
40	910-929, 958-959	6.9	Other injuries, early complications of trauma, impairments from injuries/accidents (superficial and crushing injuries, shock following injury)
41	905-909	.9	Late effects of injuries, poisonings, toxic effects, and other external causes
42	–	2.4	Unknown condition

ANALYTICAL METHODS

Health Status Regressions

To determine the relationship between the health status measures and the medical conditions, each health status indicator was regressed on the 42 condition dummy variables. The categorical nature of PHS, RL, and FL means that ordinary least squares is not an appropriate estimation technique. Instead, we employed ordered logistic regression [7], which accounts both for the discrete categories of these three health status variables and for the ordered nature of their levels (for instance, excellent health is better than good health which is better than fair health). Ordered logistic regression is a maximum-likelihood technique which requires no arbitrary scaling assumptions nor any collapsing of the response categories. Because of less restrictive assumptions, it is preferred to discriminant analysis [8]. The RL logistic regression did not converge because of a perfect association in our sample between the condition cerebrovascular disease and the category "cannot perform usual activity" (the "perfect-classification problem"). To estimate the regression coefficients, we instead used an iterative least-squares

approximation described in Salkever et al. [9]. The estimated coefficients from the logistic regressions may be used to calculate how the presence of a medical condition affects the probability of reporting poor health, role limitations, or functional limitations. In each health status equation, the following demographic covariates were included: age, age-squared, the log of family income, and dummy variables for race, sex, education, and marital status.

RAD is much more continuous than PHS, RL, or FL. However, the number of disability days must be zero or positive. In estimation, the limited range of RAD and the concentration of observations at the limit value (zero disability days) should be taken into account. An econometric technique which appropriately does so is tobit regression [10]. The tobit technique was used to estimate a regression of RAD on the medical condition and demographic variables. The results of this regression were used to calculate the increase in the expected number of disability days attributable to each medical condition.

Utilization Equation

To determine the ambulatory utilization associated with each condition, we regressed the weighted visits utilization index on the 42 condition dummies and a standard set of "enabling" and "predisposing" factors (using Andersen's terminology [11]). The additional covariates are age, race, sex, family income and size, education of the head of household, regional and urban/rural location, marital status, and health insurance coverage. Since it cannot be negative, utilization—like RAD—is a limited dependent variable. Hence, the utilization equation was also estimated by the tobit technique. The results of the estimation were used to calculate the mean (expected) utilization attributable to each condition; then conditions were ranked from first to last by the amount of utilization with which they were associated.

RESULTS

HEALTH STATUS VARIABLES

Table 3 presents summary regression statistics for the five equations we estimated. The Chi-square statistics reveal that, as a group, the medical condition and demographic variables have a highly statistically significant relationship to all of the health status measures and to ambulatory utilization. Moreover, virtually all of the medical conditions (40 of 42) have a statistically significant association with utilization.

Table 3: Summary Regression Statistics

*Dependent Variable**	*Estimation Method**	χ^2	*DF*	*p*	*Number of Statistically Significant Condition Coefficients* †
PHS	OLR	3,433	53	.001	24
RL	ILS	78‡	53;11,476	.001	18
FL	OLR	4,872	53	.001	24
RAD	Tobit	3,812	53	.001	32
Utilization	Tobit	4,202	58	.001	40

* PHS: perceived health status; RL: role limitations; FL: functional limitations; RAD: restricted-activity days; OLR: ordered logistic regression; ILS: iterative least squares (see text).

† Of the 42 conditions, the number with coefficients statistically significantly greater than 0, at the 10 percent level of significance, one-tailed test. The health status variables were scaled so that more positive indicates poorer health.

‡ *F*-statistic.

However, several of the health status indicators do not measure a large proportion of the medical conditions. Only 18 of 42 conditions statistically significantly increase the probability of reporting role limitations, and only 24 increase the probability of reporting poorer perceived health and more severe functional limitations. The PHS and RL variables are comprised of just four categories and were measured only once, at the beginning of the year of the NMCUES survey. FL contains just eight categories and was also measured only once, at the end of the year. Responses on all three variables are highly skewed toward good health or no limitations (see Table 1). Measuring health status by collecting these variables at one point in time is insufficiently precise to reflect the variations in health that many medical conditions indicate—variations which are, indeed, associated with the utilization of medical services. Restricted-activity days, measured throughout the year, has a greater range (0–366 days) and a less skewed distribution of responses. It is more sensitive, measuring 32 conditions.

Specifically, what medical conditions are most associated with poor health as measured by each of the health status indicators? Table 4 lists, for each health status variable, the ten conditions most associated with poor health as measured by that variable. (Full regression results are available on request from the author.) For example, the presence of cerebrovascular disease is associated with the greatest increase among all of the conditions in the probability of reporting poor health (PHS), role limitations (RL), or functional limitations (FL). It is also associ-

Table 4: Medical Conditions Most Associated with Poor Measured Health Status

Rank of Condition	*Variable Measuring Health Status**			
	PHS	*RL*	*FL*	*RAD*
1	Cerebrovascular disease (18)†	Cerebrovascular disease (18)	Cerebrovascular disease (18)	Cerebrovascular disease (18)
2	Ischemic heart disease (16)	Disease of pulmonary circulation and other heart disease (17)	Ischemic heart disease (16)	Fractures (32)
3	Disease of pulmonary circulation and other heart disease (17)	Ischemic heart disease (16)	Congenital anomalies (30)	Complications of medical and surgical care (39)
4	Congenital anomalies (30)	Rheumatic fever, heart disease; other circulatory disease (14)	Diseases of musculoskeletal system and connective tissue (29)	Disease of pulmonary circulation and other heart disease (17)
5	Diseases of the nervous system (11)	Complications of medical and surgical care (39)	Diseases of the nervous system (11)	Malignant neoplasm (5)
6	Rheumatic fever, heart disease; other circulatory disease (14)	Diseases of the nervous system (11)	Diseases of pulmonary circulation and other heart disease (17)	Ischemic heart disease (16)
7	Diseases of musculoskeletal system and connective tissue (29)	Mental disorders (10)	Complications of medical and surgical care (39)	Other diseases of respiratory system (20)
8	Diseases of other parts of digestive system (22)	Diseases of musculoskeletal system and connective tissue (29)	Fractures (32)	Intracranial and internal injuries (34)
9	Diseases of blood and blood-forming organs (9)	Congenital anomalies (30)	Intracranial and internal injuries (34)	Abortion, obstetric causes (26)
10	Endocrine, metabolic, nutritional (8)	Fractures (32)	Rheumatic fever, heart disease; other circulatory disease (14)	Diseases of musculoskeletal system and connective tissue (29)

*PHS: perceived health status; RL: role limitations; FL: functional limitations; RAD: restricted-activity days.

†The numbers in parentheses identify the condition in Table 2.

ated with the largest increase in the expected number of restricted-activity days (RAD).

The similarities among the conditions the health status variables measure are much more striking than the differences. In particular, all of the indicators strongly reflect conditions of the circulatory system, which are predominantly chronic and serious. Among the group of circulatory conditions used here, only the less severe hypertensive disease does not have a strong impact on all four health status variables (rheumatic fever and rheumatic heart disease is ranked 13th in the RAD equation).

Perceived health status (PHS) reflects serious, chronic conditions. In addition to heart and cerebrovascular disease, it measures diseases of the nervous system (epilepsy, multiple sclerosis, Alzheimer's disease) and diseases of the musculoskeletal system and connective tissue (arthritis, back problems, osteoporosis). PHS is the best among the variables at measuring conditions chronic and serious, yet managed so that activity and roles are not significantly restricted. Ulcers and hernias (diseases of other parts of the digestive system); anemia and hemophilia (diseases of the blood and blood-forming organs); and diabetes and thyroid problems (endocrine, metabolic, nutritional) are examples. On the other hand, PHS does not measure acute, transitory morbidity. It is the only one of the four indicators which does not measure fractures well (rank 23 in the PHS regression). Other more transitory and/or less threatening conditions, such as minor burns (rank 42), dislocations, sprains, and strains (rank 41), and intestinal infectious diseases (rank 40), are also not picked up by PHS. If it had been sampled throughout the year rather than collected only at the beginning, PHS might have reflected acute events more satisfactorily. However, Goldstein et al. [12] report that changes in PHS scores over a year's period are not correlated with acute illness or even with the onset of chronic illness.

Even more so than the other indicators, role limitations is dominated by the circulatory conditions. The coefficients of the four highest-ranked conditions in the RL regression, all circulatory morbidity, are substantially larger than the coefficient of any other condition. In addition, RL measures mental disorders (which includes drug and alcohol abuse) relatively better than the other variables.

Restricted-activity days (RAD) is less dominated by circulatory conditions than the other indicators. Fractures is ranked second and complications of medical and surgical care, third. More acute types of morbidity, such as fractures, intracranial and internal injuries, and

abortion-obstetric causes, have a greater effect on RAD than on the other indicators.

Table 4 reveals those conditions most likely to lead to poor measured health status among people who have the condition. However, a number of the conditions listed in Table 4 are rare in the NMCUES sample. To discover which conditions are most associated with poor measured health status across the entire sample, we multiplied the regression coefficient of each condition by its prevalence/incidence in the NMCUES sample (these are given in Table 2), and ranked the resulting numbers from highest to lowest. Table 5 lists, for each health status variable, the ten conditions most associated with poor health across the entire sample. For example, other diseases of the respiratory system is estimated to cause more restricted-activity days for the entire sample than any other condition. Its rank moves from seventh in Table 4 to first in Table 5, because it is much more prevalent than any of the conditions ranked ahead of it in Table 4.

Not surprisingly, many of the conditions listed in Table 5 are quite prevalent in the sample. On the other hand, some very prevalent conditions (such as disorders of the eye and adnexa, and diseases of the skin and subcutaneous tissue) are not present in Table 5 because they have little effect on measured health status. Conversely, several of the circulatory conditions are not especially prevalent but have a large effect on measured health status, and so are present in Table 5. Again, the conditions reflected by the various health status indicators are quite similar. As before, restricted-activity days is more likely to reflect transitory morbidity (diseases of the upper respiratory tract, fractures, and dislocations, sprains, and strains).

AMBULATORY UTILIZATION AND HEALTH STATUS

Which medical conditions are associated with the greatest ambulatory utilization of medical services? How well do the health status indicators measure these conditions? Table 6 lists the ten conditions associated with the most utilization among those in the NMCUES sample who had them. In addition, the amount of utilization attributable to a particular condition and the size-rank of its coefficient in both the utilization and health status regressions are reported.

Among the conditions associated with extensive ambulatory utilization, the first-ranking condition, normal pregnancy and delivery, is not measured well by any of the health status indicators. Normal pregnancy is related to an increase of $222 in expected utilization, or the equivalent of 6.9 physician visits (222/32 = 6.9, where $32 is the

Table 5: Medical Conditions, Adjusted for Prevalence/Incidence, Most Associated with Poor Measured Health Status

Rank of Condition	*Variable Measuring Health Status**			
	PHS	*RL*	*FL*	*RAD*
1	Diseases of musculoskeletal system and connective tissue (29)†	Diseases of musculoskeletal system and connective tissue (29)	Diseases of musculoskeletal system and connective tissue (29)	Other diseases of the respiratory system (20)
2	Other diseases of the respiratory system (20)	Disease of pulmonary circulation and other heart disease (17)	Other diseases of the respiratory system (20)	Diseases of musculoskeletal system and connective tissue (29)
3	Diseases of other parts of digestive system (22)	Signs, symptoms, ill-defined conditions (31)	Signs, symptoms, ill-defined conditions (31)	Diseases of other parts of digestive system (22)
4	Hypertension (15)	Mental disorders (10)	Diseases of other parts of digestive system (22)	Diseases of the upper respiratory tract (19)
5	Endocrine, metabolic, nutritional (8)	Rheumatic fever, heart disease; other circulatory disease (14)	Diseases of the nervous system (11)	Signs, symptoms, ill-defined conditions (31)
6	Signs, symptoms, ill-defined conditions (31)	Cereberovascular disease (18)	Hypertension (15)	Disease of pulmonary circulation and other heart disease (17)
7	Disease of pulmonary circulation and other heart disease (17)	Ischemic heart disease (16)	Disease of pulmonary circulation and other heart disease (17)	Fractures (32)
8	Rheumatic fever, heart disease, other circulatory disease (14)	Diseases of other parts of digestive system (22)	Endocrine, metabolic, nutritional (8)	Cerebrovascular disease (18)
9	Diseases of the nervous system (11)	Diseases of the nervous system (11)	Ischemic heart disease (16)	Rheumatic fever, heart disease, other circulatory disease (14)
10	Mental disorders (10)	Diseases of the urinary system (23)	Other injuries, early complication of trauma (40)	Dislocations, sprains, and strains (33)

*PHS: perceived health status; RL: role limitations; FL: functional limitations; RAD: restricted-activity days.

†The numbers in parentheses identify the condition in Table 2.

Table 6: Medical Conditions Associated with the Most Ambulatory Utilization, and Effect of These Conditions on Measured Health Status

Condition	*Estimated Utilization*	*Ranks† of the condition in determining:**				
		Utilization	*PHS*	*RL*	*FL*	*RAD*
Pregnancy and delivery (27)‡	$222	1	34	20	41	16
Ischemic heart disease (16)	$155	2	2	3	2	6
Malignant neoplasm bone, skin, breast (6)	$151	3	17	26	32	32
Malignant neoplasm (5)	$150	4	14	11	23	5
Fractures (32)	$143	5	23	10	8	2
Complications of medical and surgical care (39)	$140	6	11	5	7	3
Burns (37)	$139	7	42	41	42	14
Disease of pulmonary circulation and other heart disease (17)	$129	8	3	2	6	4
Intracranial and internal injuries (34)	$113	9	16	29	9	8
Mental disorders (10)	$113	10	13	7	22	29

*PHS: perceived health status; RL: role limitations; FL: functional limitations; RAD: restricted-activity days.

†Ranks may vary from 1 to 42, for each of columns 4–7. The condition most associated with poor measured health status is ranked 1, the condition least associated is ranked 42.

‡The numbers given in parentheses identify the condition in Table 2.

average charge for a physician visit), the most of any condition. However, it ranked only 34th among the 42 conditions in increasing the probability of reporting poor health, 20th in increasing the probability of reporting role limitations, 41st in increasing the probability of reporting functional limitations,[2] and 16th in increasing the expected number of restricted-activity days. This important health state is not measured adequately by any of the battery of standard morbidity-oriented health status variables employed by the NMCUES. Therefore, in utilization studies, some other means of measuring pregnancy—such as the proxy number of women of childbearing age—must be found to avoid potential omitted-variable bias.

In addition to pregnancy, the two conditions—cancer of the bone, connective tissue, skin, and breast, and burns—are not measured well by any of the health status variables. Cancer of the bone, connective

tissue, skin, and breast could consist mostly of simple skin cancers. Since such cancers can be effectively treated, they apparently do not have an adverse impact on measured health status. Burns, which are acute, transitory events, are (not surprisingly) missed by PHS, RL, and FL, which are measured only once, at the beginning or end of the year. Burns have some impact on RAD, but not as much as on utilization. The other conditions are measured reasonably well by at least one of the indicators. Among the health status measures,restricted-activity days clearly best reflects the conditions related to the most utilization.

To determine the conditions most responsible for utilization across the entire sample, we multiplied the increase in expected utilization attributable to each condition by that condition's prevalence/incidence. The ten conditions accounting for the most utilization across the sample are listed in Table 7, together with the ranks of the conditions in determining poor health across the sample, as measured by each health status indicator. For example, diseases of the musculoskeletal system and connective tissue, although it ranks only 14th among the conditions in increasing expected utilization, is quite prevalent (p = 24.4 percent), so it is related to more utilization across the sample than any other condition. It is also most associated with poor health in aggregate as measured by all of the health status variables except disability days, where it is ranked second.

Among the conditions identified in Table 7, the majority are measured well by one or more of the health status indicators. However, three conditions, disorders of the eye and adnexa, diseases of the skin and subcutaneous tissue, and normal pregnancy and delivery, are not picked up adequately by any of the indicators. These conditions, although associated with extensive ambulatory utilization across the sample, appear not to restrict activity or cause poor perceived health. This may be because diseases of the skin and subcutaneous tissue, while of cosmetic concern, are generally not severe or disabling; disorders of the eye and adnexa, if treated properly (for instance, with eyeglasses), are also typically not disabling or very serious; and normal pregnancy and delivery is not morbidity.

CONCLUSIONS AND IMPLICATIONS

What practical guidance is available to researchers based on the results of this article? All four health status variables measure the predominantly chronic, severe disease of the circulatory system—heart and cerebrovascular disease. If the primary goal is to measure these condi-

Table 7: Medical Conditions Associated with the Most Ambulatory Utilization, and Effect of These Conditions on Measured Health Status, Adjusted for Prevalence/Incidence of Conditions

Condition	*Ranks† of the condition in determining:**				
	Utilization	*PHS*	*RL*	*FL*	*RAD*
Diseases of musculoskeletal system and connective tissue (29)‡	1	1	1	1	2
Disorders of eye and adnexa (12)	2	37	41	40	29
Other diseases of respiratory system (20)	3	2	12	2	1
Diseases of upper respiratory tract (19)	4	29	42	35	4
Signs, symptoms, ill-defined conditions (31)	5	6	3	3	5
Hypertensive disease (15)	6	4	13	6	35
Diseases of skin and subcutaneous tissue (28)	7	23	39	19	36
Diseases of other parts of digestive system (22)	8	3	8	4	3
Pregnancy and delivery (27)	9	34	20	42	19
Mental disorders (10)	10	10	4	14	20

*PHS: perceived health status; RL: role limitations; FL: functional limitations; RAD: restricted-activity days.

†Ranks may vary from 1 to 42, for each of columns 3–6. The condition most associated with poor measured health status is ranked 1, the condition least associated is ranked 42.

‡The numbers given in parentheses identify the condition in Table 2.

tions, using more than one of the health status variables is redundant: role limitations is the purest measure of heart and cerebrovascular disease. PHS, RL, and FL also measure other serious, chronic conditions well—congenital anomalies, diseases of the nervous system (epilepsy, multiple sclerosis, Alzheimer's disease) and diseases of the musculoskeletal system and connective tissue (arthritis, back problems, osteoporosis). PHS is the best variable for measuring chronic and serious, yet manageable conditions—hypertension, diabetes, thyroid problems, anemia, hemophilia, ulcers. In addition to circulatory conditions, RL is relatively good at measuring mental disorders (including drug and alcohol abuse). RAD, as collected in all five rounds of the NMCUES, is the best of the four variables at measuring acute, transi-

tory morbidity—but only (not surprisingly) the type which results in significant restricted activity. Fractures, dislocations, sprains and strains, and respiratory illnesses are among the transitory illnesses RAD gauges. Since it is the most dissimilar of the four health status indicators analyzed here, RAD is a good choice for use in combination with one of the other three variables.

While reflecting certain conditions adequately, the health status variables—either singly or as a group—are incomplete measures of Andersen's "need for care" [11]. Virtually all of the conditions are related to the utilization of medical services. Yet the role limitations variable does not measure over 50 percent of the conditions, and 40 percent have no impact on perceived health and functional limitations. Disability days does better, but still misses 20 percent of the conditions. Even as a group, the health status variables do not measure a number of conditions associated with extensive ambulatory utilization.

The conditions the health status variables do not measure fall into several categories. Less severe, non-life-threatening, and transitory conditions, which may nonetheless result in substantial utilization, are gauged inadequately. Diseases of the skin and subcutaneous tissue (acne, eczema, dermatitis) and burns are examples. Pregnancy, where medical visits are mostly of a preventive, monitoring nature for a transitory health state, is another similar example. It is not surprising that health status measured at the beginning (PHS, RL) or end (FL) of the year does not capture acute events with no lasting impact on health. Nevertheless, such one-time measurement of health status is common in surveys. An improvement in measurement of transitory health events might be achieved by more frequent sampling of health status. However, the wording of the health status questions would also need to be modified to focus the respondent on a shorter time frame. For example, the self-rated health question might be changed from "In general, how do you rate your health compared to others your own age?" to "How has your health been in the last two weeks compared to normal?" Disability days, if measured frequently, as in the NMCUES, will pick up some acute morbidity not measured by the other variables, such as diseases of the upper respiratory tract (common cold, sore throat, allergies).

Interestingly, the health status indicators also do not measure those conditions where medical intervention is most effective. For example, the health status variables do not measure malignant neoplasms of the bone, skin, or breast, most of which are probably simple, curable skin cancers. They also do not pick up disorders of the eye and adnexa (myopia, astigmatism, cataract), which may be effectively

treated (eyeglasses or cataract removal). If health status is measured *after* the provision of efficacious medical care, it may be recorded as good, even though before treatment the presence of a medical condition created the need or demand for care. Use of "postdictive" health status, therefore, will weaken and bias the relationship between health status and utilization. In fact, Manning et al. [13] have shown that use of postdictive health status in utilization equations results in inconsistent estimates. Ideally, if health status is to be used as an explainer of utilization, it should be measured before treatment, but often enough to pick up acute events.

In practice, measuring health status independently of medical treatment is not feasible. Sampling health status frequently over some interval such as a year may also be impossible or too expensive. Realistically, then, how can the measurement of health status, particularly to explain utilization, be improved? Aside from an elaborate, expensive measurement of health status (Brook et al., [1]), our results lend support to two common practices. Demographic variables can be used to proxy certain conditions the health status indicators do not pick up; for instance, the number of women of childbearing years can proxy pregnancy. Of course, this sort of proxy is crude and confounds other effects of demographics on utilization. A more focused variable is counts of conditions. The problem here is that all conditions are counted equally. Our results suggest that if counts of conditions are used to supplement the standard health status variables, attention should be concentrated not on the life-threatening circulatory conditions which the health status variables measure well, but on the other, less serious transitory or curable morbidities they do not measure.

Even though our results confirm those of others that health is highly multidimensional (Ware et al. [14]) and cannot be completely summarized in a few simple indicators, the standard health status variables will and should continue to be used. Despite their limitations, they contain much information in a form that can be easily, inexpensively, and reliably administered. The major use of our results lies not in devising new health status indicators, but in understanding exactly what the popular variables measure and choosing among them for particular applications.

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NOTES

1. Based on the "Basic Tabulation List," pp. 746-54 of the *International Classification of Diseases*, 1975 Revision, Vol. 1.
2. In the NMCUES, respondents were explicitly instructed not to report functional limitations due to pregnancy.

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