Milbank Memorial Fund Quarterly/*Health and Society, Vol. 56, No. 4, 1978*

Interpreting a General Index of Subjective Well-Being

THOMAS T.H. WAN AND BARBARA LIVIERATOS

Division of Intramural Research, National Center for Health Services Research/DHEW

CONCEPTUALLY, health status is reflected by the extent to which an individual has reached certain levels of adaptation encompassing a multidimensional state of wellness in terms of physical/physiological, mental, and social well-being. Empirically, the sense of well-being is measured by subjective responses elicited from questions pertaining to self-reported health. Previous research on health status or general well-being has produced considerable perplexity. The perplexity arises primarily from attempts to define various states of well-being and to approximate the extent to which subjective responses accurately reflect physiological conditions. It is generally recognized by researchers in the health status index field that no perfect predictive criterion variable has yet been developed and used to validate subjective well-being (Kaplan, Bush, and Berry, 1976; Ware, 1976). This difficulty in assessing general well-being indexes is further aggravated by the problems of conceptualization of health.

Although a universally agreed upon predictive criterion of general well-being has not been formulated, the development of a simply administered instrument of well-being is most desirable if its valid-

0026-3745-78-5604-0531-26/$01.00/0

ity and reliability can be demonstrated. This research was undertaken to determine the feasibility and suitability of adopting as a general health measure the General Well-Being (GWB) index previously constructed by the National Center for Health Statistics (Dupuy, 1974). A central concern of this study is the elucidation of the intricate relationship between various clinical measures and a sense of general well-being. Special attention is given to age differentials in the subjective rating of well-being.

Related Research

Aging and Health

Although there have been diverse approaches to studying subjective well-being, the identification of age differences in general well-being related to clinical measures of health has received relatively little attention. Most gerontological studies of personal health status focus on issues dealing with the relationship between aging, health, and life satisfaction.

In a recent work, Shanas and Maddox (1976) gave a comprehensive overview of research findings on aging and health. In discussing patterns of morbidity, they remarked on the commonly observed association between illness and socioeconomic level, and contended that the higher prevalence of disease among lower socioeconomic groups is attributable to differences in life-style and access to health care. The greater morbidity but lower mortality rate for females was also noted. In reviewing the great majority of studies, they found that whites enjoy better health than non-whites, in terms of having less restricted activity days and less disability. Shanas and Maddox also cited the increase in the prevalence of chronic disease with age, along with dental, visual, and hearing problems. These authors maintained that illness and disability have a negative effect on self-esteem and sense of well-being, and they related physical illness to mental illness in the older age groups.

Shanas (1974) noted two major approaches to health status and health needs assessment among the elderly: the medical model, which stresses the importance of physical examination, and the functional model, which relies on self-assessments of health and functional status. Differing interpretations of health resulting from

application of these two models reflect the fact that the medical model is based on absolute levels of health rather than levels relative to one's age and sex. Maddox and Douglas (1974) used an approach that combined the two models. They made a longitudinal comparison of physician and patient ratings of health and found that not only did their ratings tend to be congruent over time, but also that the individual's rating was a more reliable predictor of future physician's rating than the reverse. This finding lends support to the use of subjective measures as reliable data.

Kovar (1977), investigating the health status of the elderly, wrote that two-thirds of the non-institutionalized elderly report that their health is good or excellent, while 9% report that their health is poor compared to others their age. The non-white elderly report poor health twice as often as the white elderly. Kovar also made the important observation that health status among persons in the same age group varies greatly, but on the average, persons in their 60s and early 70s are in far better health than those in older age groups.

The danger of broad generalizations in research dealing with aging is well illustrated in a study by Spreitzer and Snyder (1974), in which they found that women report a higher degree of life satisfaction than men from age 18 through age 65, at which time life satisfaction increases for men and decreases for women. Although their study is cross-sectional, similar findings have been reported in longitudinal studies by Palmore (1968) and Streib and Schneider (1971).

In terms of health status, differences between the sexes have most often shown females to have higher rates of morbidity, while males have higher mortality rates. A long-standing observation has, in fact, been made that "women are sicker, but men die sooner." Verbrugge (1976) suggested that interview and illness behavior related to social and psychological factors tend to inflate female morbidity rates. Nathanson (1977) advanced the supposition that observed sex differences in morbidity may also be influenced by physician behavior. Larson (1978), however, noted that the majority of studies indicate that there is no consistent pattern in sex differences in well-being for older persons. Larson conducted a comprehensive review of the literature of the past 30 years on older people's subjective well-being and stated that "among all the elements of an older person's situation, health is the most strongly related to subjective well-being."

Life Satisfaction and Health

The terms "life satisfaction" and "well-being" are often used interchangeably in the literature. Although it could be argued that they are not conceptually the same, to the extent that a higher degree of perceived life satisfaction maintains a reciprocal relationship with a greater sense of overall well-being, certain comparisons can be made.

Much of the literature on life satisfaction contains measures similar to ones used in the present study, and is, therefore, of interest. Clemente and Sauer (1976) found that race and perceived health are the most salient predictors of satisfaction, with whites showing considerably higher scores than blacks, and those with higher self-ratings of health having higher scores. They found that socioeconomic status (SES) indicators have negligible effect on life satisfaction, and they did not find an inverse relationship between age and life satisfaction.

The literature on the relationship between age and life satisfaction is interesting in the lack of consistency and consensus generated by the findings. From their examination of the literature on the subject, Riley and Foner (1968) concluded that life satisfaction tends to decline with age. Ten years later, however, it is impossible to draw such a neat and definitive conclusion about the direction of the relationship. The Clemente and Sauer study (1976) arrived at the opposite estimation of the nature of the association between age and life satisfaction, as did studies conducted by Edwards and Klemmack (1973) and Palmore and Luikart (1972). As noted above, when Spreitzer and Snyder's sample was disaggregated by sex, they observed a change in the level of life satisfaction after age 65.

Some discrepancies in research findings are also seen when the literature on sociodemographic factors is examined. Edwards and Klemmack, and Palmore and Luikart observed that family income is an important determinant of life satisfaction. Spreitzer and Snyder and Clemente and Sauer, on the other hand, attributed little strength to SES factors in predicting life satisfaction. In the great majority of studies, race displayed a consistent pattern, with whites indicating higher levels of life satisfaction than non-whites. In virtually every study in which perceived health status was used, it proved to be an important determinant of life satisfaction (Edwards and Klemmack, 1973; Palmore and Luikart, 1972; Spreitzer and Snyder, 1974;

Tornstam, 1975). By extension, it may be postulated that perceived health status will be shown to be an important predictor of well-being in the present study.

Data and Methods

The data base for our study is the National Health and Nutrition Examination Survey (HANES). The survey, conducted by the National Center for Health Statistics, was administered at 65 different U.S. locations from April, 1971, to October, 1975. The HANES includes medical, dental, nutritional, and psychological, as well as demographic, measures. A sample of 6931 non-institutionalized adults (25 to 74 years old) received the detailed HANES examination, one component of which was the General Well-Being (GWB) index.

The GWB index is self-administered, and is designed to elicit responses to questions concerning the presence, severity, or frequency of some clinical symptoms that are generally considered important in making assessments of subjective well-being. The GWB is constructed in such a way that responses to 18 items are scaled and summed to give a total GWB score. The questions are to be answered in the context of how one has been feeling during the past month (Table 1).

Most responses to the GWB items are ordered on a 0 (least favorable) to 5 (most favorable) continuum. For Questions 2, 5, 11, and 15, response scores of 0 to 10 are assigned because, in the original design of the GWB, 11 response categories were constructed for each of those questions. The summed scores may range from 0 to 110, with higher scores indicating more positive well-being. The actual range in this study is from 4 to 110.

Physical and physiological measures were obtained through clinical examinations by physicians and through medical histories. In addition, physicians documented diagnostic impressions and overall evaluations of each respondent in terms of the presence and severity of cardiovascular, respiratory, gastrointestinal, and musculoskeletal conditions. No attempt has been made to rank-order the system conditions. In terms of subjective response of self-perceived health, it is conceivable that an advanced case of arthritis could be more "severe" than a persistent respiratory disorder. For

purposes of this study, the number of reported conditions has not been totaled to represent an index figure to predict GWB scores. It has been found, however, that there is a negative association between the total number of reported chronic conditions and GWB scores. Severe conditions and positive findings are coded as 1, and others as 0. The variable of self-perceived health status is based on the repondent's subjective assessment of his or her general health. Response options range from "excellent" (coded as 1) to "very poor" (coded as 5). The socio-demographic variables used in this analysis relate to the respondents' age, sex, race, marital status, education level, income, occupational status, retirement status, and size of community.

The 25- to 74-year age range is evenly divided into five distinct age groups, each comprising a 10-year spread: 25–34, 35–44, 45–54, 55–64, and 65–74. The age factor is used as a control variable so that differential response patterns can be observed. It is most unfortunate that the upper age limit of the HANES is 74 years, since this means losing considerable information pertaining to the 75 and over "old-old" age group. There are, however, considerable data on people in the pre-retirement years and those between the ages of 65 and 74.

The analytic technique used in this study is a multivariate approach that identifies socio-demographic differentials in GWB by age and sex, and then examines the relative importance of clinical measures in predicting general well-being for each age group. The Automatic Interaction Detector (AID) analysis is based on one-way analysis of variance and employs a non-symmetrical branching technique in which the sample is subdivided into a series of mutually exclusive subgroups. Use of this program maximizes the ability to predict values of the dependent variable, in this case, GWB scores. Each predictor selected gives maximum improvement in the ability to predict values of the dependent variable. The interaction effects uncovered by the AID analysis indicate the importance of some variables under certain circumstances or for certain groups. In this study, the main area of interest is to determine those factors that divide respondents who have high and low GWB scores. If different factors are shown to determine GWB scores, it can be assumed that interaction effects are taking place. The usefulness and appropriateness of AID in this type of large-scale survey study have been detailed by Sonquist, Baker, and Morgan (1973), Andersen, Smedby, and Anderson (1970), Kass (1975), and Wan (1976).

Multiple Classification Analysis (MCA) is also used in this study, so that mean GWB scores and the effect of each independent variable can be examined before and after adjustment is made for intercorrelation with other variables.[1] The MCA also provides information about the relative contribution of each variable to variation in the dependent variable and gives a ranking of the beta values of the variables. In this study, for the MCA, the clinical measure variables are separated into measures of psychological symptoms and physical/physiological measurements. For each of the two categories of clinical measures, MCA was performed for the total sample and for each of the five age groups.

Results

Table 1 lists the GWB schedule items with mean responses by age group. Of the 18 GWB items, 13 show significant differences in response by age. Definite age progression patterns can be seen for nine items (1, 7–9, 11–13, 15–17). In all but one of these (item 17), differences in response between age groups are significant at the 0.05 level. The first item, which deals with illness and bodily disorders, is the only one for which the average score for this item decreases with age. For the other eight items that show age progression patterns, the scores are higher for the older age groups. The difference in GWB scores between age groups is statistically significant, and the oldest group has the highest mean GWB score. In addition, for 12 of the 18 index items, the oldest age group has the highest mean, while for 10 of the 18 items, the youngest group has the lowest mean scores.

For the purpose of examining the dimensionality of the 18 GWB items, we used a principal components analysis with varimax rotation that produced three common factors (Table 2). The first common factor (dimension) accounts for 18.33% (Eigenvalue/number of items = 3.3/18) of the variance in GWB and is labeled as "depressive mood." Six GWB items having high loadings on general well-being are: downhearted and blue; sad, discouraged or hopeless; nervousness; anxious, worried, or upset; under pressure;

[1]A correlation table of the 48 variables used in the MCA analysis is not displayed here, but is available from the authors upon request.

TABLE 1
Mean Scores and F-Values for Each of the 18 General Well-Being (GWB) Items by Age Groups

GWB Item*	Age Group (in years)					Test of Differences
	25-34	35-44	45-54	55-64	65-74	F-value
1 Have you been bothered by any illness, bodily disorder, pains, or fears about your health?	4.17	4.06	3.91	3.85	3.82	19.8†
2 How concerned or worried about your health have you been?‡	7.46	7.36	7.08	6.88	7.02	9.7†
3 Have you felt tired, worn-out, used up, or exhausted?	3.45	3.42	3.40	3.34	3.49	2.8†
4 Have you been waking up fresh and rested?	3.34	3.44	3.42	3.49	3.59	8.2†
5 How much energy, pep, or vitality have you felt?‡	6.39	6.25	6.22	5.97	5.99	7.5†
6 How happy, satisfied, or pleased have you been with your personal life?	3.31	3.18	3.13	3.14	3.25	5.9†
7 Has your daily life been full of things that were interesting to you?	3.39	3.48	3.51	3.55	3.60	6.0†
8 Have you felt downhearted and blue?	4.00	4.01	4.04	4.08	4.18	5.7†
9 How have you been feeling in general?	3.24	3.23	3.19	3.15	3.22	1.4
10 Have you felt so sad, dicouraged, hopeless, or had so many problems that you wondered if anything was worthwhile?	4.28	4.28	4.31	4.27	4.33	0.6
11 How depressed or cheerful have you been?‡	6.87	6.88	6.98	7.01	7.12	2.5†
12 Have you been anxious, worried, or upset?	3.77	3.80	3.86	3.97	4.14	23.4†
13 Have you been under or felt you were under any strain, stress, or pressure?	3.41	3.44	3.57	3.78	4.08	58.2†
14 Have you been bothered by nervousness or your "nerves"?	3.86	3.80	3.77	3.83	3.86	1.5
15 How relaxed or tense have you been?‡	6.37	6.38	6.54	6.73	7.09	17.6†
16 Have you been in firm control of your behavior, thoughts, emotions, or feelings?	4.10	4.14	4.16	4.16	4.24	3.6†
17 Have you been feeling emotionally stable and sure of yourself?	4.08	4.13	4.15	4.17	4.19	2.2
18 Have you had any reason to wonder if you were losing your mind or losing control over the way you act, talk, think, feel, or of your memory?	4.63	4.63	4.67	4.68	4.66	1.0
Total GWB Score	80.12	79.92	79.93	80.01	81.87	2.8†

*GWB items relate to the past month.
†Significant at 0.05 or lower level.
‡Range for these items is 0-10, for all others it is 0-5.

afraid of losing mind or losing control. The second common factor is represented by seven GWB items—bothered by bodily disorders, health concern, feeling tired, waking up fresh, energy level, good spirits, and relaxed—and clearly reflects the sense of "health concern." The third factor that is labeled as "life satisfaction and emotional stability" is represented by five GWB items—including satisfied with life, interesting daily life, cheerful, firm control of emotions, and emotionally stable. Data in Table 2 also reveal that the three common factors that account for 51.28% of the total variance in GWB items are moderately correlated with the total GWB score.

Automatic Interaction Detector Analysis

Figure 1 shows the predictor trees for the AID analysis of GWB scores by socio-demographic variables. Sex consistently proves to be the most important socio-demographic variable in the AID analysis. Each of the five age groups split by sex, with men repeatedly exhibiting higher mean GWB scores than women. It can be seen from Fig. 1 that women constitute a higher proportion of the study population in the younger age groups, while the two sexes are almost equally represented in the older age groups. Race is also shown to be a contributor to the variance of GWB scores of women in the total group and in the 25–34 and 35–44 year age groups. White women are shown to have higher mean GWB scores than non-white women. Education exhibited AID splits in three of the five age groups. In each case, the groups with higher education also have higher mean GWB scores. Marital status is seen to be of importance in the 35–44 and 45–54 year age groups. Those who are currently married or never married have higher mean GWB scores than those who are no longer married (separated, divorced, or widowed).

Table 3 indicates the relative contribution of selected socio-demographic variables in explaining the variance in GWB scores for the total sample broken down by age groups, and for each sex by age groups. Again, it can be seen that sex is the only socio-demographic variable that contributed to variance in GWB scores in every age group. The only recurrent pattern for the aggregate sample and each sex is that the 35–44 year age group exhibited the highest proportion of variance explained, followed by the oldest age group. Overall, for men 1% of the variance in GWB scores is explained by socio-

TABLE 2

Three Factor Dimensions and Zero-Order Correlations Between Each of the 18 General Well-Being (GWB) Items and the Total GWB Score

GWB Item	Factor Loading	Correlation Coefficient
Depressive Mood (Eigenvalue):	**(3.300)**	
Downhearted and blue	0.581	0.744
Sad, discouraged, hopeless	0.613	0.690
Anxious, worried, upset	0.733	0.717
Under stress, pressure	0.633	0.646
Nervousness	0.566	0.702
Afraid of losing mind or control	0.398	0.517
Health Concern (Eigenvalue):	**(3.040)**	
Bothered by bodily disorders	0.613	0.625
Health concern, worry	0.558	0.669
Feeling tired, worn-out	0.668	0.706
Waking up fresh, rested	0.537	0.639
Energy level	0.563	0.673
Good spirits	0.450	0.730
Related	0.500	0.796
Life Satisfaction and Emotional Stability (Eigenvalue):	**(2.890)**	
Satisfied with life	0.529	0.587
Interesting daily life	0.629	0.590
Depressed, cheerful	0.536	0.751
Firm control of emotions	0.465	0.560
Emotionally stable	0.569	0.605
Total Percent of Variance:		
Explained	51.280	
GWB Score: Mean	80.340	
Standard deviation	17.676	

demographic variables, while 3.2% is explained for women. A greater amount of explained variance is observed in the two extreme age groups among women. For every other age group, men had a greater amount of explained variance.

Although no other consistent patterns are as evident, there are other interesting observations to be made about the data presented in Table 3. For men, race proves to be of even minimal importance only in the 65–74 year age group, while for women it is shown to be of major importance in the youngest age group and also contributes to

TABLE 3

Automatic Interaction Detector (AID) Analysis of the Relative Contribution of Selected Socio-Demographic Variables in Explaining the Variance in GWB Scores*

Predictor	Age Group (in years)					
	Total	25-34	35-44	45-54	55-64	64-74
Men and Women:						
Sex	0.028	0.039	0.040	0.012	0.010	0.033
Race	0.011	0.023	0.011	—	—	—
Marital status	—	—	0.011	0.030	—	—
Education	—	—	0.022	—	0.017	0.039
Income	—	—	—	—	—	—
Occupation	—	—	—	—	—	—
Retirement status	—	—	—	—	—	—
Size of place	—	—	0.008	—	—	—
Total R^2	0.039	0.062	0.092	0.043	0.027	0.072
Men:						
Race	—	—	—	—	—	0.014
Marital status	—	—	0.042	—	—	—
Education	0.010	0.012	0.016	0.012	—	0.020
Income	—	—	—	—	0.014	0.008
Occupation	—	—	—	0.015	—	—
Retirement status	—	—	—	—	0.016	—
Size of place	—	—	0.023	—	—	—
Region	—	—	0.015	0.028	0.015	0.014
Total R^2	0.010	0.012	0.096	0.055	0.045	0.056
Women:						
Race	0.019	0.038	0.019	—	—	—
Marital status	—	—	0.023	0.034	—	—
Education	0.013	0.012	0.037	—	0.029	0.066
Income	—	—	—	—	0.008	—
Occupation	—	—	—	—	—	—
Retirement status	—	—	—	—	—	—
Size of place	—	—	—	—	—	—
Region	—	—	—	—	—	—
Total R^2	0.032	0.050	0.079	0.034	0.037	0.066

*Coefficients presented are partial β^2, which is the actual proportion of variance explained by each predictor when other variables are controlled. AID R^2 is the sum of partial β^2. Dashes indicate (insignificant) variables not used in AID splits.

some of the variance in the 35–44 year age group. Marital status has a greater effect for men in the 35–44 year age group than any other variable in any age group. Although contributing somewhat less to the explained variance for women, marital status was also of importance in the 35–44 and 45–54 year age groups. Education is seen to be of importance in four of five age groups for both men and women. For women in the oldest group, it accounts for 6.6% of the variance, making it the single most powerful socio-demographic variable for a given age group. Income is important for both men and women in

the 55–64 year age group. For some groups of men, occupation, retirement status, and size of place are also of some importance in explaining variance in GWB scores. Men in the 35–74 age group are affected by the region of the country in which they live, while women show this to be an insignificant variable. It might be added that the total amount of variance explained by socio-demographic factors is surprisingly low, ranging from 1.2% to 9.6% for the 25–34 and 35–44 year-old men, respectively.

AID analysis was further carried out using clinical measures in accounting for the variance in GWB scores by age group. The physical and psychological factor variables have been subtotaled so that their differential effects can be revealed. The oldest age group is seen to have a greater amount of variance in GWB scores explained by physical factors than any other age group. Likewise, that same age group has a smaller amount of variance explained by psychological factors than any other age group.

Physical measure variables that accounted for variance in the GWB scores in at least three of the five age groups are: shortness of breath, stomach pain, and musculoskeletal severity. The most important psychological variables are: nervous breakdown symptoms, professional contacts for counseling, and self-perceived health status. All three are of importance in every age group. It can readily be seen from Table 4 that for all age groups psychological factors account for a much greater proportion of the variance than do physical measures. The differences in subtotals across age groups are of interest. The youngest (25–34) age group showed only 4.4% of variance explained by one physical measure variable. In contrast, for the oldest age group (65–74), 16.5% of the total variance is explained by seven physical measure variables. The middle age group (45–54), has 11.0% of variance attributed to seven physical measures, while the next group (55–64) dips to 9.6% for five physical measures.

An opposite pattern is observed when the subtotals for psychological measures are examined. Although the number of psychological variables contributing to the explained variance remains relatively constant, the amount of variance explained by psychological symptoms shows a decline by age groups. Psychological variables account for 29.9% for the youngest age group, and 21.0% for the oldest group.

The most striking observation of the AID predictor trees for the clinical variables is the consistency of the mean GWB scores. For

TABLE 4

Detailed Description of the Most Important Clinical Measures from the AID Analysis (Partial β^2 and R^2)

Variable*	Age Group (in years)					
	Total	25-34	35-44	45-54	55-64	65-74
Summary of diagnostic impression	—	—	—	—	—	0.021
Gastrointestinal:						
Stomach pain	—	—	0.010	0.009	0.011	—
Bowel trouble	—	—	—	—	—	0.035
Ulcers	—	—	—	0.010	—	—
Respiratory:						
Shortness of breath	0.023	0.044	0.048	0.028	—	0.017
Cardiovascular:						
Current heart trouble	—	—	—	—	0.009	—
Blood pressure trouble	—	—	—	0.016	—	—
Severe chest pain	—	—	—	0.024	0.045	—
Musculoskeletal:						
Musculoskeletal severity	0.009	—	—	0.013	0.022	0.009
Arthritis	—	—	—	—	—	0.015
Aching joints	—	—	—	—	0.009	—
Swelling joints	—	—	—	0.010	—	0.013
Stiff joints	—	—	—	—	—	0.055
Sub-total A†	0.032	0.044	0.058	0.110	0.096	0.165
Psychological factors:						
Perceived nervous breakdown symptoms	0.139	0.174	0.163	0.130	0.071	0.111
Number of professional contacts	0.070	0.051	0.106	0.098	0.111	0.034
Medication for sleep problems	—	—	0.012	—	—	—
Self-perceived health status	0.073	0.074	0.022	0.043	0.064	0.065
Sub-total B‡	0.282	0.299	0.303	0.271	0.246	0.210
Total variance explained (R^2)	0.312	0.343	0.361	0.381	0.342	0.377

*Dashes refer to insignificant variances.
†Sub-total A refers to the amount of variance explained by physical measures only.
‡Sub-total B refers to the amount of variance explained by psychological measures only.

every "negative" response, or those indicating presence of symptoms, a lower mean GWB score is noticed. No deviation from this pattern is seen in any of the age groups.

Multiple Classification Analysis

In the multiple classification analysis, two categorical groups of the clinical measure variables were formed. Variables that represented psychological measures were placed in one group, and those representing physical factors in another. Separate MCA runs were made for each category for the total number of respondents and for each of the five age groups.

Table 5 presents the results from the MCA of the effects of the selected psychological variables on GWB scores for the total sample and for the five age groups. For the total group, it can be seen that perceived health status proved to be the most important psychological predictor of variance in GWB scores. Comparison of the magnitude of the beta[2] coefficients for the total sample gave the ranked order of importance according to the increment that each variable contributes to the variation in GWB scores. The order is: 1) perceived health status, 2) nervous breakdown symptoms, 3) number of professional contacts for counseling, 4) medication for headaches, 5) medication for sleep problems, 6) weight loss, 7) having seen a psychiatrist, 8) being a former mental patient, and 9) having had a nervous breakdown. Although there is some variability in ranking across age groups, the first three variables noted above remain as the three most important in each age group. It is of interest to note that although the variable "perceived nervous breakdown symptoms" ranks among the top three, having had a nervous breakdown consistently ranks as one of the three least important variables. Having been a former mental patient also ranks in one of the last two positions for each age group. The adjusted R^2 values (which signify the amount of explained GWB variance) for the psychological variables range from 36.3% for the 25–34 year age group to 40.5% for the 45–54 year group. The R^2 value for the total group is 36.4%. These figures are uniformly higher than R^2 subtotal values obtained in the AID analysis for all psychological measures. When an age pattern is sought according to the total amount of variance explained, no clear pattern is discernible. The adjusted R^2 values for the first two and the oldest age groups are quite close (36.2%, 26.6%, and

TABLE 5

Multiple Classification Analysis (MCA) of the Effects of Selected Psychological Variables on GWB Scores for the Total Sample and Five Age Groups with Variable Rankings*

Variable	Total		Age Group (in years)									
			25-34		35-44		45-54		55-64		65-74	
	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2
Nervous breakdown symptoms	0.154 (2)	0.058	0.174 (2)	0.070	0.163 (3)	0.046	0.150 (3)	0.044	0.143 (3)	0.046	0.135 (2)	0.052
Had nervous breakdown	0.032 (9)	0.000	0.024 (9)	0.000	0.055 (8)	0.002	0.046 (7)	0.001	0.027 (8)	0.000	0.020 (9)	0.000
Former mental patient	0.031 (8)	0.000	0.030 (8)	0.001	0.048 (9)	0.000	0.027 (8)	0.000	0.033 (9)	0.000	0.022 (8)	0.000
Had seen psychiatrist	0.043 (7)	0.002	0.047 (4)	0.004	0.670 (7)	0.002	0.038 (9)	0.000	0.045 (6)	0.001	0.019 (5)	0.006
Counseling contacts	0.141 (3)	0.045	0.109 (3)	0.029	0.193 (2)	0.064	0.185 (2)	0.067	0.155 (2)	0.056	0.097 (3)	0.033
Use of medication for sleep problems	0.046 (5)	0.006	0.041 (5)	0.004	0.062 (4)	0.010	0.050 (4)	0.008	0.046 (4)	0.006	0.047 (4)	0.011
Use of medication for headaches	0.012 (4)	0.007	0.006 (7)	0.002	0.009 (5)	0.005	0.012 (5)	0.007	0.013 (5)	0.005	0.017 (6)	0.003
Weight loss	0.058 (6)	0.003	0.012 (6)	0.003	0.007 (6)	0.003	0.007 (6)	0.006	0.000 (7)	0.000	0.002 (7)	0.001
Perceived health status	0.193 (1)	0.122	0.228 (1)	0.137	0.172 (1)	0.085	0.230 (1)	0.139	0.224 (1)	0.142	0.243 (1)	0.162
Total R^2 (adjusted)	0.36431		0.36288		0.36660		0.40539		0.37106		0.36515	

*Numbers in parentheses give ranked order of variables for each group.

36.5%); the 45–54 year group exhibits the highest R^2 value (40.5%), while there is a decline (to 37.1%) for the 55–65 year group. In the AID analysis there is a progressive decline in variance explained by psychological factors. A major difference in the two analyses is that in AID only the three or so most significant psychological variables were considered, while in MCA all nine psychological variables were used.

The results from the MCA of physical clinical measures variables can be seen in Table 6. Although 48 variables were used in the MCA, only those with a beta value of 0.070 or greater are shown, giving them a beta^2 value of 0.005 or greater. The ranking of the physical measure variables within each age group indicates that there is great diversity between age groups as to the order of importance of these variables. Only two variables, stomach pain and shortness of breath, are included in each of the groups. Shortness of breath is ranked first, second, or third for the total group and for the first three age groups. It drops to seventh and eighth places respectively, however, for the 55–64 and 65–74 year groups.

The adjusted R^2 values of physical health factors, when examined across age groups, show a general increase with age, from 15.3% to 24.1%. The highest R^2 value, however, is found for the 45–54 year age group (25.1%). This finding of a rise in importance of physical measures in the 45–54 age group is compatible with the AID analysis, although in that case the oldest age group proved to be the most affected by physical measures. The MCA results show only four physical measure variables accounting for 25.1% of the variance in the 45–54 year group, as compared to nine accounting for 23.6% in the 55–64 year group, and seven accounting for 24.1% in the 65–74 year group.

Discussion

Automatic Interaction Detector (AID) analysis of socio-demographic factors shows that they account for 3.9% of the variance in GWB scores for the total group. Men have consistently higher GWB scores than women. When the sample is disaggregated by sex, for men the range in the amount of variance explained is from 1.2% for the 25–34 year age group to 9.6% for the 35–44 group. Race is seen to be an important contributor to variance in the GWB scores of women in the 25–34 and 35–44 year age groups, but only for the

oldest group of men. Whites have higher GWB scores than nonwhites. Marital status is shown to have an effect on the GWB scores of men 35–44 years of age and of women 35–54 years of age. In each case, those married or single have higher GWB scores than those no longer married. In this same vein, Nathanson (1977) has noted that married people of both sexes report less illness and associated disability than the unmarried. Education contributes to the variance in GWB scores in most age groups for both sexes, especially for women in the oldest group. The other SES variables of income and occupation are only minor contributors to GWB score variation. Where education is important, those with higher levels of education exhibit higher levels of well-being. This finding is consistent with the numerous studies cited by Larson (1978). Although accounting for a small proportion of the variation in GWB scores, the direction of association between these variables and general well-being is, in fact, the same as that reported by other researchers (Spreitzer and Snyder, 1974; Clemente and Sauer, 1976; Kovar, 1977; and Shanas and Maddox, 1976). The GWB index seems to be a poor reflector of social condition and social functioning status. This would appear to operate against its adoption as an overall health index, since social well-being is considered an integral component of health (according to the World Health Organization's definition of health). The HANES data, however, contain no good measure of level of social participation, functional limitation, role incongruence, or satisfaction with socioeconomic condition. These may prove to be useful social well-being indicators in the construction of a GWB index. A truly comprehensive index would be applicable to different social contexts and be constructed with the recognition that optimal levels of physical, social, and mental functioning would vary from one social context to another. Elinson (1974) has pointed out the importance of using sociomedical health indicators in assessing health status. Lerner (1973) has delineated indicators of social well-being which could be incorporated in an index—such as welfare, role-related coping, family health, social participation and the quality of personal experience, and perception of moral worth.

In the AID analysis, psychological variables are shown to account for more of the explained variance in GWB scores for all age groups than physical measure variables. The three most important psychological variables are: self-perceived health status, presence of nervous breakdown symptoms, and number of contacts with

TABLE 6

Multiple Classification Analysis (MCA) of the Effect of Physical Clinical Measure Variables on the GWB Scores for the Total Sample and Five Age Groups with Variables Ranking*

Variable	Total		Age Group (in years) 25-34		35-44		45-54		55-64		65-74	
	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2
Gastrointestinal:												
Bowel trouble	—	—	—	—	—	—	—	—	—	—	0.059 (2)	0.021
Medication for bowel trouble	—	—	—	—	—	—	0.022 (5)	0.006	—	—	—	—
Enteritis	—	—	0.009 (2)	0.005	—	—	—	—	—	—	—	—
Stomach pain	0.064 (1)	0.019	0.033 (2)	0.009	0.061 (2)	0.014	0.083 (2)	0.018	0.069 (1)	0.015	0.079 (1)	0.026
Upset stomach	—	—	—	—	—	—	—	—	0.035 (9)	0.005	—	—
Respiratory:												
Respiratory severity	—	—	—	—	0.005 (4)	0.006	—	—	—	—	—	—
Shortness of breath	0.069 (2)	0.014	0.071 (1)	0.035	0.093 (1)	0.030	0.082 (3)	0.013	0.068 (7)	0.005	0.015 (8)	0.007
Chronic bronchitis	—	—	—	—	—	—	0.026 (4)	0.007	—	—	—	—
Cardiovascular:												
Hypertension evaluation	0.002 (4)	0.006	—	—	0.005 (5)	0.005	—	—	0.006 (2)	0.011	0.007 (3)	0.017

*Numbers in parentheses give ranked order of variables for each group.

TABLE 6 *(Continued)*

Variable	Total		Age Group (in years)									
			25-34		35-44		45-54		55-64		65-74	
	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2	η^2	β^2
Blood pressure trouble	—	—	—	—	—	—	—	—	0.094 (3)	0.010	—	—
Current heart condition	—	—	—	—	—	—	—	—	0.035 (5)	0.006	—	—
Chest pain	0.069 (3)	0.014	—	—	—	—	0.113 (1)	0.024	—	—	—	—
Neurological:												
Neurological evaluation	—	—	—	—	0.013 (3)	0.006	—	—	—	—	—	—
Numbness	—	—	0.036 (4)	0.006	—	—	—	—	0.060 (8)	0.005	—	—
Speech difficulty	—	—	0.018 (3)	0.007	—	—	—	—	0.039 (4)	0.008	0.028 (6)	0.011
Musculoskeletal:												
Musculoskeletal severity	—	—	—	—	—	—	—	—	0.027 (6)	0.006	—	—
Stiffness in joints	0.054 (5)	0.005	0.027 (5)	0.006	—	—	—	—	—	—	0.089 (5)	0.014
Arthritis	—	—	—	—	—	—	—	—	—	—	0.062 (7)	0.007
Summary of diagnostic impression	—	—	—	—	—	—	—	—	—	—	0.020 (4)	0.015
Total R^2 (adjusted)	0.19677		0.15255		0.21185		0.25136		0.23613		0.24151	

*Numbers in parentheses give ranked order of variables for each group.

professionals for counseling. It must be acknowledged that self-perceived health status can in one sense be viewed as measuring a dimension of general well-being, and may reflect a high correlation between self-assessed health and psychological well-being. Even when self-perceived health status is not used, psychological variables account for more variance than physical measures, except for the oldest age group. The fact that psychological factors exert a greater influence on well-being in the younger age groups, while the importance of physical factors increases with age, should be of great importance in planning and implementing mental and physical health programs. Health professionals would certainly benefit from a clearer understanding of the interrelationship of physical, psychological, and socio-demographic factors to a sense of well-being. There is evidence from other researchers (Mechanic, 1976; Rabkin and Struening, 1976; Dohrenwend and Dohrenwend, 1974; Selye, 1956; Holmes and Rahe, 1967) to suggest an association between life stress and illness. Additional research is especially needed in which attempts should be made to discover the nature of the psychological disorders, and whether their causes as well as their magnitude change for older age groups. Questions must be addressed to such issues as: 1) What life-change events precipitate the onset of nervous breakdown symptoms? 2) How are these events related to the presentation of complaints?

In the MCA findings, stomach pain and shortness of breath are shown to have an effect on GWB scores for all age groups. These two most important physical indicators each describe a rather general symptom, and do not identify a specific physical condition. Their demonstrated effect on well-being, however, implies the salience of including questions related to their presence in interviews by health professionals. Additional investigation is suggested to determine the nature and magnitude of the relationship of these symptoms to underlying physical conditions as well as psychological states.

The general well-being of the pre-retirement group (55–64) is most affected by cardiovascular disorders. This fact is illustrative of the position of such conditions as the leading cause of mortality. Attempts should be made to couple medical advances in cardiology with investigation into the psychological ramifications of this type of disease. The somewhat greater effect of musculoskeletal disorder on the general well-being of the oldest age group in this study reflects the greater prevalence of arthritis and related conditions among the

elderly. Additional research is necessary to determine the part played by reduced mobility in the association between musculoskeletal disorders and well-being, especially for the older age group.

The salience of marital status in affecting GWB scores and the fact that the well-being of the 35–54 year age group is so greatly affected by physical, and especially by psychological, measures suggest that the interaction among these factors reaches its most critical point during middle age. Levinson (1977) has initiated investigation of the study of the "mid-life transition" as a distinct period in adult psychosocial development. This should signal the importance of the application of a developmental, life-cycle approach to gerontology, rather than an age-segregated or cross-sectional approach.

Conclusions

This research has been undertaken as an attempt to measure the relative importance of certain socio-demographic, physical, and psychological factors in explaining variation in general well-being as measured by the National Center for Health Statistics' General Well-Being (GWB) instrument and to determine the suitability of adopting the GWB as a general health measure. A primary concern in this study is the identification of age differences in well-being and their relationship to socio-demographic factors and clinical measures of health. Sex and race are shown to have more influence on GWB scores than other socio-demographic variables, accounting for 3.9% of variance for the total group. For this reason, use of the GWB as a general well-being measure is recommended only with the proviso that sensitive indicators of social well-being be incorporated.

Multivariate analysis shows that psychological factors account for more of the explained variance in GWB scores than physical variables. Self-perceived health status, nervous breakdown symptoms, and professional contacts for counseling are the three psychological variables shown to have the strongest relationship to GWB scores. The strength of this relationship holds even when self-perceived health status is not included. The effect that these particular variables have on a sense of well-being seems to supersede the presence of physical conditions. Whether this is, in fact, true, or is a result of the GWB being a better reflector of psychological than physical factors, should be further investigated.

There is a general decrease by age in the amount of variance in GWB scores explained by psychological factors, while physical measures showed an increase with age. Stomach pain and shortness of breath are the only physical indicators that influenced the GWB scores of all age groups. An investigation into age group differences revealed that cardiovascular disorders have more of an effect on the GWB scores of those in the pre-retirement (55–64) years, while musculoskeletal disorders have the greatest effect in the oldest age group (65–74). In the MCA results, the 45–54 year age group shows the greatest amount of variance explained by physical factors, while in the AID analysis that group shows the highest amount of variance explained by psychological factors. This middle age group deserves greater emphasis as an area of study.

Throughout this analysis, the scores on the GWB index maintain a strikingly consistent pattern: higher GWB scores are found among those respondents who do not have a given symptom or condition. Although more variance in GWB scores is accounted for by psychological factors, the noted pattern is adhered to for physical measures as well. In this sense, it can be acknowledged that differences in both physical and psychological condition are accurately reflected in GWB scores. The utility of the GWB as a classifier of individuals for such purposes as allocation of health services has yet to be proven by further investigations of its reliability, sensitivity, specificity, and predictive value. The GWB may be regarded as a useful tool for portraying the psychological dimensions of the health of a given population, and its most promising use may well be as one component of a health status index that also includes sensitive measures of physical health (including functional status) and social condition.

References

Andersen, R., Smedby, B., and Anderson, O.W. 1970. *Medical Care Use in Sweden and the United States.* Chicago: University of Chicago, Center for Health Administration Studies.

Clemente, F., and Sauer, W. 1976. Life Satisfaction in the United States. *Social Forces* 54 (March): 621–631.

Dohrenwend, B.S., and Dohrenwend, B.P. 1974. *Stressful Life Events: Their Nature and Effects.* New York: John Wiley & Sons.

Dupuy, D.F. 1974. Utility of the National Center for Health Statistics' General Well-Being Schedule in the Assessment of Self-Representations of Subjective Well-Being and Distress. Paper presented at the National Conference on the Evaluation of Drug, Alcohol, and Mental Health Programs, Washington, D.C., April 1–4, 1974.

Edwards, J.N., and Klemmack, D.L. 1973. Correlates of Life Satisfaction: A Reexamination. *Journal of Gerontology* 28 (October): 497–502.

Elinson, J. 1974. Toward Sociomedical Health Indicators. *Social Indicators Research* 1 (January): 59–71.

Holmes, T.H., and Rahe, R.H. 1967. The Social Readjustment Rating Scale. *Journal of Psychosomatic Research* 11 (August): 213–218.

Kaplan, R.M., Bush, J.W., and Berry, C.C. 1976. Health Status: Types of Validity and the Index of Well-Being. *Health Services Research* 11 (Winter): 478–507.

Kass, G.V. 1975. Significance Testing in Automatic Interaction Detection (A.I.D.). *Applied Statistics* 24 (February): 178–189.

Kovar, M.D. 1977. Health of the Elderly and Use of Health Services. *Public Health Reports* 92 (January–February): 9–19.

Larson, R. 1978. Thirty Years of Research on the Subjective Well-Being of Older Americans. *Journal of Gerontology* 33 (January): 109–129.

Lerner, M. 1973. Indicators of Social Well-Being. A working paper prepared for the Rand Corporation, Santa Monica, Calif.

Levinson, D.J. 1977. The Mid-Life Transition: A Period in Adult Psychosocial Development. *Psychiatry* 40 (May): 99–112.

Maddox, G.L. 1964. Self-Assessment of Health Status, A Longitudinal Study of Selected Elderly Subjects. *Journal of Chronic Diseases* 17 (May): 449–460.

———, and Douglas, E.B. 1974. Aging and Individual Differences: A Longitudinal Analysis of Social, Psychological, and Physiological Indicators. *Journal of Gerontology* 29 (September): 555–563.

Mechanic, D. 1976. Stress, Illness, and Illness Behavior. *Journal of Human Stress* 2 (June): 2–6.

Nathanson, C.A. 1977. Sex, Illness, and Medical Care: A Review of Data, Theory, and Method. *Social Science and Medicine* 11 (January): 13–25.

Palmore, E. 1968. The Effects of Aging on Activities and Attitudes. *Gerontologist* 8 (December): 259–263.

———, and Luikart, C. 1972. Health and Social Factors Related to Life Satisfaction. *Journal of Health and Social Behavior* 13 (March): 68–80.

Rabkin, J.G., and Struening, E.L. 1976. Life Events, Stress, and Illness. *Science* 194 (November): 1003–1020.

Riley, M., and Foner, A. 1968. *Aging and Society,* Vol. I. New York: Russell Sage Foundation.

Selye, H. 1956. *The Stress of Life.* New York: McGraw Hill.

Shanas, E. 1974. Health Status of Older People: Cross National Implications. *American Journal of Public Health* 3 (March): 261–264.

———, and Maddox, G. 1976. Aging, Health and Organization of Health Resources. In Bingstock, R., and Shanas, E., eds., *Handbook on Aging and Social Science.* New York: Van Nostrand Reinhold.

Sonquist, J.A., Baker, E.L., and Morgan, J.N. 1973. *Searching for Structure.* Ann Arbor, Mich.: University of Michigan, Survey Research Center.

Spreitzer, E., and Snyder, E. 1974. Correlates of Life Satisfaction Among the Aged. *Journal of Gerontology* 29 (July): 454–459.

Streib, G.F., and Schneider, C.J. 1971. *Retirement in American Society: Impact and Process.* Ithaca, N.Y.: Cornell University Press.

Tornstam, L. 1975. Health and Self-Perception: A Systems Theoretical Approach. *Gerontologist* 15: (June) 264–270.

Verbrugge, L.M. 1976. Females and Illness: Recent Trends in Sex Differences in the United States. *Journal of Health and Social Behavior* 17 (December): 387–403.

Wan, T.T.H. 1976. Predicting Self-Assessed Health Status: a Multivariate Approach. *Health Services Research* 11 (Winter): 464–477.

Ware, J.E. 1976. Scales for Measuring General Health Perceptions. *Health Services Research* 11 (Winter): 396–415.

An earlier version of this paper was presented at the annual meeting of the Gerontological Society, San Francisco, California, November 19–22, 1977.

Address correspondence to: Thomas T. H. Wan, Ph.D., Research Fellow, National Center for Health Services Research/DHEW, Federal Center Building No. 2, Hyattsville, Maryland 20782.