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Measures of Chronic Conditions and Diseases Associated With Aging in the National Social Life, Health, and Aging Project

Sharon R. Williams,[1] Genevieve Pham-Kanter,[2] and Sara A. Leitsch[3]

[1]Department of Anthropology, Purdue University, West Lafayette, Indiana.
[2]Department of Sociology and Department of Economics, University of Chicago, Illinois.
[3]NORC at the University of Chicago, Illinois.

Objectives. This paper presents a description of the methods used in the National Social Life, Health, and Aging Project to detect the presence of chronic conditions and diseases associated with aging. It also discusses the validity and distribution of these measures.

Methods. Markers associated with common chronic diseases and conditions of aging were collected from 3,005 community-dwelling older adults living in the United States, aged 57–85 years, during 2006. Dried blood spots, physical function tests, anthropometric measurements, self-reported history, and self-rated assessments were used to detect the presence of chronic conditions associated with aging or of risk factors associated with the development of chronic diseases.

Results. The distribution of each measure, disaggregated by age group and gender, is presented.

Conclusions. This paper describes the methodology used as well as the distribution of each of these measures. In addition, we discuss how the measures used in the study relate to specific chronic diseases and conditions associated with aging and how these measures might be used in social science analyses.

Key Words: Disease measurement—Biomeasures—Self reported health.

HEALTH, in the National Social Life, Health, and Aging Project (NSHAP), was defined broadly to include not only biological but also social, psychological, and environmental domains. The design of this study was carefully planned to allow for investigation of the interaction between domains and the impact of these interactions on health and health outcomes. A great strength of NSHAP is its comprehensive collection of both social measures and biological measures. Because of these detailed measures, NSHAP is able to capture many important social, psychological, and physiological dimensions of aging.

This paper elaborates on the physiological and physical health measures reported by NSHAP, focusing particularly on the measures of chronic conditions and diseases seen most commonly in aging populations in the United States. In NSHAP, there are two types of health measures: self-reported and direct biological measures (biomeasures). For self-reported measures, respondents were asked to rate aspects of their health and report on their health conditions and physical functioning. For the biomeasures, either physical measurements of respondents' health status and physiological functioning were recorded or biological samples were collected for analysis of measures associated with physiological function. In some cases, the self-reported measures and direct biomeasures act as complements, assessing different dimensions of the same condition; in other cases, the two types of measures serve to cross-validate each other. The combination of self-reported measures and biomeasures thus gives us a more comprehensive picture of respondents' health than is typically available.

An additional objective of this article is to promote research using NSHAP by providing pertinent background information on these measures and their associated conditions. The biological and behavioral measures collected in NSHAP in combination with the breadth and depth of demographic and social data allow for many opportunities to explore the potential biological mechanisms and relationships that mediate the relationship between social factors and health at older ages. Because of space constraints, this discussion is not exhaustive, but we hope that the overviews will provide an introduction to the various measures and stimulate social science researchers to pursue analyses using these measures. To this latter end, we include references for further reading.

Nature of the Data

Study Design and Cooperation Rates

An overview of the NSHAP study design may be found in Smith and colleagues (this issue). Here, we focus on aspects of the study design that relate to the collection of physical

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health and chronic condition measures. Due to time constraints, some sections of the NSHAP were modularized to maximize the amount of information that could be obtained from the maximum number of participants in the minimum amount of time. For these sections, respondents were randomized to receive different modules, each of which asked respondents a different set of questions. Consequently, not all measures are available for all respondents. For variables associated with chronic conditions and diseases, this design resulted in only two thirds of respondents being asked to participate in the "get up and go" test and four fifths of respondents asked to provide blood spots. The resulting sample sizes for these measures will be lower than the overall sample size. An overview of the health-related measures collected in NSHAP is provided in Table 1. This table also includes final sample sizes for each of these measures.

Methods

The methods described here are those used in the in-home collection of data for NSHAP. Because of the many challenges associated with in-home collection of biological measures of health in a nationally representative sample of older adults, some of these methods are not optimal and may not be comparable to clinical standards. Every effort was made to maximize the utility and comparability of each measure. Each variable chosen for collection and each of the methods used for collection were considered relative to many limiting factors, including adaptability to collection in the home, time required for collection, cost of collection, ease of training and implementation by field interviewers, and participant burden. Field interviewers were trained, in-person, in the collection of each of these methods using a combination of lecture, demonstration, and participation and were provided with detailed, diagrammed protocols.

Biomeasure Collection

Blood pressure.—High blood pressure, also known as hypertension, is a condition in which blood pressure is persistently elevated beyond normal levels. A type of cardiovascular disease, high blood pressure accounts for about 5% of all cardiovascular-related deaths (American Heart Association, 2005) and is associated with increased risk of heart attack, heart failure, stroke, and kidney disease (Chobanian et al., 2003). The presence of hypertension is strongly associated with aging (Hajjar & Kotchen, 2003). Current guidelines published by the American Heart Association (http://www.americanheart.org) categorize normal blood pressure as a systolic blood pressure below 120 mmHg and a diastolic blood pressure below 80 mmHg. A systolic pressure between 120 and 139 mmHg or a diastolic pressure between 80 and 89 mmHg is considered to be prehypertensive, and a systolic pressure greater than 140 mmHg or a diastolic pressure greater than 90 mmHg is diagnostic of hypertension.

In NSHAP, two blood pressure readings were taken from the left arm using a Lifesource digital blood pressure monitor (Model: UA-767PVL) following the manufacturer's usage recommendations. A third blood pressure reading was taken if the first two systolic readings differed from each other by 20 mmHg or more or if the first two diastolic readings differed from each other by 14 mmHg or more. In analyzing blood pressure data, hypertension medication and other medications that affect blood pressure should be taken into account. Pulse was also recorded from the blood pressure monitor; the mean of the first two readings is typically used in analyses. Normal pulse rates are between 60 and 80 beats per minute. Table 2 reports the summary statistics of the blood pressure and pulse readings for the NSHAP sample.

Table 1. Measures, Sources, and Sample Sizes Collected in the National Social Life, Health, and Aging Project

Measure	*N*	Measures	Source
Systolic blood pressure	2,935	Hypertension	Automatic blood pressure cuff
Diastolic blood pressure	2,935	Hypertension	Automatic blood pressure cuff
Pulse	2,932		Automatic blood pressure cuff
Waist	2,901	Obesity	Standard anthropometric techniques
Weight	2,816	Obesity	Health-o-Meter scale
Height	2,893	Stature	Tape measure
BMI	2,790	Obesity	Derived from weight and height
Get up and go	1,346	Functional health	Previously validated measure
Activities of daily living	3,004	Functional health	Previously validated measure
Modified Charlson comorbidity index	3,005	Morbidity	Modified measure
Self-reported health	2,993	Relative health	Modified measure
Estradiol	2,479	Sex hormone	Saliva
Testosterone	2,403	Sex hormone	Saliva
Progesterone	2,450	Sex hormone	Saliva
Dehydroxyepiandrosterone	2,383	Sex hormone	Saliva
HbA1c	1,739	Glucose metabolism	Dried blood spot
Hemoglobin	1,859	Anemia	Dried blood spot
C-reactive protein	1,940	Inflammation	Dried blood spot
Epstein–Barr virus antibody	1,981	Immune function	Dried blood spot

Note: BMI = body mass index.

Table 2. Summary Statistics for Blood Pressure (mmHg) and Pulse (beats per minute)

Measure	Range	*M* (weighted)	*SD*
Systolic blood pressure			
Ages (years)			
57–65	91–212.7	134.2	19.1
66–75	78–233	136.7	20.3
76+	83–214	140.3	21.4
Diastolic blood pressure			
Ages (years)			
57–65	53–126.5	83.5	11.0
66–75	44–130	80.1	12.0
76+	41.5–133.7	77.7	12.3
Pulse			
Ages (years)			
57–65	41.5–134.5	72.0	12.5
66–75	40–132.5	71.1	12.1
76+	40.5–128	69.2	12.2

Note: Systolic and diastolic blood pressures are the mean of two readings if two measurements are available and three readings if three measurements are available. Pulse is the average of the first two readings.

Anthropometric measures.—Anthropometric measures refer to body measurements such as height, weight, and waist circumference that are used to characterize the size and shape of the body. In adults, anthropometric measurements are used to assess obesity, a condition in which the proportion of body fat exceeds the range thought to be normal or healthy. Obesity is associated with a higher risk of chronic conditions at older ages such as cardiovascular disease and diabetes and with a higher risk of premature death (National Task Force on the Prevention and Treatment of Obesity, 2000).

There are two measures of obesity reported by NSHAP: body mass index (BMI) and waist circumference. An individual's BMI is defined as his or her weight in kilograms divided by the square of his or her height in meters, that is, BMI = weight [kg]/(height [m])^2. (Note that weight alone is thought to be an insufficient indicator of obesity in the absence of height.) High BMI has been shown to be associated with increased risk of mortality (Calle, Thun, Petrelli, Rodriguez, & Heath, 1999). Waist measurements are useful as a proxy for abdominal fat (Lemieux, Prud'homme, Bouchard, Tremblay, & Despres, 1996), and high waist circumference has been associated with increased cardiovascular disease risk, especially among individuals with high BMI. The distributions of waist circumference, height, weight, and BMI in the NSHAP sample are shown in Table 3.

The World Health Organization (1995) has identified six statistical categories associated with ranges of BMI; these categories are typically used in analyses. The categories are low (BMI <18.5), slightly low (BMI 18.5–20), normal (BMI 20–25), high (BMI 25–30), obese (BMI ≥30), and very obese (BMI ≥40). For waist measures, the National Heart, Lung, and Blood Institute (1998) has designated as high risk having a waist circumference greater than 102 cm for men and greater than 88 cm for women. BMI and waist classifications may be used as separate measures of obesity or combined as shown in Table 4.

Table 3. Summary Statistics of Anthropometric Measures and Obesity

Measure	Range	*M* (weighted)	*SD*
Men			
Waist (inches)			
Ages (years)			
57–65	28.5–66	41.1	5.47
66–75	27–58	40.5	4.92
76+	29–58	39.7	5.06
Height (inches)			
Ages (years)			
57–65	54–82	69.8	2.98
66–75	53–81	69.1	3.03
76+	55–77	68.2	3.19
Weight (lbs)			
Ages (years)			
57–65	92.5–330	209.1	41.61
66–75	99–330	195.4	35.51
76+	103–330	181.1	35.37
BMI (kg/m^2)			
Ages (years)			
57–65	14.1–53.3	30.2	5.81
66–75	17.2–66.6	28.7	4.92
76+	17.6–47.3	27.3	4.92
Women			
Waist (inches)			
Ages (years)			
57–65	23–64	36.7	6.37
66–75	25–66.5	36.1	6.03
76+	22–54	35.8	5.28
Height (inches)			
Ages (years)			
57–65	49–72	63.8	2.82
66–75	48.5–74	62.9	3.21
76+	51–78	62.4	2.96
Weight (lbs)			
Ages (years)			
57–65	92.5–104	173.7	41.23
66–75	77–330	160.5	36.15
76+	71–274.5	152.2	31.45
BMI (kg/m^2)			
Ages (years)			
57–65	17.1–75.6	30.0	7.04
66–75	15.6–67.3	28.7	6.74
76+	14.8–59.3	27.7	6.10

Note: BMI = body mass index.

Height was measured in the following way. With the respondent against a wall, a clipboard was placed on top of the respondent's head and a Post-it note was placed directly below the clipboard. The respondent was asked to step away from the wall, and a standard measuring tape was used to measure the distance from the floor to the top of the Post-it note. Weight was measured with clothing on, using a Health-o-Meter digital scale (Model: HDL111DQ-60), and recorded to the nearest half pound. For waist measurements, a standard fiberglass tape measure was used to measure the waist at a point midway between the iliac crest and the bottom rib, just above the navel.

Table 4. Distribution of Body Mass Index (BMI) and Obesity

Classes	Proportion (weighted), %
Ages 56–65 years	
Low or slightly low	2.60
Normal	15.84
High	20.37
Obese or very obese	61.19
Ages 66–75 years	
Low or slightly low	3.09
Normal	21.17
High	20.61
Obese or very obese	55.12
Ages 76+ years	
Low or slightly low	5.00
Normal	24.26
High	15.51
Obese or very obese	55.23

Note: Classification of BMI is as follows. Low or slightly low: BMI <20; normal: BMI ≥20 and <25; high: BMI ≥25 and <30; obese and very obese: BMI ≥30 or waist circumference >102 cm for men, >88 cm for women.

Get up and go.—NSHAP reports a measure of physical mobility. Loss of mobility has been shown to be a useful predictor of future physical disability (Fried, Bandeen-Roche, Chaves, & Johnson, 2000), and in older adults, physical disability is strongly associated with chronic conditions (Wolff, Starfield, & Anderson, 2002): older individuals with multiple chronic conditions are more likely to experience rapid declines and disability, and conversely, disabled adults are at greater risk of health complications and developing other impairments (Stuck et al., 1999). Disability and impairment are also strong predictors of subjective well-being and, moreover, are better predictors of subjective ratings of well-being than the pathology or disease precipitating the disability (Ormel et al., 1997). Disabled adults also have increased mortality risk (Lamarca et al., 2003).

In NSHAP, physical mobility is measured by the timed get-up-and-go test. For this test, respondents are asked to, from a seated position, get up from a chair, walk 3 (premeasured) m at a normal pace, turn around, walk back 3 m toward the chair, and sit down again. The time (in seconds) that it took for the respondent to (a) stand, (b) walk 3 m, (c) turn around, (d) return 3 m, and (e) turn and sit was recorded with the aid of a computer. Although the times of the individual stages may be used, most analyses use, as a measure of mobility, the overall time of completion of the get-up-and-go test or a dichotomous variable based on that overall time. Bischoff and colleagues (2003) suggest a reported time of 12 s or less as indicative of normal mobility (Table 5).

Salivary hormones and dried blood spots.—Direct measures of key physiological measures were assayed from either saliva or dried blood spot samples. An in-depth discussion of the analytes, methods of collection, and analysis of salivary hormones can be found in Gavrilova and colleagues (this issue). A list of the measures assayed from saliva and dried blood spots can be found in Table 1. An in-depth discussion of the analytes, methods of collection, and analysis of dried blood spots can be found in Williams and McDade (this issue).

Table 5. Distribution of Get-Up-and-Go Overall Times (in seconds)

	Range	*M* (weighted)	*SD*	Median
Ages (years)				
57–65	3–104	11.63	6.09	11
66–75	4–118	12.73	7.49	11
76+	4–90	14.74	7.55	13

Self-rated and Self-reported Measures

Functional health.—Functional health is the ability to engage in everyday activities such as bathing or walking. According to the Centers for Disease Control (2004), many older adults report physical limitations with respect to walking, reaching, stooping, and pushing. As discussed in the mobility section, physical disability is strongly predictive of trajectories of physical health and mortality.

NSHAP reports the self-rated difficulty of engaging in seven activities of daily living that are indicators of functional health. These are walking one block; walking across a room; dressing oneself; bathing or showering; eating, such as cutting up one's food; getting in or out of bed; and using the toilet, including getting up and down. NSHAP also reports the self-rated difficulty of driving a car during the day and also at night. These items may be used as individual measures of functional health or may be combined into a single index that indicates whether the respondent has difficulty with any of the listed activities. Table 6 shows the proportion of respondents experiencing difficulty with these different daily activities.

Morbidity.—In NSHAP, respondents were asked whether they had been diagnosed with particular health conditions. Specifically, they were asked, "Has a medical doctor ever told you that you have (had) . . ." *x* health condition.

Table 6. Functional Health (Activities of Daily Living)

	Proportion Reporting Any Difficulty in Each Age Group (Weighted)		
	Ages (years, %)	Ages (years, %)	Ages (years, %)
Activity of Daily Living	56–65	66–75	76+
Walking a block	18.4	24.3	36.3
Walking across a room	7.9	9.7	18.3
Dressing self	13.4	15.0	19.4
Bathing or showering	6.9	8.3	15.0
Eating	3.8	2.9	5.9
Getting in or out of bed	9.5	9.7	14.2
Using the toilet	8.8	9.0	15.8
Driving a car during the day	9.3	11.3	27.0
Driving a car at night	29.3	35.8	58.9
Reporting difficulty with any activity (excluding driving)	20.5	22.5	30.7

Table 7. Distribution of Selected Morbidity Items

Morbidity Measure	Proportion Reporting Within Age Group (weighted), %
Ever had a heart attack	
Ages (years)	
57–56	9.49
66–75	11.4
76+	16.8
Ever had arthritis	
Ages (years)	
57–56	46.0
66–75	52.2
76+	62.8
Ever had ulcers	
Ages (years)	
57–56	11.5
66–75	15.2
76+	14.7
Ever had asthma	
Ages (years)	
57–56	11.10
66–75	9.9
76+	8.5
Ever had stroke	
Ages (years)	
57–56	5.62
66–75	8.37
76+	13.2
Ever had hypertension	
Ages (years)	
57–56	4.74
66–75	58.4
76+	60.6
Ever had diabetes	
Ages (years)	
57–56	19.1
66–75	21.9
76+	38.3
Ever had cancer	
Ages (years)	
57–56	8.5
66–75	13.4
76+	15.2
Ever had enlarged prostate (of men)	
Ages (years)	
57–56	18.1
66–75	34.6
76+	35.8

Respondents were asked about health conditions that were hypothesized to have an association with social life and sexuality, conditions that are known to be highly prevalent in older populations, and conditions predictive of mortality. These health conditions may be coded separately as individual measures of morbidity if researchers are interested in the presence or absence of a particular condition.

If researchers are interested in the presence of multiple conditions, a measure of comorbidity may be constructed. Comorbidity, or the concomitant presence of multiple conditions, has been shown to increase the risk of mortality. That is, given an individual has a certain disease, the concomitant presence of other diseases significantly increases risk of death in both the short run and the long run. In addition to the self-reports of individual diseases itemized previously, NSHAP reports a comorbidity index (comorb) of the total number of health conditions (from a list of specified conditions) reported by the individual. The list of conditions that contribute to this index is derived from the set of conditions that define the Charlson comorbidity index. Developed by Charlson, Pompei, Ales, and McKenzie (1987), the original Charlson comorbidity index is a weighted average of 19 health conditions that have been shown to be predictive of mortality. The conditions are weighted according to the degree to which they increase the risk of mortality, and this composite index has been shown to be highly predictive of 1- and 10-year mortality rates.

The Charlson index was originally validated in a research context in which health conditions were identified using patient medical records. Katz, Chang, Sangha, Fossel, and Bates (1996) subsequently adapted the Charlson index for use in a questionnaire setting. In NSHAP, we followed the model of Katz and colleagues, asking respondents to report on any previous diagnoses of health conditions.

Because NSHAP does not ask about *all* conditions that are included in the Charlson/Katz indexes, it is not possible to generate an index that is strictly comparable to these indexes; nevertheless, an unweighted count of conditions (as reported in the variable comorb) is likely to be informative as a gross measure of disease burden. We also encourage researchers to develop composite measures that are most relevant for their research needs. Table 7 reports the presence of selected health conditions in the NSHAP sample, and Table 8 gives summary statistics of the unweighted comorbidity index comorb.

Self-reported health.—Self-reported health is a person's subjective assessment of his or her own well-being. Self-reported health has been shown to be associated with a wide array of more specific health measures, such as sensory function, functional health, cognition, disease, and sexual dysfunction (Laumann, Paik, & Rosen 1999; Ostbye et al., 2006). In addition, there is some evidence to suggest that self-reported health is as useful an indicator of health and mortality as physician diagnosis (Ferraro & Farmer, 1999; Maddox & Douglas, 1973; Mossey & Shapiro, 1982). In the context of NSHAP and all its other health and morbidity measures, a self-reported measure of health is useful because it captures the concept of health as overall well-being and not simply the absence of disease (Ross & Wu, 1996). Table 9 lists the distribution of self-reported health relative to others of the same age group.

Discussion and Analytical Recommendations

Most chronic conditions and diseases associated with aging cannot be measured by a single question or biomeasure.

Table 8. Distribution of Comorbidity Index

	Range	*M* (weighted)	*SD*	Median
Total number of Charlson comorbidities				
Ages (years)				
57–65	0–9	1.3	1.33	0.0
66–75	0–8	1.7	1.41	1.0
76+	0–8	1.9	1.44	2.0

Table 9. Distribution of Self-reported Health Ratings

Classes	Proportion (weighted), %
Men	
Ages 56–65 years	
Poor	6.9
Fair	16.5
Good	23.7
Very good	40.0
Excellent	13.0
Ages 66–75 years	
Poor	6.9
Fair	17.5
Good	30.9
Very good	29.
Excellent	15.2
Ages 76+ years	
Poor	8.0
Fair	24.9
Good	30.7
Very good	27.4
Excellent	9.1
Women	
Ages 56–65 years	
Poor	5.7
Fair	15.4
Good	31.3
Very good	32.7
Excellent	14.8
Ages 66–75 years	
Poor	5.6
Fair	17.3
Good	31.0
Very good	33.8
Excellent	12.3
Ages 76+ years	
Poor	9.4
Fair	22.9
Good	32.6
Very good	25.1
Excellent	10.1

Note: Proportions may not sum to 100% because of rounding.

The following section provides a discussion of a few important chronic diseases/conditions currently affecting older adults in the United States and provides a description of the measures collected in NSHAP that are associated with these diseases/conditions.

Measures of Cardiovascular Diseases

Diseases associated with the cardiovascular system, including heart diseases, cerebral vascular disease, and peripheral artery disease, are consistently the number one cause of mortality in the United States (Neyer et al., 2007). Significant differences in prevalence and mortality rates associated with cardiovascular diseases have been reported by gender, race, and ethnic group (Barnett et al., 2001; Casper et al., 1999; Rosamond et al., 2007). These disparities in cardiovascular health and its associated mortality risk cannot be accounted for by purely genetic, biological, social, or behavioral factors but are most likely caused by the complex interaction of all these factors.

NSHAP includes several measures of cardiovascular disease. In the morbidity section of the interview, participants were asked if they had ever had hypertension, heart disease, or a stroke. Both systolic and diastolic blood pressures were also directly measured. Systolic and diastolic blood pressures are common measures of hypertension, one of the most common cardiovascular diseases. Current guideliness suggested by the Centers for Discase Control define hypertension as a systolic blood pressure above 140 mm Hg or 90 mm Hg diastolic. Blood pressure levels between 120 and 139 mm Hg systolic or 80-89 mm Hg diastolic are considered to be prehypertensive and associated with an increased risk of developing cardiovascular diaease (Chobaman et al., 2003). Levels of C-reactive protein, a risk factor for cardiovascular disease (Koenig et al., 1999; Pai et al., 2004; Ridker, 2003; Ridker, Cushman, Stampfer, Tracy, & Hennekens, 1997; Ridker, Rifai, Rose, Buring, & Cook, 2002), were also measured from dried blood spots.

Measures of Diabetes

Diabetes is one of the leading causes of morbidity and mortality among persons aged 65 and older (Desai, Zhang, & Hennessy, 1999). About 20% of persons in this age group are estimated to have diabetes, with another 25% in prediabetic stages (Samos & Roos, 1998). Moreover, because diabetes can be asymptomatic for many years, about 50% of older individuals with diabetes are thought to be undiagnosed (Meneilly & Tessier, 2001).

NSHAP includes two different measures directly related to diabetes. The first measure indicates whether an individual reports ever having been told by a medical doctor that he or she has diabetes or high blood sugar. This self-report measure may be interpreted directly as an indicator of diagnosed diabetes, or it may be used as part of a composite comorbidity score (discussed in the morbidity section). The second NSHAP measure associated with diabetes—assessed from blood spot samples obtained from respondents—is the percentage of hemoglobin attached to glucose. This measure is known as glycosylated hemoglobin, or HbA1c. Details on the collection and properties of the HbA1c biomarker are discussed in Williams and McDade (this issue).

Because HbA1c is a relatively new biomarker in the context of population-based surveys, there are as yet no standard guidelines for its use in social science research. There are, however, several considerations that might be useful to bear in mind in using the HbA1c measure for such research.

First, interpreted directly as a measure of glycemic control for patients with diabetes, as is done in a clinical setting, an HbA1c level of 7% is an important target (American Diabetes Association, 2003). This level of HbA1c is thought to be the threshold level below which there are many fewer health complications from diabetes (healthy persons without diabetes have HbA1c levels ≤6%).

Second, although it is tempting to use HbA1c as a population measure of morbidity associated with diabetes, an analysis using HbA1c in this way is somewhat complicated. The main problem is that two individuals with the same HbA1c level may have very different morbidity profiles, depending on whether they have been diagnosed and are under treatment. For example, a "normal" HbA1c reading may identify either an individual who truly does not have diabetes or an individual who has diabetes but is currently controlling it through medication or lifestyle modification; the second person is likely to have already had some pathology related to diabetes affecting his or her health, and this is not detected in the HbA1c measure. Thus, to use HbA1c as a morbidity measure, it is best to combine this measure with information on whether the respondent reports having been diagnosed with diabetes and with information from the medication log indicating diabetic treatments such as sulfonylureas, biguanides, or insulin.

Measures of Allostatic Load

The concept of allostatic load has been proposed as a mechanism by which environmental factors can affect physiology and result in differential health outcomes, especially at older ages (McEwen, 2002; McEwen & Seeman, 1999; McEwen & Stellar, 1993). Allostatic load is the cumulative cost of maintaining allostasis (Sterling & Eyer, 1988)—a relatively stable and steady state. Over time, the dysregulation of the systems involved in maintaining allostasis, especially those involved with the stress response, may occur and result in declining health and the development of chronic disease. A high allostatic load has been associated with increased risk of mortality, cognitive and physical function decline, and increase in general health decline (McEwen, 2007). Social factors such as socioeconomic status and social integration and racial and ethnic group have been associated with allostatic load (Geronimus, Hicken, Keene, & Bound, 2006; T. Seeman et al., 2004; T. E. Seeman, Singer, Ryff, Dienberg, & Levy-Storms, 2002).

Measures of allostatic load include direct measures of the primary mediators of the physiological stress response of the sympathetic nervous system (SNS) and the hypothalamic-pituitary-adrenal (HPA) axis (McEwen, 2007) as well as measures associated with the chronic effects of the SNS and HPA axis activity (McEwen & Seeman, 1999) including cardiovascular activity and atherosclerosis development, metabolism and adiposity, and glucose metabolism. Not all the measures generally used to measure allostatic load are available in the NSHAP data; however, measures of most of the above-mentioned systems are available. Further, because of the cumulative nature of allostatic load, a true measure of allostatic load would optimally include measures of change in these biological markers over time, but this was not possible.

NSHAP does not measure stress directly but does include measures of perceived stress. Measures of perceived stress use a four-question modification of Cohen's Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). Perception of anxiety is also measured in NSHAP using a modification of the seven-item subset of the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). Further discussion of these NSHAP measures and other quality of life measures can be found in Drum and colleagues (this issue). However, dehydroxyepiandrosterone (DHEA) levels are assessed from saliva, and DHEA has been associated with HPA axis activity (for a more detailed discussion, see Gavrilova and colleagues, this issue). Measures of cardiovascular activity and atherosclerosis development in NSHAP include heart rate, systolic and diastolic blood pressure, and C-reactive protein. Metabolism and adiposity are measured using BMI and waist circumference, and glucose metabolism is measured with HbA1c. For more detailed discussions on measuring allostatic load, see, for example, McEwen and Seeman (1999), Seeman and colleagues (2004), Seeman and colleagues (2002), and Seplaki, Goldman, Weinstein, and Lin (2006).

Conclusions

NSHAP provides a combination of self-reported-rated and direct biomeasures associated with health. The main objective of this research was to provide the means by which to understand the variability in health outcomes in older adults by integrating biological and social measures. By providing both self-reported and assessed measures, we hope that when combined with the breadth of available social measures, we are providing a rich source of data to explore in an attempt to understand health outcomes in aging adults.

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Correspondence

Address correspondence to Sharon R. Williams, PhD, Department of Anthropology, Purdue University, 700 West State Street, West Lafayette, IN 47907. Email: srw@purdue.edu

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