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Age- and Sex-Specific Transformations of Health Status Measures to Incorporate Death

Ann M. Derleth
University of Washington

Paula Diehr
University of Washington, pdiehr@u.washington.edu

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Abstract

Introduction: Measures of health status and physical function do not usually include a specific code for death. This can cause problems in longitudinal studies because analyses limited to survivors may bias the results. One approach is to recode the status variables to include a reasonable value for death. One method that has been used is to replace each scale value with the estimated probability that a person with this value will be "healthy". "Healthy" has been defined as being above a particular threshold on the variable of interest one year later, or alternatively as being in excellent, very good, or good self-rated health in the same year. Transformation coefficients have been published for various health status measures, but the coefficients were estimated from data for older adults (usually older than 65).

Methods: Here, we used data from the Medical Expenditures Panel Survey (MEPS) to develop new age-specific coefficients for self-rated health, activities of daily living (ADL), instrumental activities of daily living (IADL), and the SF-12 physical function scale (PCS). We computed new age-specific transformations for ages 0 through 85 and compared the new transformations with published transformations for persons aged 65 and older.

Results: The transformed values were different at different ages, The new transformed values for persons 65 and over were remarkably similar to the published results, calculated from different datasets.

Conclusion: The new transformation equations should be particularly useful for studies involving persons younger than 65. For older persons, either the published equations or these new equations may be used.

Age- and Sex-Specific Transformations of Health Status Measures to Incorporate Death

1.0 Introduction

In assessing the level of health of a population or group, it is often desired to obtain a measure of health other than survival. Interest may be in the average health of persons in the group at one point in time, in the change in average health over time or in predicting future health for persons with a given level of baseline health. Such a measure is especially appropriate for assessing care for chronic diseases, where persons can live long periods with the disease, placing a burden on the person's health and function and health care costs. Among the health measures used are self-reported ratings of general health, health status, activities of daily living, or quality of life. Diehr, et al.[i] pointed out that in studies looking at trends in health in an entire cohort over time, where health measures are obtained at baseline and one or more additional times, analyses that exclude deaths or impute values for the period after death do not adequately account for deaths. Excluding deaths results in average outcomes computed only for the healthier group who did not die. Imputing values assigns a level of health to persons who are dead.

In a series of reports from studies of older adults, Diehr and colleagues have developed transformations where the health variables of interest could be recoded into new variables that are useful for outcomes analysis and that have a clear meaning and a value for death[i]. For example, for the global health measure "How would you rate your health? Excellent, very good, good, fair, or poor" (EVGGFP),[ii iii] three approaches have been given: (1) A category was added for the dead and the percent of persons in each health state was then plotted at each time point. (2) EVGGFP was transformed to a dichotomous variable, "healthy (1)" or "unhealthy (0)", where healthy was defined as excellent, very good or good (EVGG) and unhealthy was fair, poor or dead. This variable was then plotted as trajectories of health over time, including before and after events such as stroke and death. [iv v] (3) EVGGFP was transformed to the probability of being healthy one year in the future (PHF), conditional on the current value, with deaths set to unhealthy because there was no possibility of being healthy in the future.[ii] In a recent paper, Diehr, et al.[i] provided transformations for 11 health variables and three definitions of healthy for older adults. Diehr and colleagues have also reported transformations for the subscales and summary scores of the SF-36 [ii vi] again using data from older adults. Using this approach, researchers can keep the people who die in the analysis by transforming (ie, "coding") the health measure into one of the three types of measures outlined above, conditional on their baseline health: the proportion in each level of health at a point in time, including death; the proportion who are healthy at a point in time; or the percent probability of being healthy one year in the future, conditional on baseline health. The latter measure can be used in a Markov model to predict a trajectory of health beyond the end of a study or for a population for which one of these health measures is available. For example, Ostbye and Taylor used the method with longitudinal data from the Health and Retirement Study (HRS) and the Asset and Health Dynamics Among the Oldest Old (AHEAD) to show that individuals who had quit smoking at least 15 years prior to baseline had a similar number of YHL left as never smokers. [vii] The method was also used by Strandberg, et al. using the summary scores of the SF-36 in a study of alcohol consumption and quality of life in men in old age.[viii]

The PHF transformations published by Diehr, et al. in the papers cited above were developed using data from studies in older adults. PHF transformations have not been studied for those primarily under 65. This study used data from a general US population sample at all ages to (1) develop and evaluate PHF transformations for all ages from birth to 85 and (2)validate the PHF transformations for those over 65.

2.0 Methods

2.1 Data and Context: The Medical Expenditure Panel Survey (MEPS). The Medical Expenditure Panel Survey (MEPS) of the civilian non -institutionalized population in the U.S is a continuous overlapping longitudinal survey that is designed to produce nationally representative statistics on health care expenses as well as health conditions and health insurance availability and coverage.[ix] MEPS is co-sponsored by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS) in the United States Department of Health and Human Services. Although MEPS provides weights to project to the US non-institutionalized civilian population, I have not used those weights here.

2.1.1 Subjects. The subjects for this study were persons residing in dwelling units surveyed in the Medical Expenditure Panel Survey (MEPS) for the years 1996 – 2001. For each panel, the sample is drawn from dwelling units sampled for the National Health Interview Survey (NHIS) in the prior year. Each panel consisted of approximately 13,000 to 22,000 subjects and five interviews were conducted over a period of two and a half years. To obtain a sample size large enough to develop transformations by age group, I combined the data for all the panels surveyed by MEPS from 1996 through 2001. Each year a new panel is started, so that except for the first year in 1996, in any one year, the total response set will consist of dwelling units in two panels, the second year of the earlier panel and the first year of the later panel.

2.1.2 The Survey. For each panel, the first interview was conducted in the early months of the first year and asked respondents to relate information for persons in their reporting, including health status, beginning with the start of the year until the date of the interview. The fifth and last interview was conducted after the end of the second year and asked for information up to the end of the second year. The third interview was carried out in the months immediately preceding and following the end of the first year. Interviews two and four were conducted roughly at mid-year in each year of the survey. Each interview after the first one related to the time period from the prior interview to the current interview or the end of the second year, if it was the last interview. MEPS used complex rules for determining whether a person was eligible for inclusion in each interview. [x] These rules allow inclusion of newborns into the sample during the two years and exclusion of persons who die or leave and go to an institution or military assignment. I retained the persons who had died, recoding them as dead for each health status variable I used in the analysis. Thus, for those who were present and within scope of the survey at each interview, it was possible to have as many as 3 approximately one-year time spans from which to estimate the transition probabilities, from interview one to three, two to four, and three to five. Throughout this paper, these one year time spans will be called "transition pairs".

In addition, in years since 2000, a mail-back, Self-Administered Questionnaire (SAQ), which included the SF-12, was administered to all household respondents 18 years old and older during rounds 2 and 4, which are approximately one year apart. Each respondent could therefore contribute one transition pair from this survey. Responses from the panels for which two observations were available, panels 5 and 6, from the years 2000 to 2002, were included in this study.

2.1.3 Measures

2.1.3.1 General Health – EVGGFP. Interviewers asked the respondent to report the perceived health status of each reporting unit member, including rating their health as Excellent, Very Good, Good, Fair or Poor (EVGGFP). I have used all available transition pairs with this rating complete. The perceived health status for these individuals is recoded to 0 for each interview period following the death. Healthy for this item was defined as being in Excellent, Very Good or Good health.

2.1.3.2 ADL's. In each round the interviewer asks whether and which persons in the reporting unit receives help or supervision in performing activities of daily living, such as bathing, dressing or getting around the house because of an impairment or a physical or mental health problem. The number of such limitations is not recorded, only the presence or absence of one or more limitations. As with EVGGFP, I used all available year-apart measures, so there could be as many as three such measures on each respondent. Healthy for this measure was defined as having no limitations in ADL's.

2.1.3.3 IADL's. In each round the interviewer also asks whether and which persons in the reporting unit receives help or supervision in performing instrumental activities of daily living (IADL's), such as using the telephone, paying bills, taking medications, preparing light meals, doing laundry, or going shopping, because of an impairment or a physical or mental health problem. As with ADL's, the number of such limitations is not recorded, only the presence or absence of one or more limitations. I used all available year-apart measures, so each respondent could have up to three measures. Healthy was defined as having no limitations in IADL's.

2.1.3.4 SF-12 PCS. The SAQ was sent to adult respondents age 18 or older in rounds 2 and 4 of the panels being surveyed since 2000. I included respondents from panels 5 and 6 who had returned both questionnaires and those who had returned the first questionnaire and then died before the end of round 4. The SAQ includes the questions from the SF-12 from which the physical component summary score, the PCS, is computed. I used the scores computed by MEPS, which follow the guidelines of Ware, et al. [xi] [xii] Two definitions of healthy were examined for the PCS: (a) being in excellent, very good or good health at one year or (b) having a PCS value in the top 75% of persons using the norm from 1998 (45.46) from the SF-36 Summary Score manual.[xii] The published PCS transformations used the 1990 norm for men of 33.48.

2.1.3.5 Age and gender. Age and gender are also recorded at each round in the MEPS files. The age at the baseline interview for each time span is used for this analysis. Age was also grouped into categories for analysis: 0-17, 18- 64, 65-74, 75-84 and 85 + years and into five year age groups. MEPS coded anyone 90 or older at 90 for years 1996-2000, and anyone 85 years of age or older at 85 since 2000, so it is not possible to subdivide that group any further.

2.2 Analysis

2.2.1 Using logistic regression to predict PHF. Logistic regression was used to predict the probability of being healthy in the future. The dependent variable was the variable "healthy" (as defined above under each measure) coded as 1 for healthy and 0 for not healthy. Age, gender and baseline health status were independent variables, with terms for the log of the age variable and, where appropriate, the health status variable, included to improve fit. For example, for EVGGFP, the estimation was:

logit(EVGG health 1 year later) = $\alpha + \beta_1$ (EVGGFP baseline) + β_2 (log(EVGGFP)) + β_3 (male) + β_4 (Age) + β_5 (log(Age)).

The estimated probability of being healthy (EVGG health) one year later for a given baseline health value (E, VG, G, F, P) was then:

[exp[$\alpha + \beta_1$ (EVGGFP baseline) + β_2 (log(EVGGFP)) + β_3 (male) + β_4 (Age) + β_5 (log(Age))] / [1+exp[$\alpha + \beta_1$ (EVGGFP baseline) + β_2 (log(EVGGFP)) + β_3(male) + β_4 (Age) + β_5 (log(Age))]]*100.

Evaluation of the logistic models was conducted using the likelihood ratio test, residual analysis and graphical assessment. Comparisons of transformations in particular categories were also conducted using t-tests.

2.2.2 Graphical Inspection. The resulting PHF transformations were graphed for each starting health state and compared with graphs of the transformations published for older adults. Graphs of the transformed PCS by age for different baseline PCS values were also assessed. Finally, for an example, PHF-PCS transformations were calculated for persons with or without diabetes and their graphs by age were compared to the Franks transformation of SF-36 summary scores to preference weighted health status (PRF) from Chapter 1.

2.3 Categorical Probability of Being Healthy in the Future (PHF). For each health status variable discussed above, the definition of "healthy" stated above was used to calculate the probability of being healthy one year later, conditional on the level of health at baseline, and according to categories of age and gender. This probability was multiplied by 100 to form the PHF transformation. For example, of the 15,176 transition pairs for males who were in excellent health at baseline and between 1 and 17 years of age, 9,736 were in excellent health a year later, 3,818 were in very good health and 1,486 were in good health a year later for a total of 15,040 in excellent, very good or good health. Thus 15,040 / 15,176 = 0.991 were healthy one year later. Multiplied by 100, the PHF transformation for males age 1-17 years who are in excellent health becomes 99.

All analysis was conducted using STATA 8 and 9.

3.0 Results

3.1. Respondents and transition pairs. The survey files for 1996 – 2001 included data for 97,976 subjects, including 46,958 (48%) males and 51,018 (52%) females. Of those, 91,477 (93%) subjects had health status recorded for 221,224 transition pairs for the global health question, (EVGGFP), each representing a one-year time span, including 916 deaths in 1,339 transition pairs for which health status at one year was set to 0. Males and females again represented 48% and 52% of the respondents with health status. The mean and median age was 34, with 25% of subjects 14 or under and 25% 50 or older. Thirteen percent of subjects were 65 or older. When subjects were grouped by age, there were greater than 3000 transition pairs for each year of age between 0 and 48, greater than 2000 up to age 56, greater than 1000 until age 77 and greater than 500 to age 85.

For ADL's 91,918 subjects provided 221,788 transition pairs and for IADL's 91,768 subjects provided 221,345 transition pairs.

There were 18,689 respondents age 18 and older who provided baseline and one-year responses to the SAQ and thus provided that many transition pairs for analysis. The overall response rate to the first two rounds of the SAQ was 61%, which reflects the response rate to the MEPS survey itself and the responses to the SAQ (87%).[xiii] Average age was 46 years with 25% between 18 and 32 and 25% older than 57. Males represented 46% of respondents and females 54%.

3.2 PHF For Ages 0 to 85 - Logistic Regression Results. The top rows of Table 1 show the coefficients developed from the logistic regression analysis in the MEPS data and the lower rows present the published coefficients for transforming the health variables to PHF. Equation specification for the MEPS data matched that for the published values except that the current health variable for ADL's and IADL's is the presence or absence of limitations, not how many. For the PCS, equations are presented for two definitions of "healthy": PCS in the top 75% of PCS scores for persons of that age group as published by Ware, et al.[xi] and global health rated excellent, very good or good. In addition, MEPS based equations for the PCS are provided incorporating just baseline PCS, as those published, and also incorporating age and gender. Since they were developed on a broader age range than the previously published values, it is not surprising that the MEPS based coefficients and constants differ from those published for older adults. Note, however that the coefficients for the PCS equations including just baseline health are quite similar to those published. For ADL's and IADL's, the health variable is an indicator variable for presence of one or more limitations, and thus is a somewhat different equation than those published for older adults.

The mean of each transformation by age based on the MEPS equations in Table 1 is shown in Figure 1. Note that one of the reasons the lines differ for each health variable is because the definition of healthy differs for each variable. Not shown is the transformation for the PCS using the EVGG definition of healthy. That line exactly mirrored the line for the MEPSPHF_EVG. Mean transformations based on the ADL and IADL do not show much decrement as age increases until about age 65, whereas transformations based on the global health question, EVGGFP, and the PCS show a steady drop as age increases.

3.3 PHF given baseline health – graphical inspection. Graphs of the PHF by age based on the global health question, EVGGFP, are shown in Figure 2a for males and Figure 2b for females. Values for the published transformations are represented by + symbols for persons 65+ and for the MEPS based values by a "o". The top most set of lines (one long, one short) represents PHF for persons who reported Excellent health at baseline. The next set is PHF for persons who reported Very Good health at baseline, etc. The slope of the lines are steeper for the published values for persons in fair or good health, possibly reflecting some selection in the

MEPS data in that some institutionalized persons are not represented. In addition, the study from which the published values came had data available for each age up to 100 whereas the MEPS data were top coded at 85 and 90. Patterns were quite similar for males and females.

Figures 3a and 3b show graphs for PHF based on ADL's and are laid out the same as the EVGGFP graphs, with the + symbol representing the published values and the o representing the MEPS based data. Figures 4a and 4b similarly show the PHF based on IADL's. In all these graphs, the published values have steeper slope for the middle range of limitations (1-3 limits) by age than the MEPS based values and patterns were similar for men and women.

Figures 5a and 5b show the PHF values for selected baseline PCS scores, again for males and females using the top 75% of the PCS norms for 1998 as the definition of healthy. These graphs show that for a given baseline PCS score, the PHF drops as age increases. The slope of the line is steepest for those starting at PCS = 45, which is about the average baseline PCS in this overall population of respondents. Those at PCS 60, which is near the highest value seen, have about the same PHF_PCS until about age 60 after which it declines gradually.

An example comparing, by age group, the PHF based on the PCS to preference weighted health status based on SF-36 summary scores (PRF) from Chapter 1 is shown in Figure 6 for persons with or without diabetes. For either measure, the greatest difference between those with and without diabetes is seen in the ages from 45-64. The PHF values are lower for older ages than the PRF values for the diabetes group as well as the non-diabetes group.

3.4 MEPS PHF compared to published transformations – categorical. The PHF generated from the MEPS data by age groups are shown in Table 2 along with the values published from studies of older adults. The MEPS based probabilities for persons 65 and older are remarkable consistent with the published values of 95, 90, 80, 30, 15, 0. The MEPS data are likely to be somewhat positively selected, given that institutionalized persons are excluded unless they return to the community, but also the oversampling of blacks and Hispanics may offset that to some extent. Probabilities are higher for those 0 to 64.

4.0 Limitations

The sample design of MEPS, drawn from households who responded to the prior year sample of the NHIS, suggests that there is most likely some healthy volunteer bias in the responses. The fact that persons were not surveyed once they went to an institution and stayed means that deaths and decrements in health may not be completely ascertained. One year transitions for persons over 85 are problematic since respondents aged 90 or over were coded as 90 ("top-coded") for 1996 – 2000 and 85 for the later years. One analysis of these data that imputed values for those who went to an institution found that it did not change the probability of being sick appreciably.[xiv] At each interview, one person responded for the reporting unit (family, household), thus approximately 55% of the ratings of general health, ADL's and IADL's were proxy ratings. Todorov and Kirchner used data from the National Health Interview Survey on disability to assess the bias in proxies' reports on disability, observing that proxies under-reported disabilities for people aged 18 – 64 years but over-reported for people 65 years and older.[xv] Steinman, et al. found that the prevalence of reduced health related quality of life for proxy reports in the NHIS was half that of self-reports, but that adjustment for case mix (socioeconomic differences and limitations in function) explained most of that difference. They concluded that relatively less bias would be introduced by including proxy reports than to exclude them[xvi]. Finally, I did not apply the longitudinal weights that are provided in MEPS that adjust for non-response and for over-sampling of some population groups, and thus this analysis assumes that the probability of transition from one health state to another is the same across all groups sampled.

5.0 Discussion and Conclusions

5.1 Incorporation of Age/Gender. Transformations calculated in the MEPS data across all ages showed that the mean PHF was lower for persons of greater age for all levels of health, ADL's, IADL's and PCS, with the exception of newborns under 1 year of age.. Mean values across all respondents by age were highest for health defined by presence or absence of ADL's or IADL's, intermediate for health defined by the response to the global health question (EVGGFP) and lowest for health defined as being in the top 75% of the 1998 norms for the SF-PCS. Equations are provided to calculate these transformations using age, gender and baseline health. In addition numeric transformations are provided that can be used with broad categories of age.

5.2 Validation of Published Values. The values obtained in the MEPS data for persons over 65 were remarkably similar to those previously published for self rated health. For the ADL's and IADL's, the values for those with limitations were similar to the values published for persons with 3 or more limitations. It is important to remember that the definitions of limitations were not exactly the same between the different sources.

5.2.1 EVGGFP. The logistic regression coefficients from MEPS data produced PHF values that were more gently sloped as age increased for those over 65 than the published values except for those beginning in excellent health. The studies in which the published values were developed had more detail on age beyond 85 than the MEPS data. For studies where the data are limited to older persons, the published equations might be preferred. However, if the age range is broad, then the equations from the MEPS data would be preferred.

The observed categorical transformations for the EVGGFP variable to the Probability of Being Healthy in the Future (PHF) for persons 65 and older are remarkably similar in the MEPS data to those previously published even though there were differences in the populations being studied. The published values of 95, 90, 80, 30, 15 and 0 could be used in this age group.

5.2.2 ADL's and IADL's. For Activities of Daily Living (ADL) and Instrumental Activities of Daily Living IADL), I have seen that the transformation for those with no limitations at baseline is similar to that published in studies of older adults for those over 65. For those with limitations, the results are not directly comparable since the prior studies provided transformations for the specific number of limitations between 1 and 6, whereas MEPS has only presence of 1 or more. In addition there are some differences between the data sources in the specific limitations that are ascertained. For studies with a preponderance of older adults, the previously published transformations will provide more detail. If the researcher is using data with a large number of persons under 65, however, the MEPS based transformation may be preferred. From inspection of the graphs, it appears that they replicate approximately the PHF in the published transformations for persons with 3 or more limitations

5.2.3 SF-PCS. The equations for transforming the baseline PCS to the PHF for either definition of healthy are remarkably similar to those published. The published equations used the 1990 norm for persons over 65 to define the top 75%, which was 33.48, because that was the study population. Equations are provided for transforming the PCS that also incorporate age and gender. The example comparing PCS based PHF to PRF from Chapter 1 showed that the PHF values were substantially lower for older persons, much in the same way the PHF based on PCS was lower than the PHF based on EVGGFP, ADL or IADL limitations.

5.3 Conclusion. Transforming measures of physical function or self rated health to a measure that incorporates a value for death that is meaningful allows the inclusion of all subjects in a longitudinal analysis and prevents a bias obtained through excluding the deaths (only healthier are followed) or imputing values for those who have died. Using data from MEPS, a survey of the US non-institutionalized civilian population, I was able to develop transformations for across a broad age range for the global health question, ADL's, IADL's and the SF-PCS. MEPS data were also used to confirm previously published transformations for four health variables to the probability of being healthy in the future conditional on current health for older adults. .If analysis is being conducted in a population where a large proportion of persons are under the age of 65, the MEPS based transformations provide a transformation that reflects a broader age range. If the analysis is being conducted with data primarily from older adults, the published transformations have been confirmed and are likely to provide a better fit particularly for persons over 85.

Table 1: Logistic Regression Coefficients for Transforming Health Variables to the Percent Probability of Being Healthy 1 year in the Future (PHF)

Dependent Health Variable:	Regression Coefficients					
	constant (a)	Baseline health (X) (b)	Log of Baseline Health ln(X) (c)	Male (d)	Age (e)	ln(Age) Pub or ln(Age + 1) MEPS (f)
	-------------------- from the MEPS# data – all ages -----------------					
EVGGFP (5=excellent, 4=very good, … 1=poor) [healthy=EVGG]	-3.75	0.253	4.024	0.104	-.0276	0.103
Activities of Daily Living (ADL's) [healthy = 0 ADL's]	4.77	-4.751	NA	-0.008	-.072	0.816
Instrumental Activities of Daily Living (IADL's) [healthy=0 IADL's]	5.295	-3.945	NA	0.070	-.0614	0.413
SF-PCS (healthy = top 75%	-6.313	0.155	NA	NA	NA	NA
SF-PCS [healthy = top 75%]	-7.532	0.140	NA	0.212	-0.058	1.213
SF-PCS [healthy = EVGG]	-3.160	0.109	NA	NA	NA	NA
SF-PCS [healthy=EVGG]	2.113	0.104	NA	-0.002	.0251	-1.638
	-------------------------- published – older adults -------------------------------					
EVGGFP (5=excellent, 4 is very good, …,1=poor) (healthy=EVGG)	-2.13	0.154	5.84	-.066	-.047	-0.359
Activities of Daily Living (ADL's) ** (healthy= 0 ADL's)	-3.81	0.562	-3.94	.126	-.117	3.392
Instrumental Activities of Daily Living (IADL's ** (healthy= 0 IADL's)	-10.41	0.63	-3.91	.223	-.125	4.929
SF-PCS (healthy = top 75%)	-6.57	0.187	NA	NA	NA	NA
SF-PCS (healthy=EVGG)	-3.77	0.109	NA	NA	NA	NA

*logit ($healthy_1$) = a + b($variable_0$) + c ln($variable_0$ + 1)+d*male + e*age + f*ln(age)

** See appendix Table 1 for question wording

MEPS: Medical Expenditure Panel Survey responses, 1996 - 2001[ix]

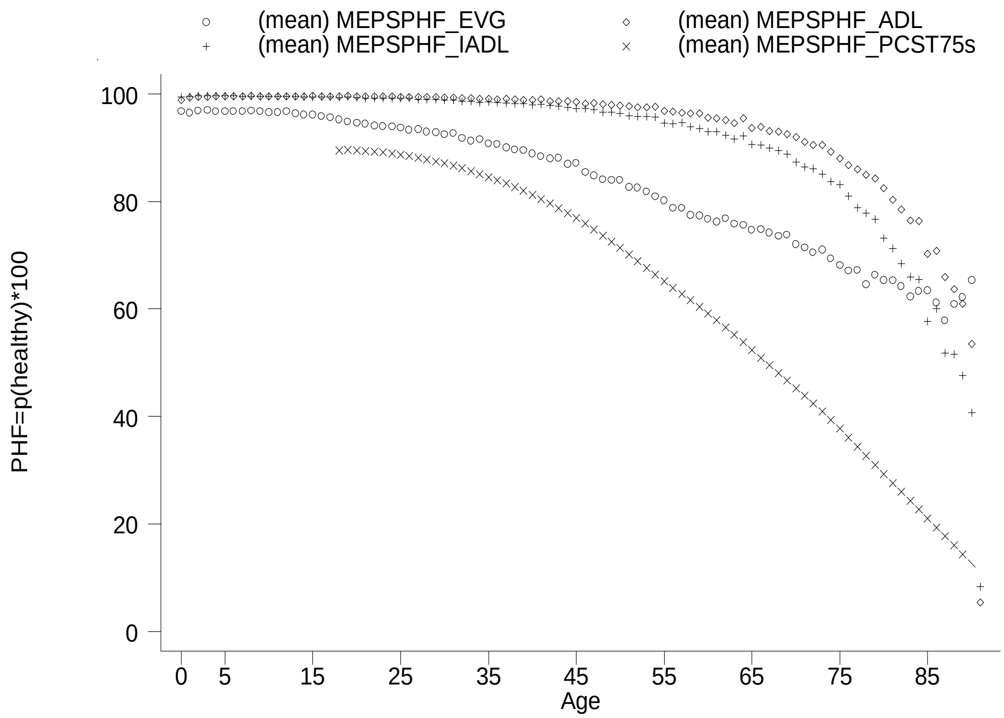


Figure 1: Mean PHF for EVGG, ADL, IADL, PCS by Age

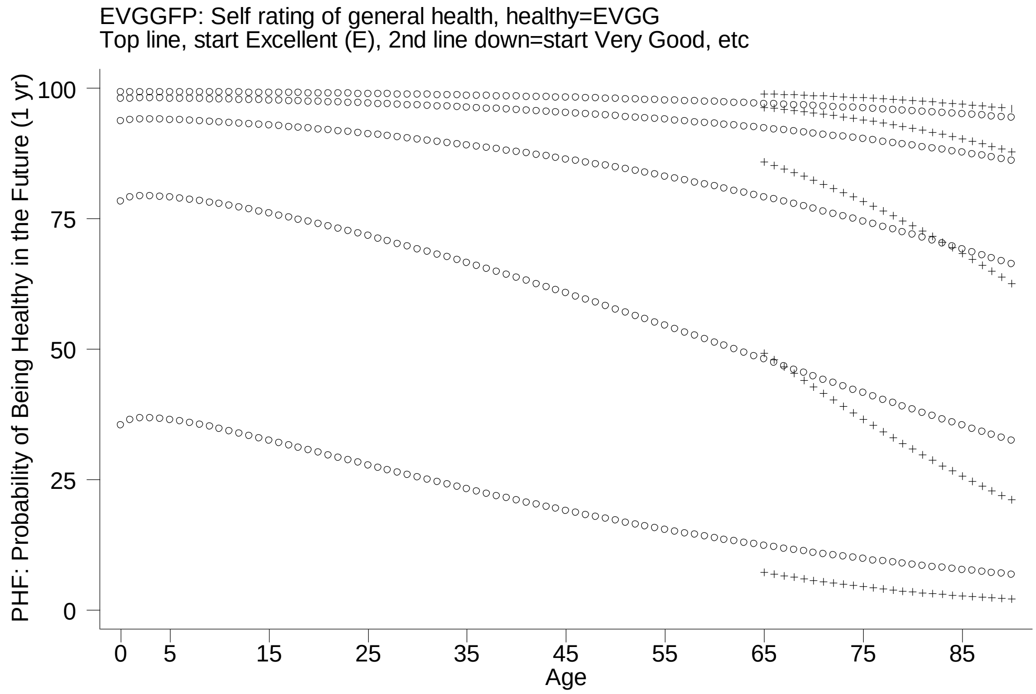


Figure 2a: PHF for EVGGFP: MEPS (o) vs. Published (+) by Age, Males

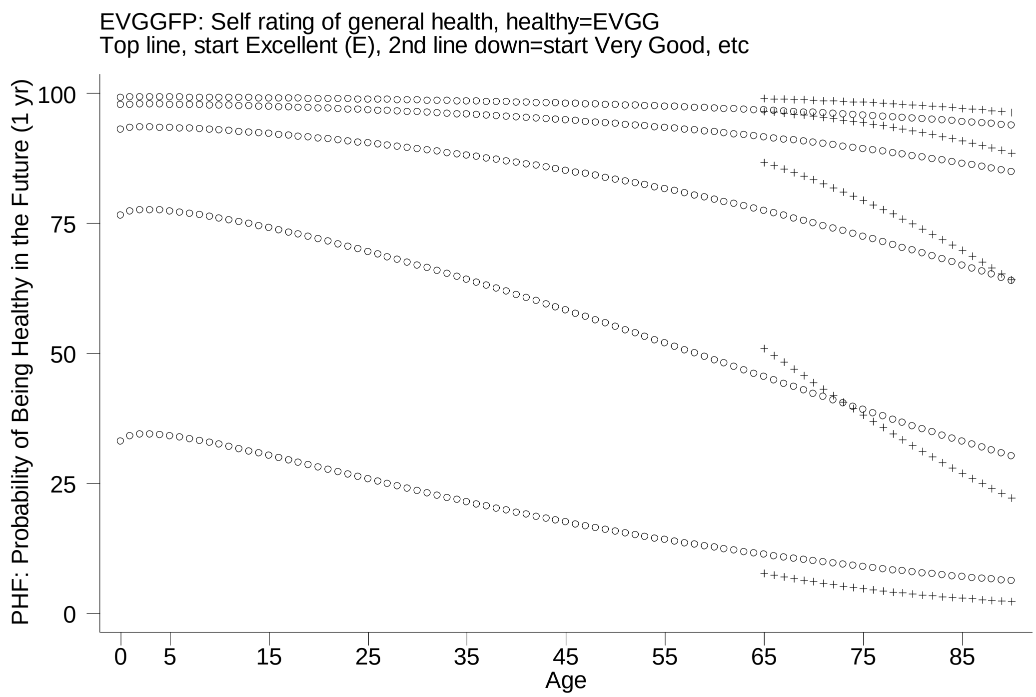


Figure 2b: PHF for EVGGFP: MEPS (o) vs. Published (+) by Age, Females

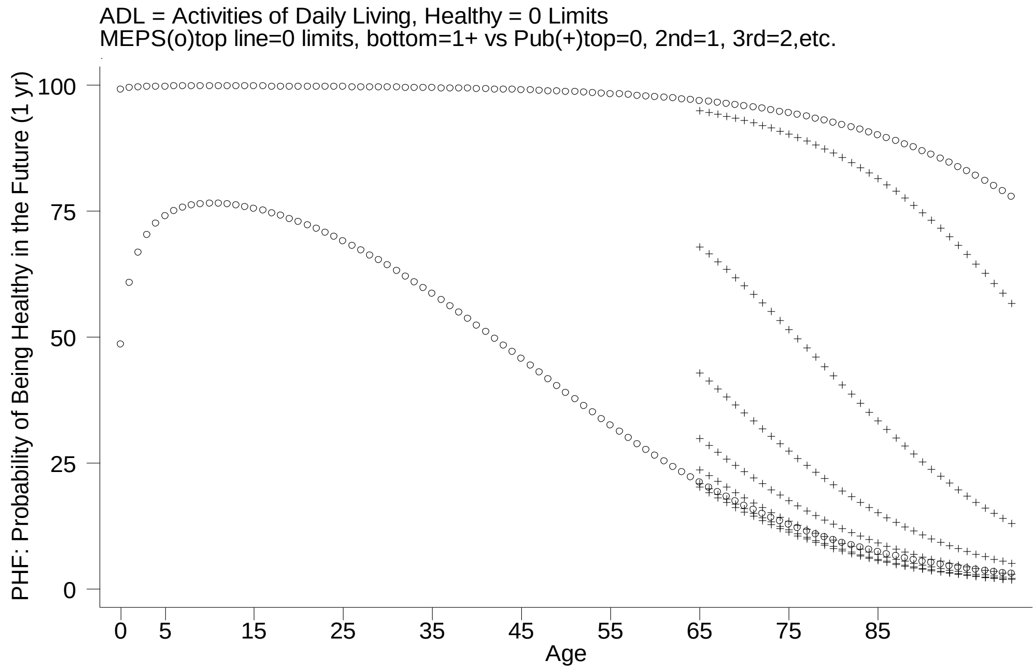


Figure 3a: PHF for ADL's: MEPS (o) vs. Published (+) by Age, Males

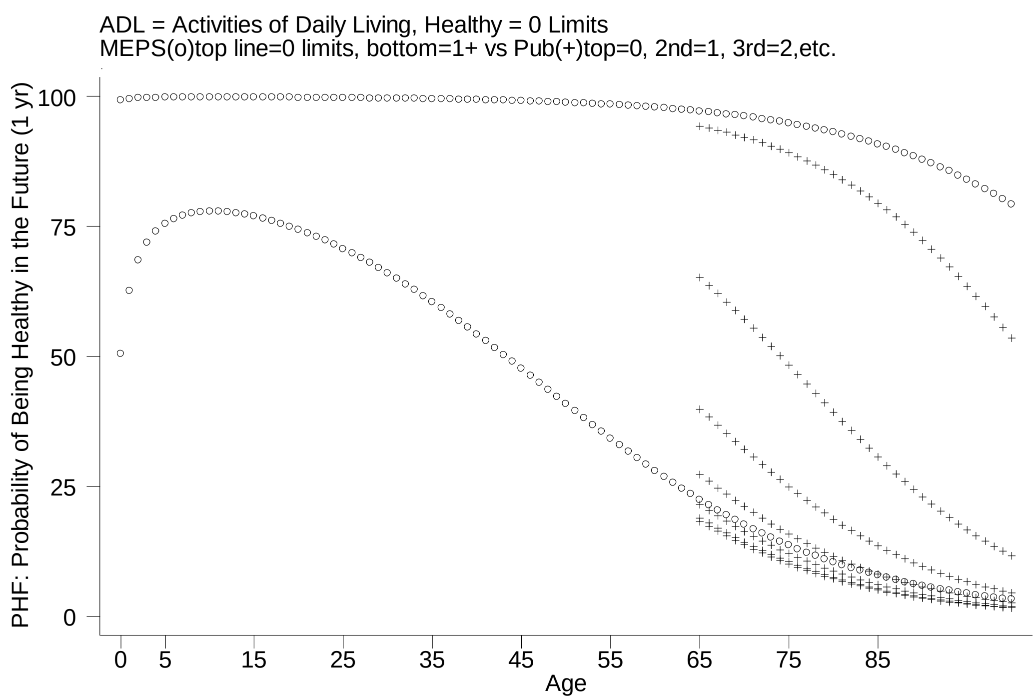


Figure 3b: PHF for ADL's: MEPS (o) vs. Published (+) by Age, Females

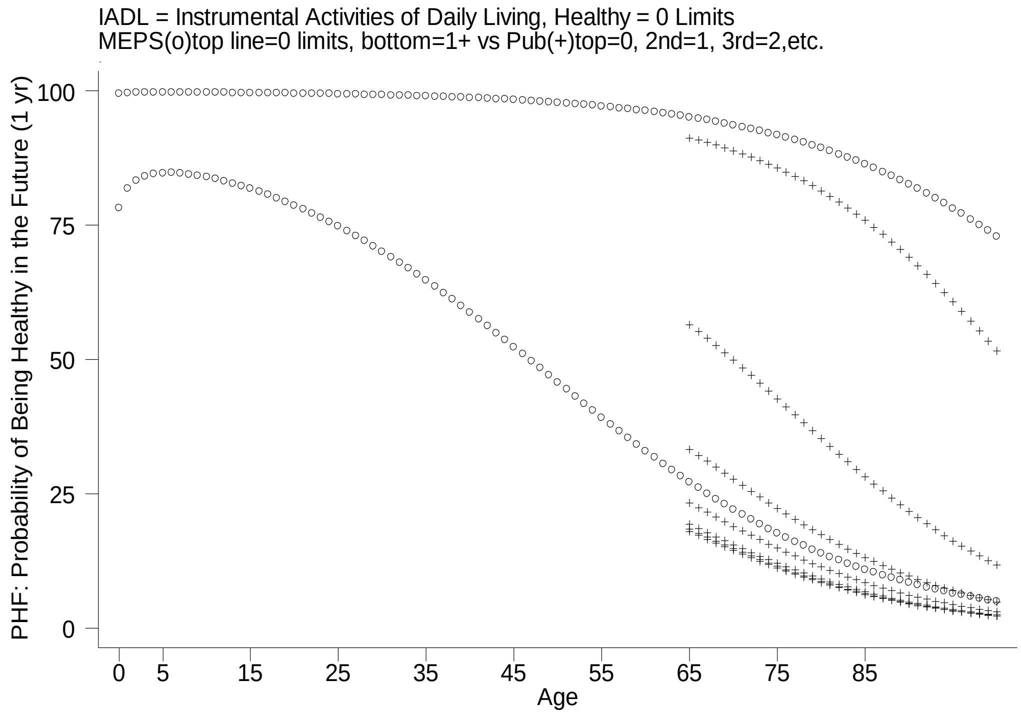


Figure 4a: PHF for IADL's: MEPS (o) vs Published (+) by Age, Males

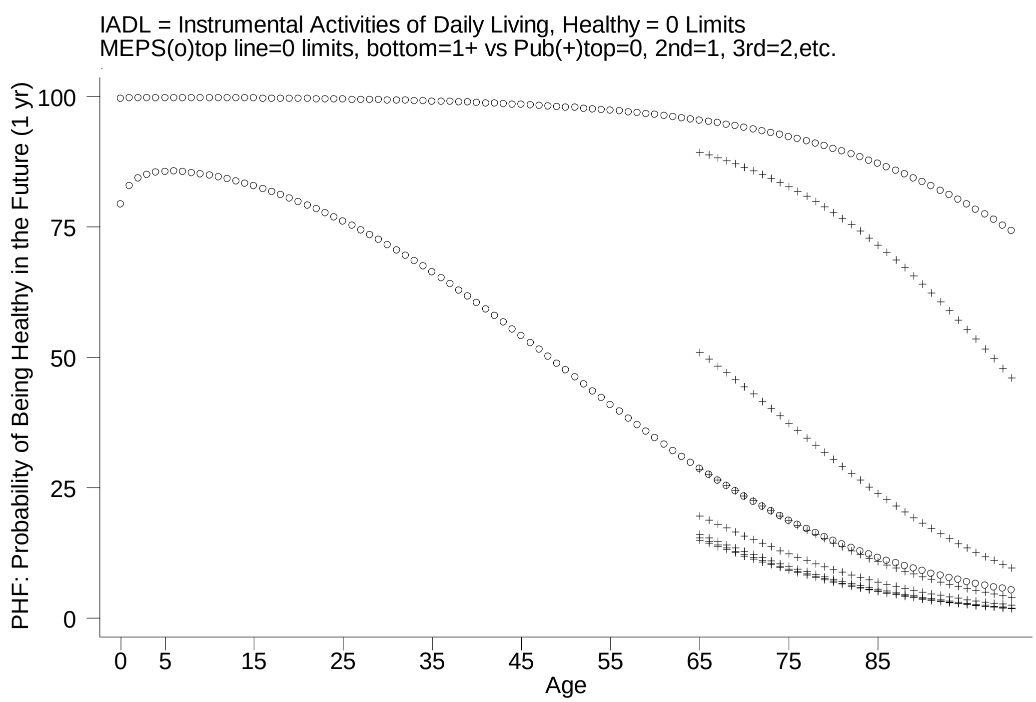


Figure 4b: PHF for IADL's: MEPS (o) vs. Published (+) by Age, Females

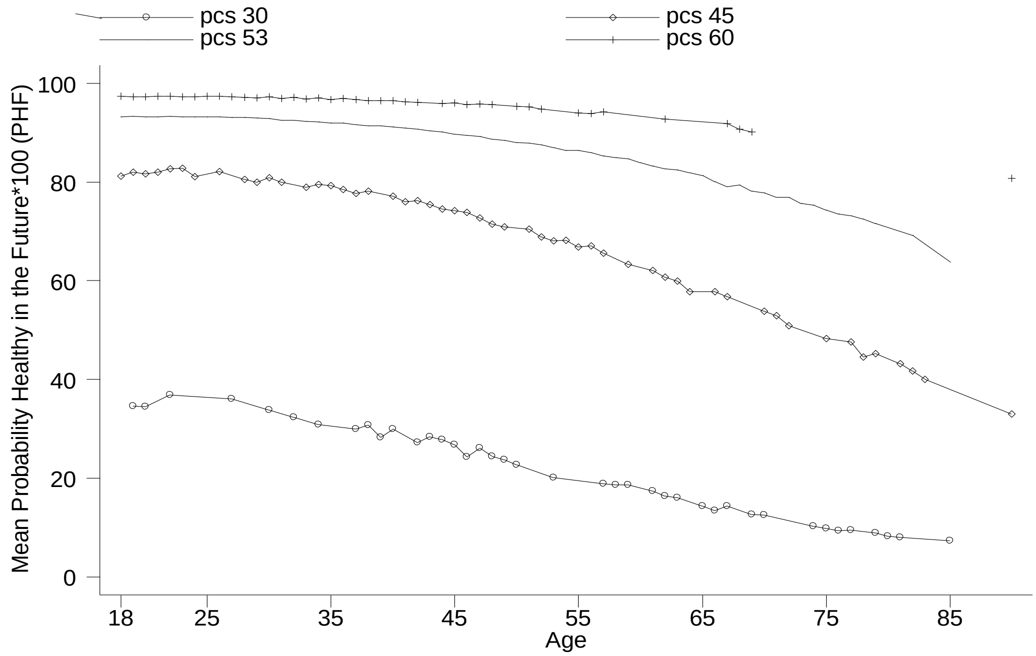


Figure 5a: PHF Given Baseline PCS Values by Age, Males

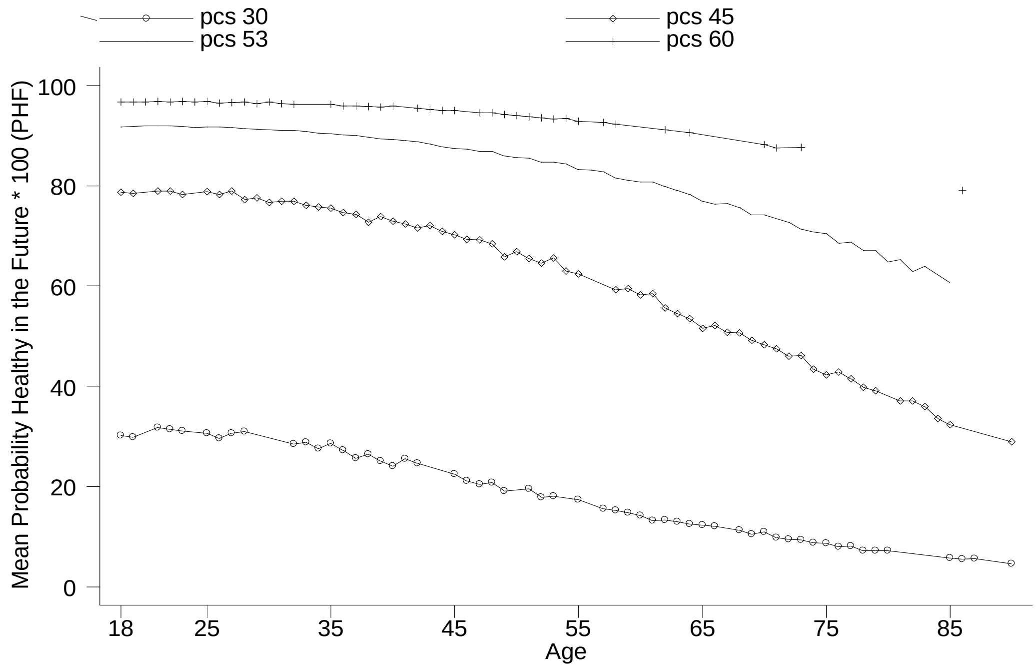
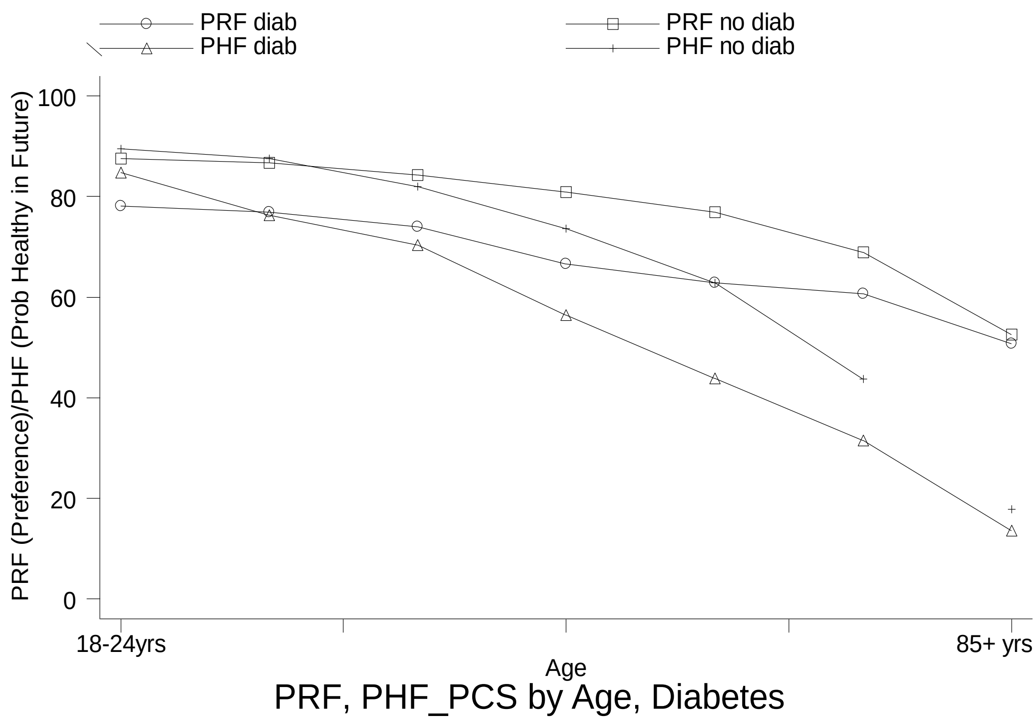


Figure 5b: PHF Given Baseline PCS Values by Age, Females



PRF = Preference weighted health status transformed from SF-36, Franks model. PHF-PCS = Probability of being healthy in the future based on whether baseline PCS was in top 75% of norm. Diab = person reported being told they had diabetes. Nodiab = person did not report having diabetes. Age groups: 18-24 yrs, 25-44 yrs, 45-54 yrs, 55-64 yrs, 65-74 yrs, 75-84 yrs, 85+ yrs.

Figure 6: Comparison of PRF to PHF-PCS by Age, Presence of Diabetes

Table 2 : Probability of Being Healthy in the Future (PHF) by Age Group: Categorical Transformations

	MEPS Age Group						Published Values* (Age >=65)
	Under 1 yr	1-17 yrs	18-44 yrs	45-64 yrs	65-84 yrs	85+ yrs	
Number of subjects	1388	25205	33971	18463	9063	917	
Number of transition pairs	3347	62710	84382	45807	22575	2403	
Baseline Health to Transform							
Global Health	**PHF** Healthy = Excellent, Very Good or Good at one year						
Excellent	97	99	98	98	95	83	95
Very Good	96	98	96	95	91	77	90
Good	92	94	90	85	77	67	80
Fair	76	74	60	45	40	36	30
Poor	65	54	30	15	14	17	15
Dead	0	0	0	0	0	0	0
ADL's	**PHF:** Healthy = No ADL's at one year						
None	99.4	99.8	99.6	98.5	95	83	88
>=1	81	45	43	37	21	13	33
IADL's	**PHF:** Healthy = No IADL's at one year						
None	99.7	99.8	99.3	98	92	74	82
>=1	73	55	50	44	27	15	30

MEPS: Medical Expenditure Panel Survey responses 1996-2001.
Published values: Diehr, et al. [i]
ADL's: Limitations in Activities of Daily Living; IADL's: Limitations in Instrumental Activities of Daily Living.

[i] Diehr P, Johnson LL, Patrick DL, Psaty B. Methods for incorporating death into health-related variables in longitudinal studies. J Clin Epidemiology 2005; 58: 1115-1124.

[ii] Diehr P, Patrick DL, Spertus J, Kiefe CI, McDonell M, Fihn SD. Transforming self-rated health and the SF-36 Scales to include death and improve interpretability. Medical Care 2001; 39:670-680.

[iii] Diehr P, Patrick D, Hedrick S, Rothman M, Grembowski D, Raghunathan TE, Beresford S. Including deaths when measuring health status over time. Medical Care. 33:AS164-AS172. 1995.

[iv] Diehr P, Patrick DL. Trajectories of health for older adults over time: accounting fully for death. Ann Intern Med 2003;139:416-21.

[v] Diehr P, Williamson J, Patrick DL, Bild DE, Burke GL. Patterns of self-rated health in older adults before and after sentinel health events. J Am Geriatr Soc 49:36-44, 2001.

[vi] Diehr P, Patrick DL, McDonell M, Fihn SD. Accounting for Deaths in Longitudinal Studies Using the SF-36: the Performance of the PCS and the PCTD. Medical Care 2003;41:1065-73

[vii] Ostbye T, Taylor DH Jr. The effect of smoking on years of healthy life (YHL) lost among middle-aged and older Americans. Health Services Research 2004; 39: 531-551.

[viii] Strandberg AY, Strandberg TE, Salomaa VV, Pitkala K, Miettinen TA. Alcohol consumption, 29-y total mortality, and quality of life in men in old age. Am J Clin Nutr 2004;80:1366-71.

[ix] Cohen SB: Sample design of the 1997 Medical Expenditure Panel Survey Household Component. Rockville, MD: Agency for Healthcare Research and Quality; 2000 MEPS Methodology Report No. 11. AHRQ Publication No. 01-0001 [www.ahrq.gov/data/mepsweb.htm$what].

[x] Medical Expenditure Panel Survey (MEPS) Documentation: http://www.meps.ahrq.gov/PufFiles/H60/H60doc.pdf, for example, for the 2001 files.

[xi] Ware, Jr., J.E., Kosinski, M., and Keller, S. *How to Score the SF-12 (r) Physical and Mental Health Summary Scales* (Third Edition). (September 1998). QualityMetric, Inc., Lincoln, RI.

[xii] Ware JEE and Kosinski M. *SF-36$^{(R)}$ Physical & Mental Health Summary Scales: A Manual for Users of Version 1*, Second Edition, Lincoln, RI: Quality Metric Incorporated, 2001.

[xiii] Pancholi M. Statistical Brief #7: Smoking status of adults – United States, 2000. http://www.meps.ahrq.gov/papers/st7/stat07.htm, last accessed 11-15-05.

[xiv] Diehr P, Derleth A, Newman A, Cai L. Is the number of sick persons constant over time? 2005. Working paper. Berkeley Electronic Press (Bepress). Accessed at http://www.bepress.com/uwbiostat/paper264.

[xv] Todorov A, Kirchner MA, Kirchner C. Bias in proxies' reports of disability: data from the national health interview survey on disability. Am J Public Health. 2000;90:1248-1253.

[xvi] Steinman MG, Ross RN, Maislin MS, Iezzoni L. Estimating health-related quality of life in populations through cross-sectional surveys. Medical Care 2004;42:569-578