EXPLANATION OF COMPUTED VARIABLES

The National Health Measurement Study (NHMS)
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NHMS Documents Available:

1. Dataset Overview
2. Sample Design and Weight Calculation
3. Codebook
4. Explanation of Computed Variables
5. Computer Assisted Telephone Interview (CATI) Script
1. Introduction

The national health measurement study (NHMS), a random digit-dial survey of community dwelling adults within the continental contiguous United States, collected data on numerous health-related variables and health questionnaires which were used to produce several computed variables [1]. The respondents in the NHMS completed commonly administered health-related quality of life (HRQoL) questionnaires and health status questions, such as, Short Form SF-36v2™, self-administered version of the Quality of Well-Being Scale (QWB-SA), EuroQol EQ-5D (EQ-5D), Health Utilities Index questionnaire, Health and Activity Limitation Index (HALex) and Psychological Well-being questionnaire, as well as, questions pertaining to discrimination, weight and height used to estimate body mass index (BMI). The responses to these questionnaires were used to compute HRQoL indexes and other summary scales which are described in this document. The descriptions of the HRQoL questionnaires and their computed variables are extracted from Fryback et al (2007) publications and other relevant literature as reference in this document.

Note that in the SAS programs provided variable names and response coding may not correspond directly to the NHMS CODEBOOK because when the data were prepared for public release there was an effort to make variable names more intelligible. We have not changed the CATI names or SAS codes that we used, so researchers interested in using the SAS programs should carefully consider the coding needed for their application.

References.

2. **SF-36v2™**

*General Description of SF-36v2™ computed variables.*

The SF-36v2™ is a multipurpose, proprietary health survey with 36 questions (http://www.sf-36.org/) that yield eight health component scales that can be further summarized into two summary scores: mental and physical health scores (MCS36v2, PCS36v2) [1, 2]. The eight health component scales that can be computed from the questionnaire are physical function, role-physical, bodily pain, general health, vitality, role-emotional, mental health and social functioning. The computed variables as they are presented in the NHMS data set, their labels and nationally-representative norms are summarized in Table 1. The 36 SF-36v2™ questionnaire items in the NHMS are named items sf1 through sf36. See the NHMS Codebook and CATI documents for further detail on these variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCS36V2</td>
<td>SF-36 MENTAL COMPONENT SCORE</td>
<td>3828</td>
<td>53.8</td>
<td>0.21</td>
</tr>
<tr>
<td>PCS36V2</td>
<td>SF-36 PHYSICAL COMPONENT SCORE</td>
<td>3828</td>
<td>49.2</td>
<td>0.24</td>
</tr>
<tr>
<td>pf36</td>
<td>SF-36 Physical Functioning Component</td>
<td>3842</td>
<td>84.9</td>
<td>0.56</td>
</tr>
<tr>
<td>rp36</td>
<td>SF-36 Role-Physical Component</td>
<td>3840</td>
<td>81.1</td>
<td>0.61</td>
</tr>
<tr>
<td>bp36</td>
<td>SF-36 Bodily Pain Component</td>
<td>3843</td>
<td>72.9</td>
<td>0.62</td>
</tr>
<tr>
<td>gh36</td>
<td>SF-36 General Health Component</td>
<td>3844</td>
<td>71.0</td>
<td>0.57</td>
</tr>
<tr>
<td>vt36</td>
<td>SF-36 Vitality Component</td>
<td>3844</td>
<td>65.7</td>
<td>0.49</td>
</tr>
<tr>
<td>re36</td>
<td>SF-36 Role-Emotional Component</td>
<td>3835</td>
<td>90.5</td>
<td>0.45</td>
</tr>
<tr>
<td>mh36</td>
<td>SF-36 Mental Health Component</td>
<td>3843</td>
<td>82.6</td>
<td>0.38</td>
</tr>
<tr>
<td>sf36a</td>
<td>SF-36 Social Functioning Component</td>
<td>3843</td>
<td>87.4</td>
<td>0.52</td>
</tr>
</tbody>
</table>

The process of computing SF-36v2™ components and summary variables involves several steps [2].

First, 10 items are reverse-coded then an algorithm involving simple algebraic summation of item scores specific to each health component is applied to produce component-specific raw scales while accounting for missing item responses. The component-specific raw scales are then transformed to range from 0 to a 100 followed by a norm-based (z-score) transformation such that each scale ranges from 0 to a 100 with mean of 50 and a standard deviation of 10 in the 1998 general U.S. population [2]. The norm-based transformation is applied so that component-specific scales can be meaningfully compared between each other.

The two summary scores, mental and physical summary scores (MCS, PCS) are computed by aggregating norm-based component scores using factor score coefficients from the 1990 general
U.S. population [2]. The aggregated summary scores are standardized to have a mean of 50 with a standard deviation of 10, in the general 1998 U.S. population [2].

The full SF-36v2™ scoring algorithm, 1998 general U.S. population means, standard deviations and 1990 general U.S. population factor scores used to compute norm-transformed SF-36v2™ components and summary scores are published in chapters 6 and 7 of How to Score Version 2 of the SF-36 Health Survey (Ware et al 2000) or can be purchased on-line (http://www.sf-36.org/) [2].

References.
1. Ware JE. SF-36 Health Survey Update. SPINE 2000; 25(24); 3130-3139.

SF-36v2™ Computed Variables SAS Code.

The 36 SF-36v2™ questionnaire items in the NHMS data set are named items sf1 through sf36. The following code needs to be modified if variable names are changed, location and/or the name of the data set is changed. In the following code the SF-36 items are coded as they appear on the SF-36 questionnaire. Users of this code should carefully compare the CATI coding of these items, the Codebook definitions for the data set, and the logical manner in which the items are used in the SAS program below.

**********************************************************************;
* SF-36 scores calculated from instruction in Ware, et al., How to Score ;
* written by J. Hanmer and modified by J. Buechner                       ;
* Missing values are coded as less than zero.
**********************************************************************;

data one;
  set clean.noscore;
run;
data one;
  set one;
  array sf sf1-sf36;
  do i=1 to 36;
    if sf[i]<0 then sf[i]=.;
  end;
  pfsnum=0;
  if 0<sf3<4 then pfsnum=pfsnum+sf3;
  pfsum=pfsum+pfsnum;
  if 0<sf3<4 then pfsum=pfsnum+sf3;

3
if 0<sf4<4 then pfsum=pfsum+sf4;
if 0<sf5<4 then pfsum=pfsum+sf5;
if 0<sf6<4 then pfsum=pfsum+sf6;
if 0<sf7<4 then pfsum=pfsum+sf7;
if 0<sf8<4 then pfsum=pfsum+sf8;
if 0<sf9<4 then pfsum=pfsum+sf9;
if 0<sf10<4 then pfsum=pfsum+sf10;
if 0<sf11<4 then pfsum=pfsum+sf11;
if 0<sf12<4 then pfsum=pfsum+sf12;

pfcount=0;
if 0<sf3<4 then pfcount=pfcount+1;
if 0<sf4<4 then pfcount=pfcount+1;
if 0<sf5<4 then pfcount=pfcount+1;
if 0<sf6<4 then pfcount=pfcount+1;
if 0<sf7<4 then pfcount=pfcount+1;
if 0<sf8<4 then pfcount=pfcount+1;
if 0<sf9<4 then pfcount=pfcount+1;
if 0<sf10<4 then pfcount=pfcount+1;
if 0<sf11<4 then pfcount=pfcount+1;
if 0<sf12<4 then pfcount=pfcount+1;

if (pfcount> 4)then
  pf=round(((pfsum-pfcount)/(2*pfcount))*100,.1);
else
  pf = .;
run;
***************************************************************
* calculate Role Physical (RP)                                *
***************************************************************;
data one;
  set one;
  rpsum=0;
  if 0<sf13<6 then rpsum=rpsum+sf13;
  if 0<sf14<6 then rpsum=rpsum+sf14;
  if 0<sf15<6 then rpsum=rpsum+sf15;
  if 0<sf16<6 then rpsum=rpsum+sf16;

  rpcount=0;
  if 0<sf13<6 then rpcount=rpcount+1;
  if 0<sf14<6 then rpcount=rpcount+1;
  if 0<sf15<6 then rpcount=rpcount+1;
  if 0<sf16<6 then rpcount=rpcount+1;

  if (rpcount> 1) then
    rp=round(((rpsum-rpcount)/(4*rpcount))*100,.1);
  else
    rp = .;
run;
**************************************************************************
* calculate Bodily Pain (BP)                                        *
**************************************************************************;
data one;
  set one;
if sf21=1 then body=6;
if sf21=2 then body=5.4;
if sf21=3 then body=4.2;
if sf21=4 then body=3.1;
if sf21=5 then body=2.2;
if sf21=6 then body=1;
if sf21<0 then body=.

if sf22=1 and sf21=1 then body2=6;
if sf22=1 and 1 <sf21< 7 then body2=5;
if sf22=2 and 0 <sf21< 7 then body2=4;
if sf22=3 and 0 <sf21< 7 then body2=3;
if sf22=4 and 0 <sf21< 7 then body2=2;
if sf22=5 and 0 <sf21< 7 then body2=1;

if body=. and sf22=1 then body2=6;
if body=. and sf22=2 then body2=4.75;
if body=. and sf22=3 then body2=3.5;
if body=. and sf22=4 then body2=2.25;
if body=. and sf22=5 then body2=1;

bpcount=0;
if 0 <body< 7 then bpcount=bpcount+1;
if 0 <body2< 7 then bpcount=bpcount+1;

bpsum=0;
if 0 <body< 7 then bpsum=bpsum+body;
if 0 <body2< 7 then bpsum=bpsum+body2;

if (bpcount>0) then
bp=round(((bpsum-bpcount)/(5*bpcount))*100,.1);
else
bp=.;
run;

***************************************************************************
* calculate General Health (GH)                                          *
***************************************************************************;
data one;
  set one;
  if sf1=1 then health=5;
  if sf1=2 then health=4.4;
  if sf1=3 then health=3.4;
  if sf1=4 then health=2;
  if sf1=5 then health=1;
  if sf34=1 then health2=5;
  if sf34=2 then health2=4;
  if sf34=3 then health2=2;
  if sf34=4 then health2=1;
  if sf34=. then health2=3;
  if sf36=1 then health3=5;
  if sf36=2 then health3=4;
if sf36=3 then health3=2;
if sf36=4 then health3=1;
if sf36=. then health3=3;

if sf33=1 then health4=1;
if sf33=2 then health4=2;
if sf33=3 then health4=4;
if sf33=4 then health4=5;
if sf33=. then health4=3;

if sf35=1 then health5=1;
if sf35=2 then health5=2;
if sf35=3 then health5=4;
if sf35=4 then health5=5;
if sf35=. then health5=3;

ghsum=0;
if 0<health<6 then ghsum=ghsum+health;
if 0<health2<6 then ghsum=ghsum+health2;
if 0<health3<6 then ghsum=ghsum+health3;
if 0<health4<6 then ghsum=ghsum+health4;
if 0<health5<6 then ghsum=ghsum+health5;

ghcount=0;
if 0<health<6 then ghcount=ghcount+1;
if 0<health2<6 then ghcount=ghcount+1;
if 0<health3<6 then ghcount=ghcount+1;
if 0<health4<6 then ghcount=ghcount+1;
if 0<health5<6 then ghcount=ghcount+1;

if (ghcount > 2) then
  gh=round(((ghsum-ghcount)/(4*ghcount))*100,.1);
else
  gh = .;
run;

*****************************************************************************
* calculate Vitality (VT)                                                  *
*****************************************************************************
data one;
  set one;
    if sf23=1 then vt1=5;
    if sf23=2 then vt1=4;
    if sf23=3 then vt1=3;
    if sf23=4 then vt1=2;
    if sf23=5 then vt1=1;
    if sf27=1 then vt2=5;
    if sf27=2 then vt2=4;
    if sf27=3 then vt2=3;
    if sf27=4 then vt2=2;
    if sf27=5 then vt2=1;

  vtsum=0;
  if 0<sf23<6 then vtsum=vtsum+vt1;
if $0<sf27<6$ then vtsum=vtsum+vt2;
if $0<sf29<6$ then vtsum=vtsum+sf29;
if $0<sf31<6$ then vtsum=vtsum+sf31;

vtcount=0;
if $0<sf23<6$ then vtcount=vtcount+1;
if $0<sf27<6$ then vtcount=vtcount+1;
if $0<sf29<6$ then vtcount=vtcount+1;
if $0<sf31<6$ then vtcount=vtcount+1;

if (vtcount> 1) then
  vt=round(((vtsum-vtcount)/(4*vtcount))*100,.1);
else
  vt = .;
run;
****************************************************************************;
* calcuate Social Functioning(SF)                                        *
*****************************************************************************
data one;
    set one;
    if sf20=1 then soc1=5;
    if sf20=2 then soc1=4;
    if sf20=3 then soc1=3;
    if sf20=4 then soc1=2;
    if sf20=5 then soc1=1;

sfsum=0;
if $0<soc1<6$ then sfsum=sfsum+soc1;
if $0<sf32<6$ then sfsum=sfsum+sf32;

sfcount=0;
if $0<soc1<6$ then sfcount=sfcount+1;
if $0<sf32<6$ then sfcount=sfcount+1;

if (sfcount> 0) then
  sf=round(((sfsum-sfcount)/(4*sfcount))*(100,.1));
else
  sf = .;
run;
****************************************************************************;
* calcuate Role Emotional(RE)                                              *
****************************************************************************
data one;
    set one;
    resum=0;
    if $0<sf17<6$ then resum=resum+sf17;
    if $0<sf18<6$ then resum=resum+sf18;
    if $0<sf19<6$ then resum=resum+sf19;

recount=0;
if $0<sf17<6$ then recount=recount+1;
if $0<sf18<6$ then recount=recount+1;
if $0<sf19<6$ then recount=recount+1;
if (recount > 1) then
    re = round(((resum - recount) / (4 * recount)) * 100, .1);
else
    re = .;
run;
***************************************************************************;
* Calculate Mental Health (MH)                                           
***************************************************************************;
data one;
    set one;
    if sf26 = 1 then mh1 = 5;
    if sf26 = 2 then mh1 = 4;
    if sf26 = 3 then mh1 = 3;
    if sf26 = 4 then mh1 = 2;
    if sf26 = 5 then mh1 = 1;
    if sf30 = 1 then mh2 = 5;
    if sf30 = 2 then mh2 = 4;
    if sf30 = 3 then mh2 = 3;
    if sf30 = 4 then mh2 = 2;
    if sf30 = 5 then mh2 = 1;
    mhsum = 0;
    if 0 < sf24 < 6 then mhsum = mhsum + sf24;
    if 0 < sf25 < 6 then mhsum = mhsum + sf25;
    if 0 < sf26 < 6 then mhsum = mhsum + mh1;
    if 0 < sf28 < 6 then mhsum = mhsum + sf28;
    if 0 < sf30 < 6 then mhsum = mhsum + mh2;
    mhcount = 0;
    if 0 < sf24 < 6 then mhcount = mhcount + 1;
    if 0 < sf25 < 6 then mhcount = mhcount + 1;
    if 0 < sf26 < 6 then mhcount = mhcount + 1;
    if 0 < sf28 < 6 then mhcount = mhcount + 1;
    if 0 < sf30 < 6 then mhcount = mhcount + 1;
    if (mhcount > 2) then
        mh = round(((mhsum - mhcount) / (4 * mhcount)) * 100, .1);
else
    mh = .;
run;
***************************************************************************;
* Calculate Mental Component Summary (MCS)                                 
* and Physical Component Summary (PCS)                                     
* The constants M1-M8 and S1-S8 (means and standard deviation in the general; 
* 1998 U.S. population) and constants W1-W8 and V1-V1 (factor scores in the ; 
* general 1990 U.S. population) are proprietary and published in Ware, et al.; 
* How to Score Version 2 of the SF-36 Health Survey, Quality Metric, Inc.,; 
* 2000. 
***************************************************************************;
data one;
    set one;
if pf ne . and rp ne . and bp ne . and gh ne . and vt ne .
and sf ne . and re ne . and mh ne . then do;
   
   pf_z=(pf-M1)/S1;
   rp_z=(rp-M2)/S2;
   bp_z=(bp-M3)/S3;
   gh_z=(gh-M4)/S4;
   vt_z=(vt-M5)/S5;
   sf_z=(sf-M6)/S6;
   re_z=(re-M7)/S7;
   mh_z=(mh-M8)/S8;
end;
run;

data one;
set one;
prepcs=(pf_z*W1)+(rp_z*W2)+(bp_z*W3)+(gh_z*W4)+(vt_z*W5)+(sf_z*W6)+(re_z*W7)+(mh_z*W8);
premcs=(pf_z*V1)+(rp_z*V2)+(bp_z*V3)+(gh_z*V4)+(vt_z*V5)+(sf_z*V6)+(re_z*V7)+(mh_z*V8);
run;

data one;
set one;
pcs=(prepcs*10)+50;
mcs=(premcs*10)+50;
run;

proc means data=one n min max mean;
   var pf rp bp gh vt re mh sf mcs pcs;
   output out=sftable;
run;

data one;
set one;
drop sf36;
rename pf=pf36;
rename rp=rp36;
rename bp=bp36;
rename gh=gh36;
rename vt=vt36;
rename re=re36;
rename mh=mh36;
rename sf=sf36a;
rename mcs=mcs36;
rename pcs=pcs36;
run;

data clean.SF36;
set one;
keep caseid mcs36 pcs36 pf36 rp36 bp36 gh36 vt36 re36 mh36 sf36a;
attrib pf36 label="SF36 Physical Functioning Component";
attrib rp36 label="SF36 Role-Physical Component";
attrib bp36 label="SF36 Bodily Pain Component";
attrib gh36 label="SF36 General Health Component";
attrib vt36 label="SF36 Vitality Component";
attrib re36 label="SF36 Role-Emotional Component";
attrib mh36 label="SF36 Mental Health Component";
attrib sf36a label="SF36 Social Functioning Component";
run;

data tmp1;
  set clean.noscore;
run;
*********************************************************
*Defines values greater than 7 or less than 0 as missing ;
*********************************************************
data tmp1;
  set tmp1;
  array sf sf1-sf36;
  do i=1 to 36;
    if sf[i]<0 then sf[i]=. ;
  end;
  if sf3>7 then sf3=.;
  if sf4>7 then sf4=.;
  if sf12>7 then sf12=.;
  if sf15>7 then sf15=.;
  if sf18>7 then sf18=.;
  if sf21>7 then sf21=.;
  if sf22>7 then sf22=.;
  if sf24>7 then sf24=.;
  if sf27>7 then sf27=.;
  if sf28>7 then sf28=.;
  if sf32>7 then sf32=.;
  rand=uniform(-1);
  sf24r=sf24;
  sf27r=sf27;
  sf28r=sf28;
  sf32r=sf32;
3. SF-12v2™

**General Description of SF-12v2™ computed variables.**

The SF-12v2™ 8 component scores and 2 summary component score (MCS12, PCS12) are computed from the SF-36v2™ using 12 of the 36 questionnaire items [1]. The 8 health component scales that can be computed from the questionnaire are physical function, role-physical, bodily pain, general health, vitality, role-emotional, mental health and social functioning which could be summarized into 2 summary component scores (MCS12, PCS12). The computed variables for SF-12v2™ included in the NHMS data set are summarized in Table 2. See the NHMS Codebook and CATI documents for further detail on these variables.

**Table 2. Weighted Means of SF-12v2™ computed variables in the NHMS data set**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCS12</td>
<td>SF12 Mental Component Score (From SF12V2)</td>
<td>3822</td>
<td>53.8</td>
<td>0.22</td>
</tr>
<tr>
<td>PCS12</td>
<td>SF12 Physical Component Score (From SF12V2)</td>
<td>3822</td>
<td>49.2</td>
<td>0.24</td>
</tr>
</tbody>
</table>

The process of computing SF-12v2™ components and summary variables is similar to that of SF-36v2™, so it will not be repeated here [1]. The main difference between the scoring algorithms is that SF-12v2™ scoring uses only 12 of the 36 SF-36v2™ questionnaire items. Additionally, different 1998 general U.S. population means and standard deviations are used to norm-transform the 8 health components. The full SF-12v2™ scoring algorithm, 1998 general U.S. population means, standard deviations and 1990 general U.S. population factor scores used to compute norm-transformed SF-36v2™ components and summary scores are published in chapters 6 and 8 of How to Score Version 2 of the SF-12 Health Survey (Ware et al 2002) [1]. For further information on SF-36v2™ and SF-12v2™ see the following website: http://www.sf-36.org/.

**References.**

1. Ware, et al., How to Score Version 2 of the SF-12 Health Survey, Quality Metric Inc., 2002.

**SF-12v2™ Computed Variables SAS Code.**

The 36 SF-36v2™ questionnaire items in the NHMS data set are named items sf1 through sf36. Twelve of the questions are used towards computing the SF-12v2™ component and summary scores. The following code needs to be modified if variable names are changed, location and/or the name of the data set is changed.

```
******************************************************************************;
* SF-12 Scores calculated from instructions in Ware, et al., How to Score     ;
* written by J. Hanmer and modified by J. Buechner 2006                     ;
* Missing values are coded as less than zero                                 ;
******************************************************************************;

******************************************************************************;
*conversion from SF-36 version 2 data: page 20 of SF-12 manual               ;
* SF36 = SF12 by section convention, then SF36 = SF12 by number convention  ;
******************************************************************************;
```
* SF3b = SF2a  SF4 = SF2  
* SF3d = SF2b  SF6 = SF3  
* SF4b = SF3a  SF14 = SF4  
* SF4c = SF3b  SF15 = SF5  
* SF8 = SF5  SF22 = SF8  
* SF1 = SF1  SF1 = SF1  
* SF9e = SF6b  SF27 = SF10  
* SF10 = SF7  SF32 = SF12  
* SF5b = SF4a  SF18 = SF6  
* SF5c = SF4b  SF19 = SF7  
* SF9d = SF6a  SF26 = SF9  
* SF9f = SF6c  SF28 = SF11  
*****************************************************************************;
%include 'C:\DATA\25aug2006\include.sas';
data xyz;
   set clean.noscore;
run;
data xyz;
   set xyz;
   rename sf4 = s2;
   rename sf6 = s3;
   rename sf14 = s4;
   rename sf15 = s5;
   rename sf22 = s8;
   rename sf1 = s1;
   rename sf27 = s10;
   rename sf32 = s12;
   rename sf18 = s6;
   rename sf19 = s7;
   rename sf26 = s9;
   rename sf28 = s11;
   drop sf12;
run;*****************************************************************************;
* I label the items in order from 1 to 12 instead of by section with subquestions (4a, 4b, etc):  
* SF2a=SF2: Moderate activities, 1= limited a lot, 2= limited a little, 3= not limited at all ;  
* SF2b=SF3: Climbing several flights, 1= limited a lot, 2= limited a little, 3= not limited at all ;  
* SF3a=SF4: Physical accomplished less from 1= all the time to 5= none of the time ;  
* SF3b=SF5: Physical limited work from 1= all the time to 5= none of the time ;  
* SF5=SF8: Pain interfere with work from 1= not at all to 5= extremely  
* SF1=SF1: Health in General from 1= excellent to 5= poor  
* SF6b=SF10: A lot of energy from 1= all the time to 5= none of the time  
* SF7=SF12: Social limits from health from 1= all the time to 5= none of the time  
* SF4a=SF6: Emotional accomplish less from 1= all the time to 5= none of the time  
* SF4b=SF7: Emotional less careful from 1= all the time to 5= none of the time  
* SF6a=SF9: Calm and peaceful from 1= all the time to 5= none of the time  

* SF6c=SF11: Downhearted and Blue from 1 = all the time to 5 = none of the time;

*****************************************************************************;
*********************************
* physical functioning. page 32;
*********************************
data xyz;
  set xyz;
PF12 = (s2 + s3 - 2)/4 * 100;
if s2=. then pf12=.;
if s3=. then pf12=.;
run;

**************************;
* role physical page 32;
**************************;
data xyz;
  set xyz;
RP12 = (s4 + s5 - 2)/8 * 100;
if s4=. then rp12=.;
if s5=. then rp12=.;
run;

***********************;
* bodily pain page 33;
***********************;
data xyz;
  set xyz;
if s8=1 then s8r=5;
if s8=2 then s8r=4;
if s8=3 then s8r=3;
if s8=4 then s8r=2;
if s8=5 then s8r=1;
BP12 = (s8r-1)/4 * 100;
run;

***************************;
* general health. page 33;
***************************;
data xyz;
  set xyz;
if s1=1 then s1r=5;
if s1=2 then s1r=4.4;
if s1=3 then s1r=3.4;
if s1=4 then s1r=2;
if s1=5 then s1r=1;
GH12 = (s1r-1)/4 * 100;
run;

**************************;
* vitality. page 34;
**************************;
data xyz;
  set xyz;
if s10=1 then s10r=5;
if s10=2 then s10r=4;
if s10=3 then s10r=3;
if s10=4 then s10r=2;
if s10=5 then s10r=1;
VT12 = (s10r-1)/4 * 100;
run;

/******************************************************************************;
* social functioning. page 34;
******************************************************************************;
data xyz;
   set xyz;
SF12 = (s12-1)/4 * 100;
run;

******************************************************************************;
* role emotional. page 35. ;
******************************************************************************;
data xyz;
   set xyz;
RE12 = (s6 + s7 - 2)/8 * 100;
run;

******************************************************************************;
* mental health. page 35. ;
******************************************************************************;
data xyz;
   set xyz;
      if s9=1 then s9r=5;
      if s9=2 then s9r=4;
      if s9=3 then s9r=3;
      if s9=4 then s9r=2;
      if s9=5 then s9r=1;
MH12 = (s9r + s11 - 2)/8 * 100;
run;

******************************************************************************;
*pcs and mcs. pages 46, 50 ;
******************************************************************************;
******************************************************************************;
* Calculate Mental Component Summary (MCS)
* and Physical Component Summary (PCS)
******************************************************************************;
* The constants M1-M8 and S1-S8 (means and standard deviation in the general;
* 1998 U.S. population) and constants W1-W8 and V1-V1 (factor scores in the;
* general 1990 U.S. population) are published in Ware, et al., How to Score;
******************************************************************************;
data xyz;
   set xyz;
      pf_z=(pf12 – M1)/S1;
      rp_z=(rp12 – M2)/S2;
      bp_z=(bp12 – M3)/S3;
      gh_z=(gh12 – M4)/S4;
      vt_z=(vt12 – M5)/S5;
\[ sf_z = \frac{(sf_{12} - M6)}{S6}; \]
\[ re_z = \frac{(re_{12} - M7)}{S7}; \]
\[ mh_z = \frac{(mh_{12} - M8)}{S8}; \]
run;

```
data xyz;
  set xyz;
  phys = (pf_z * W1) + (rp_z * W2) + (bp_z * W3) + (gh_z * W4) + (vt_z * W5) - (sf_z * W6) - (re_z * W7) - (mh_z * W8);
  ment = -(pf_z * V1) - (rp_z * V2) - (bp_z * V3) - (gh_z * V4) + (vt_z * V5) + (sf_z * V6) + (re_z * V7) + (mh_z * V8);
run;
```

data xyz;
  set xyz;
  PCS12 = 50 + (phys * 10);
  MCS12 = 50 + (ment * 10);
run;

```
proc means data=xyz;
  var pf12 rp12 bp12 gh12 vt12 sf12 re12 mh12 mcs12 pcs12;
run;
```

data clean.SF12;
  set xyz;
  sf12a=sf12; *PF12 RP12 BP12 GH12 VT12 SF12a RE12 MH12;
  keep caseid PCS12 MCS12;
  proc sort;
    by caseid;
run;
4. SF6D_36v2 from SF-36v2™ and SF6D_12v2 from SF-12v2™

General Description of SF6D_36v2 and SF6D_12v2 computed variables.

SF6D_36v2 and SF6D_12v2 are our labels for the SF-6D index estimated from SF-36v2™ and SF-12v2™, respectively. SF-6D was developed using the standard gamble (SG) health state valuation technique and refers to health in “past 4 weeks.” It includes 6 health domains (see Table 3) defined from responses to the SF-36v1 and v2 and SF-12v1 and v2[1,2]. Brazier et al [1,2] publish algorithms converting health profiles defined from these domains into a utility score anchored by 0=dead and 1=best health state. The worst health state for a living person scores 0.3 on the SF-6D. NHMS data set includes SF-6D computed from the SF-36v2™ and from the SF-12v2™, and the 6 health domain variables defined from SF-36v2™ items.

### Table 3. Six SF-6D domain variables

<table>
<thead>
<tr>
<th>Item</th>
<th>Physical Functioning</th>
<th>Role limitations</th>
<th>Social functioning</th>
<th>Pain</th>
<th>Mental health</th>
<th>Vitality</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHMS variable name</td>
<td>sf6phy</td>
<td>sf6role</td>
<td>sf6soc</td>
<td>sf6pain</td>
<td>sf6men</td>
<td>sf6vit</td>
</tr>
<tr>
<td>Number of levels</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>SF-36v2™ items used</td>
<td>SF3, SF4, SF12</td>
<td>SF15, SF18</td>
<td>SF32</td>
<td>SF21, SF22</td>
<td>SF24, SF28</td>
<td>SF27</td>
</tr>
</tbody>
</table>

The SF-6D algorithms to compute index scores are distributed by Prof. Brazier (http://www.shef.ac.uk/scharr/sections/heds/mvh/sf-6d) and are also distributed by Quality Metric, Inc., for SF-36v2™ customers. The algorithm mapping SF1-SF36 into SF-6D domain variables is in the SAS code below, as is the SF-6D scoring function which converts the domain profile into a utility score.

### References.

### SF6D-SF36v2 Computed Variables SAS Code.

The 36 SF-36v2™ questionnaire items in the NHMS data set are named items sf1 through sf36. The following code needs to be modified if variable names are changed, location and/or the name of the data set is changed.

```
*-----------------------------------------------------------------------------;
* Defines values greater than 7 or less than 0 as missing;                     
*-----------------------------------------------------------------------------;
data tmp1;
  set tmp1;
  array sf sf1-sf36;
```
do i=1 to 36;
   if sf[i]<0 then sf[i]=.;
end;

if sf3>7 then sf3.=.;
if sf4>7 then sf4.=.;
if sf12>7 then sf12.=.;
if sf15>7 then sf15.=.;
if sf18>7 then sf18.=.;
if sf21>7 then sf21.=.;
if sf22>7 then sf22.=.;
if sf24>7 then sf24.=.;
if sf27>7 then sf27.=.;
if sf28>7 then sf28.=.;
if sf32>7 then sf32.=.;

rand=uniform(-1);

sf24r=sf24;
sf27r=sf27;
sf28r=sf28;
sf32r=sf32;

****************************************************************************;
* SF-6D scores calculated using model 10 from Brazier and Robers, The
Estimation of a Preference -based Measure of Health from the SF12, Medical
Care, 2004, 42(9), 851-859 with modifications from Quality Metric (personal
communication), and Brazier 2007. Code written by J. Hamner and modified by
J. Buechner 2006-2007.    ;
* This code presumes they are numbered and coded as follows:   ;
* sf3 = vigorous activities where 1="limited a lot" to 3="not limited at all"   ;
* sf4 = moderate activities where 1="limited a lot" to 3="not limited at all" ;
* sf12 = bathing and dressing where 1="limited a lot" to 3="not limited at all" ;
* sf15 = physical limited work where 1="all of the time" to 5="none of the time" ;
* sf18 = emotional accomplish less where 1="all of the time" to 5="none of the time" ;
* sf21 = bodily pain where 1="none" to 6="very severe"      ;
* sf22 = pain interferes with work where 1="not at all" to 5="extremely";    
* sf24 = nervous where 1="all the time" to 5="none of the time";  
* sf27 = energy where 1="all the time" to 5="none of the time" ;
* sf28 = downhearted and blue where 1="all the time" to 5="none of the time" ;
* sf32 = social activities where 1="all the time" to 5="none of the time"  ;
****************************************************************************;

if 0<sf15<5 then sf15=1;
if sf15=5 then sf15=2;
if 0<sf18<5 then sf18=1;
if sf18=5 then sf18=2;

SFPhys=.;
IF (sf3=3 and sf4=3 and sf12=3)then SFPhys = 1 ;
IF (sf3 in (1,2) and sf4=3 and sf12=3) then SFPhys = 2 ;
IF (sf4=2 and sf12=3) then SFPhys = 3;
IF (sf4=1 and sf12=3) then SFPhys = 4;
IF (sf12=2) then SFPhys = 5;
IF (sf12=1) then SFPhys = 6;

SFRole=.;
IF (sf15=2 and sf18=2) then SFRole = 1;
IF (sf15=1 and sf18=2) then SFRole = 2;
IF (sf15=2 and sf18=1) then SFRole = 3;
IF (sf15=1 and sf18=1) then SFRole = 4;

SFSocial=.;
IF (sf32r=5) then SFSocial = 1;
IF (sf32r=4) then SFSocial = 2;
IF (sf32r=3) then SFSocial = 3;
IF (sf32r=2) then SFSocial = 4;
IF (sf32r=1) then SFSocial = 5;

SFPain=.;
IF (sf21=1 and sf22=1) then SFPain = 1;
IF (sf21 in (2,3,4,5,6) and sf22=1) then SFPain = 2;
IF (sf22=2) then SFPain = 3;
IF (sf22=3) then SFPain = 4;
IF (sf22=4) then SFPain = 5;
IF (sf22=5) then SFPain = 6;

SFMental=.;
IF (sf24r=5 and sf28r ne .) or (sf28r=5 and sf24r ne .) then SFMental=1;
IF (sf24r=4 and sf28r ne .) or (sf28r=4 and sf24r ne .) then SFMental=2;
IF (sf24r=3 and sf28r ne .) or (sf28r=3 and sf24r ne .) then SFMental=3;
IF (sf24r=2 and sf28r ne .) or (sf28r=2 and sf24r ne .) then SFMental=4;
IF (sf24r=1 and sf28r ne .) or (sf28r=1 and sf24r ne .) then SFMental=5;

SFVital=.;
IF (sf27r=1) then SFVital = 1;
IF (sf27r=2) then SFVital = 2;
IF (sf27r=3) then SFVital = 3;
IF (sf27r=4) then SFVital = 4;
IF (sf27r=5) then SFVital = 5;

*create MOST category if any dimension is at its worst state ;
most=0;
if SFPhys=4 or SFPhys=5 or SFPhys=6 or
  SFRole=3 or SFRole=4 or
  SFSocial=4 or SFSocial=5 or
  SFPain=5 or SFPain=6 or
  SFMental=4 or SFMental=5 or
  SFVital=4 or SFVital=5
then most=1;

**********************************************************************************************;
* Scoring using consistent version of model 10 from in table 4- mean model
  with interaction terms. This is based on the sf6d12 since the scores in the
  2004 Medical Care publication differed from the Health Economics values
  published in 2002.                  ;
**********************************************************************************************;
If (SFPhys=1) then pf1 = 0 ;
IF (SFPhys=2) then pf1 = -.035 ;
IF (SFPhys=3) then pf1 = -.035 ;
IF (SFPhys=4) then pf1 = -.044 ;
IF (SFPhys=5) then pf1 = -.056 ;
If (SFPhys=6) then pf1 = -.117 ;

If (SFRole=1) then rl1 = 0 ;
IF (SFRole=2) then rl1 = -.053 ;
IF (SFRole=3) then rl1 = -.053 ;
IF (SFRole=4) then rl1 = -.053 ;

IF (SFSocial=1) then sc1 = 0 ;
IF (SFSocial=2) then sc1 = -.057 ;
IF (SFSocial=3) then sc1 = -.059 ;
IF (SFSocial=4) then sc1 = -.072 ;
IF (SFSocial=5) then sc1 = -.087 ;

If (SFPain=1) then pn1 = 0 ;
IF (SFPain=2) then pn1 = -.042 ;
IF (SFPain=3) then pn1 = -.042 ;
IF (SFPain=4) then pn1 = -.065 ;
IF (SFPain=5) then pn1 = -.102 ;
If (SFPain=6) then pn1 = -.171 ;

If (SFMental=1) then mh1 = 0 ;
IF (SFMental=2) then mh1 = -.042 ;
IF (SFMental=3) then mh1 = -.042 ;
IF (SFMental=4) then mh1 = -.100 ;
IF (SFMental=5) then mh1 = -.118 ;

IF (SFVital=1) then v1 = 0 ;
IF (SFVital=2) then v1 = -.071 ;
IF (SFVital=3) then v1 = -.071 ;
IF (SFVital=4) then v1 = -.071 ;
IF (SFVital=5) then v1 = -.092 ;

if most=0 then mst1 = 0 ;
if most=1 then mst1 = -.061 ;

attrib pf1 label="SF6d36 Physical Component";
attrib rl1 label="SF6d36 Role Component";
attrib sc1 label="SF6d36 Social Component";
attrib pn1 label="SF6d36 Pain Component";
attrib mh1 label="SF6d36 Mental Component";
attrib v1 label="SF6d36 Vital Component";

SFIndex1 = 1 + pf1+rl1+sc1+pn1+mh1+v1+mst1 ;

run;
proc freq data=tmp1;
tables sfvital sfmental sfpain sfsocial sfrole sfphys;
run;
data tmp1;
   set tmp1;
if pf1=. or rl1=. or sc1=. or pn1=. or mh1=. or v1=. or mst1=. then
  SFIndex1=.;
rename sfindex1=sf6d36;
run;
data clean.SF6D36;
  set tmp1;
  pf6d=pf1;
  rl6d=rl1;
  sc6d=sc1;
  pn6d=pn1;
  mh6d=mh1;
  vit6d=v1;
  sf6phy=sfphys;
  sf6role=sfrole;
  sf6men=sfmental;
  sf6soc=sfsocial;
  sf6pain=sfpain;
  sf6vit=sfvital;
  attrib pf6d label="SF6d36 Physical Component";
  attrib rl6d label="SF6d36 Role Component";
  attrib sc6d label="SF6d36 Social Component";
  attrib pn6d label="SF6d36 Pain Component";
  attrib mh6d label="SF6d36 Mental Component";
  attrib vit6d label="SF6d36 Vital Component";
  attrib sf6phy label="SF6d36 Physical Domain";
  attrib sf6role label="SF6d36 Role Domain";
  attrib sf6soc label="SF6d36 Social Domain";
  attrib sf6pain label="SF6d36 Pain Domain";
  attrib sf6men label="SF6d36 Mental Domain";
  attrib sf6vit label="SF6d36 Vital Domain";
  drop sfphys sfrole sfmental sfsocial sfpain sfvital;
  keep caseid sf6d36 pf6d rl6d sc6d pn6d mh6d vit6d sf6phy sf6role
  sf6men sf6soc
    sf6pain sf6vit;
run;

SF6D-SF12v2 Computed Variables SAS Code.

***************************************************************************;
* Score for SF-6D from version 2 of the SF-12. Calculated based on Brazier
  and Robert, The estimation of a preference-based measure of health from the
  SF-12. Medical Care, 2004; 42(9): 851-859 with modifications from Quality
  Metric (personal communication), and Brazier 2007. Code written by J.
  Buechner. Presumes the conversion from 5 to 2 role categories is the same as
  for the SF-36 version.;
* sf4 = moderate activities where 1="limited a lot" to 3="not limited at all"
* sf15 = physical limits kind of work where 1="all of the time" to 5="none of
  the time";
* sf18 = emotional accomplish less where 1="all of the time" to 5="none of
  the time";
* sf22 = pain interferes with work where 1="not at all" to 5="extremely";
* sf27 = lots of energy where 1="all the time" to 6="none of the time";
* sf28 = downhearted where 1="all the time" to 6="none of the time" ;
* sf32 = social activities where 1="all the time" to 5="none of the time" ;
*****************************************************************************;
%include "C:\DATA\25aug2006\include.sas";
data sf6d12 ;
   set clean.noscore;
run;
*****************************************************************************;
*recode 5 item response in version2 to 2 item response of version1 ;
*****************************************************************************;
data sf6d12;
   set sf6d12;
   if 0<sf15<5 then sf15=1;
   if sf15=5 then sf15=2;
   if 0<sf18<5 then sf18=1;
   if sf18=5 then sf18=2;
run;

data sf6D12;
   set sf6D12;
   SFPhys=.;
   IF sf4=3 then SFPhys = 1 ;
   IF sf4=2 then SFPhys = 2 ;
   IF sf4=1 then SFPhys = 3 ;
   SFRole=.;
   IF (sf15=2 and sf18=2) then SFRole = 1 ;
   IF (sf15=1 and sf18=2) then SFRole = 2 ;
   IF (sf15=2 and sf18=1) then SFRole = 3 ;
   IF (sf15=1 and sf18=1) then SFRole = 4 ;
   SFSocial=.;
   IF (sf32=5) then SFSocial = 1 ;
   IF (sf32=4) then SFSocial = 2 ;
   IF (sf32=3) then SFSocial = 3 ;
   IF (sf32=2) then SFSocial = 4 ;
   IF (sf32=1) then SFSocial = 5 ;
   SFPain=.;
   IF sf22>0 then SFPain=sf22;
   SFMental=.;
   IF sf28=5 then SFMental=1 ;
   IF sf28=4 then SFMental=2 ;
   IF sf28=3 then SFMental=3 ;
   IF sf28=2 then SFMental=4 ;
   IF sf28=1 then SFMental=5 ;
   SFVital=.;
   If sf27>0 then SFVital=sf27;
*****************************************************************************;
* Create Domains ;
*****************************************************************************;
if sfphys in (1,2) then pf6d12=0;
if sfphys=3 then pf6d12=-.045;
if sfrole=1 then rf6d12=0;
if sfrole in (2,3,4) then rf6d12=-.063;
if sfsocial=1 then s6d12=0;
if sfsocial=2 then s6d12=-.063;
if sfsocial=3 then s6d12=-.066;
if sfsocial=4 then s6d12=-.081;
if sfsocial=5 then s6d12=-.093;
if sfpain in (1,2) then bp6d12=0;
if sfpain=3 then bp6d12=-.042;
if sfpain=4 then bp6d12=-.077;
if sfpain=5 then bp6d12=-.137;
if sfvital=1 then v6d12=0;
if sfvital in (2,3,4) then v6d12=-.078;
if sfvital=5 then v6d12=-.106;
if sfmental=1 then mh6d12=0;
if sfmental=2 or sfmental=3 then mh6d12=-.059;
if sfmental=4 then mh6d12=-.113;
if sfmental=5 then mh6d12=-.134;
most=0;
if sfphys=3 or sfrole>=3 or sfpain>=4 or sfvital>=4 or sfsocial>=4 or sfmental>=4 then most=-.077;

sf6d=1+pf6d12+rf6d12+s6d12+bp6d12+v6d12+mh6d12+most;
if pf6d12=. or rf6d12=. or s6d12=. or bp6d12=. or v6d12=. or mh6d12=. then sf6d=.;
run;

data clean.sf6d12v2;
set sf6d12;
sf6d_12v2=sf6d;
keep caseid sf6d_12v2;
run;
5. QWB-SA

**General Description of QWB-SA computed variables.**

Permission to use the QWB-SA was obtained free of charge from the University of California, San Diego, Health Services Research Center, La Jolla, CA (http://medicine.ucsd.edu/fpm/hoap/index.html). The QWB-SA is usually self-administered using a two-sided optical scan form. The QWB-SA was adapted for this study so that it could be administered by computer-assisted telephone interview. The QWB-SA assesses health over the past 3 days. The QWB-SA combines 3 domains of functioning (mobility, physical activity, social activity) with a lengthy list of symptoms and health problems, each assigned a weight, using an algorithm that yields a single summary score [1,3] based on presence or absence of activities and symptoms on each of the past 3 days. The final QWB-SA score is the average of the 3 single-day scores. The original QWB algorithm was developed using visual analog scale (VAS) ratings of health state descriptions by a community sample of adults located in the San Diego, CA, area. The QWB-SA algorithm is conceptually similar to that of the original QWB, but was derived from ratings by a convenience sample of people in family medicine clinics around San Diego; VAS scales were used to rate domain levels and some case descriptions formed from special combinations of domains in a multi-attribute utility elicitation process. Excluding dead (0.00), the minimum possible QWB-SA score is 0.09 and the maximum is 1.0. The QWB-SA index and its health components are summarized in Table 4.

**Table 4. QWB-SA computed variables in the NHMS data set**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean*</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>QWB_CPX</td>
<td>QWB-SA acute and chronic symptoms score</td>
<td>3758</td>
<td>0.68</td>
<td>0.003</td>
</tr>
<tr>
<td>QWB_MOB</td>
<td>QWB-SA self-care and mobility score</td>
<td>3758</td>
<td>0.999</td>
<td>0.000</td>
</tr>
<tr>
<td>QWB_PAC</td>
<td>QWB-SA physical activity score</td>
<td>3758</td>
<td>0.97</td>
<td>0.001</td>
</tr>
<tr>
<td>QWB_SAC</td>
<td>QWB-SA self-care and usual activity score</td>
<td>3758</td>
<td>0.99</td>
<td>0.000</td>
</tr>
<tr>
<td>QWB_VAS</td>
<td>QWB-SA visual analogue scale</td>
<td>3822</td>
<td>82.21</td>
<td>0.494</td>
</tr>
<tr>
<td>qwbscore</td>
<td>Total QWB-SA Score</td>
<td>3758</td>
<td>0.65</td>
<td>0.004</td>
</tr>
</tbody>
</table>

*Component scores were subtracted from one so that bigger values indicate better health.

**References.**


**QWB-SA Computed Variables SAS Code.**

An example of the QWB-SA SAS scoring code is given below. Questionnaire item names and data set directory may have to be changed if variables are renamed or the data set file is moved.
QWB-SA scores calculated from Sieber et al., Quality of Well-Being Self; 
* Program (HOAP), University of California, San Diego, 2004. Code 
* written by J. Hanmer. J. Buechner added component scores for: 
  * acute and chronic symptoms (cpx) 
  * self-care and mobility (mob) 
  * physical activity (pac) 
  * self-care and usual activity (sac) 
* based on instruction in R. Kaplan et al., Coding and Scoring the Self- 
* administered QWB Form 1.04 (QWB-SA), 1997. 
* 
* Fields named by the following scheme: 
  * -QWB[section number][question letter][question part] 
  * -if the question part is yesterday, 2 days ago, 3 days ago 
  * the corresponding code is _1, _2, _3 
* scores are computed with any amount of missing data 
***************************************************************************

%include 'C:\DATA\25aug2006\include.sas';
data xyz;
  set clean.noscore;
run;

data xyz;
  set xyz;
  CPX1=0;
  CPX2=0;
  CPX3=0;
  MOB1=0;
  MOB2=0;
  MOB3=0;
  PAC1=0;
  PAC2=0;
  PAC3=0;
  SAC1=0;
  SAC2=0;
  SAC3=0;
run;

data xyz;
  set xyz;
  if QWB14=1 then CPX1=.066;
  if QWB15=1 then CPX1=.148;
  if QWB11=1 then CPX1=.153;
  if QWB31_1=1 then CPX1=.160;
  if QWB2f_1=1 then CPX1=.178;
  if QWB1j=1 then CPX1=.187;
  if QWB1k=1 then CPX1=.187;
  if QWB2c_1=1 then CPX1=.189;
  if QWB3m_1=1 then CPX1=.201;
  if QWB1h=1 then CPX1=.204;
  if QWB2g_1=1 then CPX1=.204;
  if QWB2k_1=1 then CPX1=.208;
  if QWB3n_1=1 then CPX1=.223;
  if QWB1g=1 then CPX1=.225;
  if QWB1f=1 then CPX1=.233;
if QWB3k_1=1 then CPX1=.255;
if QWB1e=1 then CPX1=.256;
if QWB2p_1=1 then CPX1=.259;
if QWB2m_1=1 then CPX1=.260;
if QWB2i_1=1 then CPX1=.271;
if QWB1i=1 then CPX1=.274;
if QWB2n_1=1 then CPX1=.278;
if QWB3b_1=1 then CPX1=.286;
if QWB2a_1=1 then CPX1=.293;
if QWB3a_1=1 then CPX1=.296;
if QWB1q2=1 then CPX1=.297;
if QWB3h_1=1 then CPX1=.297;
if QWB2h_1=1 then CPX1=.298;
if QWB2d_1=1 then CPX1=.299;
if QWB2v_1=1 then CPX1=.306;
if QWB3l_1=1 then CPX1=.307;
if QWB3f_1=1 then CPX1=.311;
if QWB2s_1=1 then CPX1=.318;
if QWB2u_1=1 then CPX1=.318;
if QWB2w_1=1 then CPX1=.320;
if QWB3d_1=1 then CPX1=.324;
if QWB3c_1=1 then CPX1=.327;
if QWB21_1=1 then CPX1=.343;
if QWB2e_1=1 then CPX1=.350;
if QWB1a2=1 then CPX1=.358;
if QWB1b=1 then CPX1=.358;
if QWB2r_1=1 then CPX1=.365;
if QWB2t_1=1 then CPX1=.365;
if QWB2g_1=1 then CPX1=.369;
if QWB2y_1=1 then CPX1=.377;
if QWB3g_1=1 then CPX1=.378;
if QWB2j_1=1 then CPX1=.386;
if QWB2b_1=1 then CPX1=.389;
if QWB1d=1 then CPX1=.408;
if QWB1c1=1 then CPX1=.423;
if QWB2o_1=1 then CPX1=.424;
if QWB3e_1=1 then CPX1=.430;
if QWB2x_1=1 then CPX1=.517;
if QWB1al=1 then CPX1=.523;
if QWB3j_1=1 then CPX1=.559;
run;

data xyz;
  set xyz;
  if QWB1l4=1 then CPX2=.066;
  if QWB1l5=1 then CPX2=.148;
  if QWB1l1=1 then CPX2=.153;
  if QWB3l_2=1 then CPX2=.160;
  if QWB2f_2=1 then CPX2=.178;
  if QWB1j=1 then CPX2=.187;
  if QWB1k=1 then CPX2=.187;
  if QWB2c_2=1 then CPX2=.189;
  if QWB3m_2=1 then CPX2=.201;
  if QWB1h=1 then CPX2=.204;
  if QWB2g_2=1 then CPX2=.204;
  if QWB2k_2=1 then CPX2=.208;
  if QWB3n_2=1 then CPX2=.223;
if QWB1g=1 then CPX2=.225;
if QWB1f=1 then CPX2=.233;
if QWB3k_2=1 then CPX2=.255;
if QWB1e=1 then CPX2=.256;
if QWB2p_2=1 then CPX2=.259;
if QWB2m_2=1 then CPX2=.260;
if QWB2i_2=1 then CPX2=.271;
if QWB1i=1 then CPX2=.274;
if QWB2n_2=1 then CPX2=.278;
if QWB3b_2=1 then CPX2=.286;
if QWB2a_2=1 then CPX2=.293;
if QWB3a_2=1 then CPX2=.296;
if QWB1cZ=1 then CPX2=.297;
if QWB3h_2=1 then CPX2=.297;
if QWB2h_2=1 then CPX2=.298;
if QWB2d_2=1 then CPX2=.299;
if QWB2v_2=1 then CPX2=.306;
if QWB3l_2=1 then CPX2=.307;
if QWB3f_2=1 then CPX2=.311;
if QWB2s_2=1 then CPX2=.318;
if QWB2u_2=1 then CPX2=.318;
if QWB2w_2=1 then CPX2=.320;
if QWB3d_2=1 then CPX2=.324;
if QWB3c_2=1 then CPX2=.327;
if QWB2l_2=1 then CPX2=.343;
if QWB2e_2=1 then CPX2=.350;
if QWB1aZ=1 then CPX2=.358;
if QWB1b=1 then CPX2=.358;
if QWB3j_2=1 then CPX2=.358;
if QWB3j=1 then CPX2=.365;
if QWB2t_2=1 then CPX2=.365;
if QWB2q_2=1 then CPX2=.369;
if QWB2y_2=1 then CPX2=.377;
if QWB3g_2=1 then CPX2=.378;
if QWB2j_2=1 then CPX2=.386;
if QWB2b_2=1 then CPX2=.389;
if QWB1d=1 then CPX2=.408;
if QWB1c1=1 then CPX2=.423;
if QWB2o_2=1 then CPX2=.424;
if QWB3e_2=1 then CPX2=.430;
if QWB2x_2=1 then CPX2=.517;
if QWB1a=1 then CPX2=.523;
if QWB3j_2=1 then CPX2=.559;

run;

data xyz;
  set xyz;
  if QWB14=1 then CPX3=.066;
  if QWB15=1 then CPX3=.148;
  if QWB11=1 then CPX3=.153;
  if QWB3l_3=1 then CPX3=.160;
  if QWB2f_3=1 then CPX3=.178;
  if QWB1j=1 then CPX3=.187;
  if QWB1k=1 then CPX3=.187;
  if QWB2c_3=1 then CPX3=.189;
  if QWB3m_3=1 then CPX3=.201;
  if QWB1h=1 then CPX3=.204;
  if QWB2g_3=1 then CPX3=.204;
data xyz;
  set xyz;
  if QWB6c_1=1 then MOB1=.031;
  if QWB5a_1=1 then MOB1=.089;
run;

data xyz;
  set xyz;
  if QWB6c_2=1 then MOB2=.031;
  if QWB5a_2=1 then MOB2=.089;
run;
data xyz;
    set xyz;
    if QWB6c_3=1 then MOB3=.031;
    if QWB5a_3=1 then MOB3=.089;
run;

data xyz;
    set xyz;
    if QWB7a_1=1 then PAC1=.072;
    if QWB7b_1=1 then PAC1=.072;
    if QWB7c_1=1 then PAC1=.072;
    if QWB7d_1=1 then PAC1=.072;
    if QWB7e_1=1 then PAC1=.072;
    if QWB7f_1=1 then PAC1=.072;
    if QWB7g_1=1 then PAC1=.163;
    if QWB7i_1=1 then PAC1=.163;
run;

data xyz;
    set xyz;
    if QWB7a_2=1 then PAC2=.072;
    if QWB7b_2=1 then PAC2=.072;
    if QWB7c_2=1 then PAC2=.072;
    if QWB7d_2=1 then PAC2=.072;
    if QWB7e_2=1 then PAC2=.072;
    if QWB7f_2=1 then PAC2=.072;
    if QWB7g_2=1 then PAC2=.163;
    if QWB7i_2=1 then PAC2=.163;
run;

data xyz;
    set xyz;
    if QWB7a_3=1 then PAC3=.072;
    if QWB7b_3=1 then PAC3=.072;
    if QWB7c_3=1 then PAC3=.072;
    if QWB7d_3=1 then PAC3=.072;
    if QWB7e_3=1 then PAC3=.072;
    if QWB7f_3=1 then PAC3=.072;
    if QWB7g_3=1 then PAC3=.163;
    if QWB7i_3=1 then PAC3=.163;
run;

data xyz;
    set xyz;
    if QWB8a_1=1 then SAC1=.054;
    if QWB8b_1=1 then SAC1=.054;
    if QWB8c_1=1 then SAC1=.054;
    if QWB5b_1=1 then SAC1=.096;
run;

data xyz;
    set xyz;
if QWB8a_2=1 then SAC2=.054;
if QWB8b_2=1 then SAC2=.054;
if QWB8c_2=1 then SAC2=.054;
if QWB5b_2=1 then SAC2=.096;
run;

data xyz;
set xyz;
if QWB8a_3=1 then SAC3=.054;
if QWB8b_3=1 then SAC3=.054;
if QWB8c_3=1 then SAC3=.054;
if QWB5b_3=1 then SAC3=.096;
run;

data xyz;
set xyz;
Score1= 1 - CPX1 - MOB1 - PAC1 - SAC1;
Score2= 1 - CPX2 - MOB2 - PAC2 - SAC2;
Score3= 1 - CPX3 - MOB3 - PAC3 - SAC3;
TotalScore= Score1 + Score2 + Score3;
if totalscore le 3 then do;
QWB= TotalScore/3;
totcpx=(cpx1 + cpx2 + cpx3)/3;
totmob=(mob1 + mob2 + mob3)/3;
totpac=(pac1 + pac2 + pac3)/3;
totsac=(sac1 + sac2 + sac3)/3;
end;
run;

data clean.QWB;
set xyz;
keep caseid QWB score1 score2 score3 totcpx totmob totpac totsac;
proc sort;
by caseid;
run;
6. EuroQol EQ-5D

**General Description of EQ-5D computed variables.**

Permission to administer EQ-5D was given without charge by the EuroQol Group (http://www.euroqol.org). The EQ-5D questions refer to “your health today.” The EQ-5D descriptive system uses 5 domains (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression), each with 3 response options (no problems, moderate problems, severe problems), defining a total of 243 unique health states [1]. For this study, we applied the scoring algorithm derived for the U.S. general population. This scoring algorithm was derived from time tradeoff assessments of EQ-5D health states made by a population sample of some 4,000 U.S. adults in face-to-face household interviews [2]. The EQ-5D index and its health components are summarized in Table 5a. The EQ-5D items are called eq5d1 through eq5d5 in the NHMS data set. Table 5b shows US population-based preference weights for all possible health states defined by the EQ-5D descriptive system [2].

**Table 5a.** EQ-5D variables in the NHMS data set

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
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<td>EQ5D1*</td>
<td>EQ5D Mobility</td>
<td>3837</td>
<td>2.79</td>
<td>0.011</td>
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<td>EQ5D2*</td>
<td>EQ5D Self-care</td>
<td>3844</td>
<td>2.96</td>
<td>0.004</td>
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<td>EQ5D3*</td>
<td>EQ5D Usual Activities</td>
<td>3840</td>
<td>2.79</td>
<td>0.011</td>
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<td>EQ5D4*</td>
<td>EQ5D Pain</td>
<td>3837</td>
<td>2.49</td>
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<tr>
<td>EQ5D5*</td>
<td>EQ5D Anxiety or depression</td>
<td>3829</td>
<td>2.77</td>
<td>0.012</td>
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<tr>
<td>EQVAS</td>
<td>EQ5D VAS-current health rating</td>
<td>3822</td>
<td>82.23</td>
<td>0.428</td>
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<tr>
<td>EQ5DSCORE</td>
<td>EQ5D Score (US Version)</td>
<td>3812</td>
<td>0.87</td>
<td>0.004</td>
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</table>

* These are actual EQ-5D categorical items that were reverse-coded so that higher numbers mean better health.

**Table 5b.** US Population-Based Predicted Preference Weights for 243 EQ-5D Health States,[2]

<table>
<thead>
<tr>
<th>State</th>
<th>Value</th>
<th>SE</th>
<th>State</th>
<th>Value</th>
<th>SE</th>
<th>State</th>
<th>Value</th>
<th>SE</th>
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</tr>
<tr>
<td>33112</td>
<td>0.230</td>
<td>0.019</td>
<td>13133</td>
<td>0.123</td>
<td>0.024</td>
<td>33233</td>
<td>-0.100 0.019</td>
<td></td>
</tr>
<tr>
<td>31223</td>
<td>0.224</td>
<td>0.017</td>
<td>13233</td>
<td>0.123</td>
<td>0.021</td>
<td>33333</td>
<td>-0.109 0.012</td>
<td></td>
</tr>
</tbody>
</table>

SE: standard error.

**References.**

**EQ-5D Computed Variables SAS Code.**

```sas
***************************************************************************.;
* This program computes the U.S. preference-weighted index score using self-reported EQ-5D data. It is presumed that the data set includes the following five variables:                             ;
* Dimension     Variable Name     Range               ;
* Mobility       MO                1-3           ;
* Self-care      SC                1-3    ;
* Usual activities UA                1-3    ;
* Pain/discomfort PD                1-3    ;
* Anxiety/depression AD                1-3    ;
***************************************************************************;
```

* 1 = no problems,  2 = moderate problems, and 3= severe problems. The variables containing responses for the five dimensions must be named as above(in capital letters). Missing values should be left blank (i.e., a '.' should not be substituted for a missing value). The index score will not be generated when responses are missing for 1 or more of the five dimensions. In the data step, the user should specify the location (LIBNAME) and name of
the data set to be analyzed (DATANAME). It is recommended that the index values be saved to a new data set (NEWDATANAME) in the desired library.

****************************************************************************

options ls=78 ps=56 nocenter;
%include 'C:\DATA\25aug2006\include.sas';

data xyz;
   set clean.noscore;
run;

data xyz;
   set xyz;
   EQMO=eq5d1;
   EQSC=eq5d2;
   EQUA=eq5d3;
   EQPD=eq5d4;
   EQAD=eq5d5;
****************************************************************************
* Generate Dummy Variables for Levels 2 and 3 of Five Dimensions  ;
****************************************************************************

m1 =0 ;
m2 =0 ;
s1 =0 ;
s2 =0 ;
u1 =0 ;
u2 =0 ;
p1 =0 ;
p2 =0 ;
a1 =0 ;
a2 =0 ;
run;

data xyz;
   set xyz;
   if EQMO = 2 then m1 = 1 ;
   if EQMO = 3 then m2 = 1 ;
   if EQSC = 2 then s1 = 1 ;
   if EQSC = 3 then s2 = 1 ;
   if EQUA = 2 then u1 = 1 ;
   if EQUA = 3 then u2 = 1 ;
   if EQPD = 2 then p1 = 1 ;
   if EQPD = 3 then p2 = 1 ;
   if EQAD = 2 then a1 = 1 ;
   if EQAD = 3 then a2 = 1 ;
****************************************************************************
* Generate Interaction Terms (I2, I2-squared, I3, I3-squared)  ;
****************************************************************************
m0 = 0 ;
s0 = 0 ;
u0 = 0 ;
p0 = 0 ;
a0 = 0 ;
if m1 = 0 and m2 = 0 then m0 = 1 ;
if s1 = 0 and s2 = 0 then s0 = 1 ;
if u1 = 0 and u2 = 0 then u0 = 1 ;
if p1 = 0 and p2 = 0 then p0 = 1 ;
if a1 = 0 and a2 = 0 then a0 = 1 ;

i2 = m1 + s1 + u1 + p1 + a1 ;
i2 = i2 - 1 ;
if i2<0 then i2 = 0 ;
i22 = i2*i2 ;

i3 = m2 + s2 + u2 + p2 + a2 ;
i3 = i3 - 1 ;
if i3<0 then i3 = 0 ;
i32 = i3*i3 ;

******************************;
* Generate D1 Term ;
******************************;

i1 = m0 + s0 + u0 + p0 + a0 ;
d1 = 4 - i1 ;
if d1<0 then d1 = 0 ;

*********************************************************;
* Create variables indicating larger number is healthier ;
*********************************************************;

pred = .146016*m1 + .557685*m2 + .1753425*s1 + .4711896*s2 + .1397295*u1 +
   .3742594*u2 + .1728907*p1 + .5371011*p2 + .156223*a1 + .4501876*a2 + -.1395949*d1 +
   .0106868*i22 + .1215579*i3 + -.1215579*i32 ;
EQ_index = 1 - pred ;
if (EQMO<0) or (EQSC<0) or (EQUA<0) or (EQPD<0) or (EQAD<0) then EQ_index = . ;
run;
proc means data=xyz;
   var eq_index;
run;

* Create variables indicating larger number is healthier ;
************************************************************;
data xyz;
   set xyz;
   rename eq_index=EQUS;
   array eq eq5d1-eq5d5;
   array eqrev eq5drev1-eq5drev5;
   do i=1 to 5;
      if eq[i]=1 then eqrev[i]=3;
      if eq[i]=2 then eqrev[i]=2;
      if eq[i]=3 then eqrev[i]=1;
   end;
   attrib eq5drev1 label="EQ5D, Mobility reversed" format=eq1rev.;
   attrib eq5drev2 label="EQ5D, Self-care reversed" format=eq2rev.;
attrib eq5drev3 label="EQ5D, Usual Activities reversed" format=eq3rev.;
attrib eq5drev4 label="EQ5D, Pain reversed" format=eq4rev.;
attrib eq5drev5 label="EQ5D, Anxiety reversed" format=eq5rev.;
attrib EQMO label="EQ5D, Mobility Domain" format=eqmob.;
attrib EQSC label="EQ5D, Self-care Domain" format=eqself.;
attrib EQUA label="EQ5D, Usual Activities Domain" format=eqact.;
attrib EQPD label="EQ5D, Pain Domain" format=eqpain.;
attrib EQAD label="EQ5D, Anxiety Domain" format=eqdep.;
run;

data clean.EQUS;
  set xyz;
  keep caseid EQUS eq5drev1-eq5drev5 eqmo eqsc equa eqpd eqad;
  proc sort;
    by caseid;
run;
7. Health Utilities Index Mark II and Mark III (HUI2, HUI3)

General Description of HUI2 and HUI3 computed variables.

License to use the proprietary HUI2/3 English-language questionnaire and mapping algorithm with a 1 week recall period was purchased from Health Utilities, Inc. (http://www.healthutilities.com/). A condition of the license is that users not reveal the content of the questions or the mapping algorithm. Respondents are asked to consider “your level of ability or disability during the past week.” Scoring algorithms for both HUI2 and HUI3 were derived from standard gamble assessments made by adults in community samples in Hamilton, Ontario, and employ multiplicative multi-attribute utility functions. The algorithms map data from the same 40-item interviewer-administered questionnaire to each of the HUI2 and HUI3 classification systems. The HUI2 defines health status on 6 attributes (sensation, mobility, emotion, cognition, self-care and pain—we excluded an optional fertility dimension as is usual in the literature). Each attribute is divided into 4 or 5 levels, resulting in 8,000 unique health states [1]. The HUI3 defines health on 8 attributes (vision, hearing, speech, ambulation, dexterity, emotion, cognition and pain), each having 5 or 6 levels, and jointly describing 972,000 unique health states [2]. Both HUI2 and HUI3 scoring functions have health states scored less than 0 (dead). HUI2 scores range from -0.03 to 1.0; HUI3 scores range from -0.36 to 1.0. The two HUI indexes are summarized in Table 6a. Tables 6b and 6c give the multiattribute utility functions for HUI2 and 3 used to score the instruments. The HUI questionnaire items in the NHMS data set are called HUI1 through HUI40.

Table 6a. Weighed means of HUI2 and 3.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>hui2score</td>
<td>Overall HUI2 Score</td>
<td>3558</td>
<td>0.85</td>
<td>0.00</td>
</tr>
<tr>
<td>hui3score</td>
<td>Overall HUI2 Score</td>
<td>3567</td>
<td>0.81</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 6b. Multiattribute Utility Function for HUI2 [3]

<table>
<thead>
<tr>
<th>Sensation</th>
<th>Mobility</th>
<th>Emotion</th>
<th>Cognition</th>
<th>Self-care</th>
<th>Pain</th>
<th>Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>x1</td>
<td>b1</td>
<td>x2</td>
<td>b2</td>
<td>x3</td>
<td>b3</td>
<td>x4</td>
</tr>
<tr>
<td>1</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>0.95</td>
<td>2</td>
<td>0.95</td>
<td>2</td>
<td>0.97</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>0.86</td>
<td>3</td>
<td>0.81</td>
<td>3</td>
<td>0.81</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>0.61</td>
<td>4</td>
<td>0.70</td>
<td>4</td>
<td>0.65</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>0.53</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Formula: \[ u^* = 1.00 \times b_1^* \times b_2^* \times b_3^* \times b_4^* \times b_5^* \times b_6^* \times b_7^* - 0.05 \]

Where \( u^* \) is the utility of the health state on a utility scale where dead has a utility of 0.00 and healthy has a utility of 1.00. Because the worst possible health state was judged by respondents as worse than death, it has a negative utility of -0.03. The standard error of \( u^* \) is 0.015 for measurement error and sampling error, and 0.06 if model error is also included.
Table 6c. Multiattribute Utility Function for HUI3 [2]

<table>
<thead>
<tr>
<th>Vision</th>
<th>Hearing</th>
<th>Speech</th>
<th>Ambulation</th>
<th>Dexterity</th>
<th>Emotion</th>
<th>Cognition*</th>
<th>Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x_1$</td>
<td>$b_1$</td>
<td>$x_2$</td>
<td>$b_2$</td>
<td>$x_3$</td>
<td>$b_3$</td>
<td>$x_4$</td>
<td>$b_4$</td>
</tr>
<tr>
<td>1</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>2</td>
<td>0.98</td>
<td>2</td>
<td>0.95</td>
<td>2</td>
<td>0.93</td>
<td>2</td>
<td>0.95</td>
</tr>
<tr>
<td>3</td>
<td>0.89</td>
<td>3</td>
<td>0.89</td>
<td>3</td>
<td>0.86</td>
<td>3</td>
<td>0.86</td>
</tr>
<tr>
<td>4</td>
<td>0.84</td>
<td>4</td>
<td>0.81</td>
<td>4</td>
<td>0.73</td>
<td>4</td>
<td>0.76</td>
</tr>
<tr>
<td>5</td>
<td>0.75</td>
<td>5</td>
<td>0.68</td>
<td>5</td>
<td>0.65</td>
<td>5</td>
<td>0.66</td>
</tr>
<tr>
<td>6</td>
<td>0.61</td>
<td>6</td>
<td>n/a</td>
<td>6</td>
<td>0.58</td>
<td>6</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Formula (Dead-Perfect Health Scale)

$$u^* = 1.371 (b_1 b_2 b_3 b_4 b_5 b_6 b_7 b_8) - 0.371$$

where $u^*$ is the utility of a chronic health state† on the utility scale where dead‡ has a utility of 0.00, and healthy§ has a utility of 1.00.

*The single-attribute utility score for Level 3 Cognition is greater than the single-attribute utility score for Level 2 Cognition.
†Chronic states, and the perfect health state, are here defined as lasting for a lifetime.
‡Dead is defined as immediate.

References.

HUI2/3 Computed Variables SAS Code.

Because the license from HUI Inc. precludes revealing the mapping from the 40 HUI questions to the HUI2 and HUI3 attributes, we suppress the SAS code here. Computation of HUI2 and HUI3 scores was accomplished by using the formulci in Tables 6b and 6c with the attribute levels as inputs.
8. HALex

*General Description of HALex computed variables.*

No permission is needed to use the HALex. The HALex is the only summary index available for the U.S. National Health Interview Survey, and it is used to track years of healthy life in Healthy People 2000 and 2010 [1]. HALex questions refer to “your health in general.” It consists of two domains, 6 levels of activity limitation (ranging from “no limitations” to “unable to perform activities of daily living”) and 5 levels of self-reported health (“excellent”, “very good”, “good”, “poor”, “fair”), jointly defining 30 health states. This is the only one of the six indexes to use self-rated health to describe health states. For the self-rated health domain we used question 1 from the SF-36v2TM. For the activity domain we used the questions from Appendix 1 of Erickson [1], adapted for computer-assisted telephone administration. The scoring algorithm was developed ad hoc without actual preference survey data using correspondence analysis to the Health Utilities Index Mark I. The worst of the 30 health states is scored 0.10 and the best scored 1.0. The two HALex index and its health components are summarized in Table 7.

### Table 7. HALex computed variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL*</td>
<td>HALex limitation component</td>
<td>3844</td>
<td>1.71</td>
<td>0.032</td>
</tr>
<tr>
<td>Halexscore</td>
<td>Score of HALex</td>
<td>3844</td>
<td>0.79</td>
<td>0.005</td>
</tr>
</tbody>
</table>

* HL is a categorical variables ranging from 1 through 6 (‘not limited’ to ‘limited in ADLs’)

The HALex questionnaire items are called HALEX1 through HALEX11 in the NHMS data set, additionally, sf1 which is the general health question from SF-36v2TM is used in estimation of computed variables. The HALex score is computed based on a look-up table in Erickson et al (1998) [1].

**References.**

**HALex Computed Variables SAS Code.**

```sas
dm 'output;clear;log;clear;';
%include 'C:\DATA\25aug2006\include.sas';
data xyz;
    set clean.noscore;
run;
***************;
```
* Use EVGFP from the SF36. Categorize people into limitations (HL), ;
* set so 1=not limited,..., 6=limited in adl
********************************************************************
data xyz;
  set xyz;
  hl=1;
run;

data xyz;
  set xyz;
  if age>69 & halex11=1 then hl=2;
  if age>69 & halex10=1 then hl=5;
  if age>69 & halex9=1 then hl=6;
run;

data xyz;
  set xyz;
  if .<age<69 & halex8=1 then hl=2;
  if .<age<69 & halex7=1 then hl=3;
  if .<age<69 & halex5=1 then hl=3;
  if .<age<69 & halex3=1 then hl=3;
  if .<age<69 & halex6=1 then hl=4;
  if .<age<69 & halex4=1 then hl=4;
  if .<age<69 & halex2=1 then hl=4;
  if .<age<69 & halex10=1 then hl=5;
  if .<age<69 & halex9=1 then hl=6;
run;

scores are assigned by table look up from Table 2 in article;
********************************************************************
data xyz;
  set xyz;
  if sf1=1 & hl=1 then HALex=1.0 ;
  if sf1=1 & hl=2 then HALex=.87 ;
  if sf1=1 & hl=3 then HALex=.81 ;
  if sf1=1 & hl=4 then HALex=.68 ;
  if sf1=1 & hl=5 then HALex=.57 ;
  if sf1=1 & hl=6 then HALex=.47 ;
  if sf1=2 & hl=1 then HALex=.92 ;
  if sf1=2 & hl=2 then HALex=.79 ;
  if sf1=2 & hl=3 then HALex=.74 ;
  if sf1=2 & hl=4 then HALex=.62 ;
  if sf1=2 & hl=5 then HALex=.51 ;
  if sf1=2 & hl=6 then HALex=.41 ;
  if sf1=3 & hl=1 then HALex=.84 ;
  if sf1=3 & hl=2 then HALex=.72 ;
  if sf1=3 & hl=3 then HALex=.67 ;
  if sf1=3 & hl=4 then HALex=.55 ;
  if sf1=3 & hl=5 then HALex=.45 ;
  if sf1=3 & hl=6 then HALex=.36 ;
  if sf1=4 & hl=1 then HALex=.63 ;
  if sf1=4 & hl=2 then HALex=.52 ;
  if sf1=4 & hl=3 then HALex=.48 ;
  if sf1=4 & hl=4 then HALex=.38 ;
  if sf1=4 & hl=5 then HALex=.29 ;
  if sf1=4 & hl=6 then HALex=.21 ;
if sf1=5 & hl=1 then HALex=.47;
if sf1=5 & hl=2 then HALex=.38;
if sf1=5 & hl=3 then HALex=.34;
if sf1=5 & hl=4 then HALex=.25;
if sf1=5 & hl=5 then HALex=.17;
if sf1=5 & hl=6 then HALex=.10;
run;

proc means;
  var HALex;
run;

data clean.halex;
  set xyz;
  attrib hl label="Halex limitation component";
  keep caseid halex sf1 hl;
  proc sort;
    by caseid;
run;
9. Scales of Psychological Well-Being (PWB Self-Acceptance Score, PWB Purpose in Life Score)

General Description of Scales of Psychological Well-Being computed variables.

The Scales Psychological Well-Being which include 6 dimensions (autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-acceptance) were developed by Carol Ryff [1, 2, 3]. In the NHMS study, we asked the respondents to answer questions pertaining to purpose in life and self-acceptance scales only with 8 and 7 questions, respectively. The original PWB response scales are 7-category Likert scales ranging from strongly disagree to strongly agree. Because these proved too hard for respondents to use on the telephone we used 5-category scales with the same end anchors. Scales are made by recoding responses so that larger response number indicates higher well-being, then summing responses and normalizing to a range of 0-100. The weighted means of the two summary scales are presented in Table 8.

Table 8. Weighted means of Purpose in Life and Self-Acceptance Scales

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PWBS</td>
<td>PWB Self-Acceptance Score</td>
<td>3769</td>
<td>81.26</td>
<td>0.50</td>
</tr>
<tr>
<td>PWBP</td>
<td>PWB Purpose in Life Score</td>
<td>3780</td>
<td>80.12</td>
<td>0.44</td>
</tr>
</tbody>
</table>

References.

Computed Variables SAS Code.

The Scales of Psychological Well-Being questions are called in PWBP1 through PWBP8 and PWBS1 through PWBS7 in the NHMS data set for PWB Purpose in Life Score and PWB Self-Acceptance Score, respectively, and the two summary scales are PWBS and PWBP.
* calculate PWB Purpose in Life

```sas
data pwb;
set pwb;
purpose=0;
if 0<pwbpl2<6 then purpose=purpose+pwbpl2;
if 0<pwbpl5<6 then purpose=purpose+pwbpl5;
if 0<pwbpl6<6 then purpose=purpose+pwbpl6;
if 0<pwbpl11<6 then purpose=purpose+pwbpl11;
if pwbpl4=1 then pl1=5;
if pwbpl4=2 then pl1=4;
if pwbpl4=3 then pl1=3;
if pwbpl4=4 then pl1=2;
if pwbpl4=5 then pl1=1;
if pwbpl18=1 then pl2=5;
if pwbpl18=2 then pl2=4;
if pwbpl18=3 then pl2=3;
if pwbpl18=4 then pl2=2;
if pwbpl18=5 then pl2=1;
if pwbpl19=1 then pl3=5;
if pwbpl19=2 then pl3=4;
if pwbpl19=3 then pl3=3;
if pwbpl19=4 then pl3=2;
if pwbpl19=5 then pl3=1;
if pwbpl10=1 then pl4=5;
if pwbpl10=2 then pl4=4;
if pwbpl10=3 then pl4=3;
if pwbpl10=4 then pl4=2;
if pwbpl10=5 then pl4=1;
purpose = purpose+pl1+pl2+pl3+pl4;
plcount=0;
if 0<pwbpl4<6 then plcount=plcount+1;
if 0<pwbpl18<6 then plcount=plcount+1;
if 0<pwbpl19<6 then plcount=plcount+1;
if 0<pwbpl10<6 then plcount=plcount+1;
if 0<pwbpl15<6 then plcount=plcount+1;
if 0<pwbpl16<6 then plcount=plcount+1;
if 0<pwbpl11<6 then plcount=plcount+1;
if ((plcount/2)>1)then pl=round(((purpose-plcount)/((5*plcount)-plcount))*100,1);
else pl=.;
run;
```

* calculate PWB Self Acceptance

```sas
```
data pwb;
  set pwb;
  accept=0;
  if 0<pwbsa3<6 then accept=accept+pwbsa3;
  if 0<pwbsa7<6 then accept=accept+pwbsa7;
  if 0<pwbsa10<6 then accept=accept+pwbsa10;

  if pwbsa1=1 then sa1=5;
  if pwbsa1=2 then sa1=4;
  if pwbsa1=3 then sa1=3;
  if pwbsa1=4 then sa1=2;
  if pwbsa1=5 then sa1=1;

  if pwbsa2=1 then sa2=5;
  if pwbsa2=2 then sa2=4;
  if pwbsa2=3 then sa2=3;
  if pwbsa2=4 then sa2=2;
  if pwbsa2=5 then sa2=1;

  if pwbsa5=1 then sa3=5;
  if pwbsa5=2 then sa3=4;
  if pwbsa5=3 then sa3=3;
  if pwbsa5=4 then sa3=2;
  if pwbsa5=5 then sa3=1;

  if pwbsa13=1 then sa4=5;
  if pwbsa13=2 then sa4=4;
  if pwbsa13=3 then sa4=3;
  if pwbsa13=4 then sa4=2;
  if pwbsa13=5 then sa4=1;

  accept = accept+sa1+sa2+sa3+sa4;
  sacount=0;
  if 0<pwbsa1<6 then sacount=sacount+1;
  if 0<pwbsa2<6 then sacount=sacount+1;
  if 0<pwbsa5<6 then sacount=sacount+1;
  if 0<pwbsa13<6 then sacount=sacount+1;
  if 0<pwbsa7<6 then sacount=sacount+1;
  if 0<pwbsa10<6 then sacount=sacount+1;

  if ((sacount/2) > 1) then sa=round(((accept-sacount)/(5*sacount) - sacount)*100).1;
  else sa = .;
run;

data pwb;
  set pwb;
  pl4rev=pl1;
  pl8rev=pl2;
  pl9rev=pl3;
  pl10rev=pl4;
  pl14rev=pl11;
  pl18rev=pl12;
  pl19rev=pl13;
  pl10rev=pl14;
  salrev=sa1;
  sa2rev=sa2;
  sa5rev=sa3;
  sa13rev=sa4;
  format pl4rev pl8rev pl9rev pl10rev salrev sa2rev sa5rev sa13rev pwbr.;
proc sort data=pwb(keep=caseid sa pl pl4rev pl8rev pl9rev pl10rev salrev sa2rev sa5rev sal3rev) out=clean.pwb;
   by caseid;
run;
10. Discrimination Questions (Everyday Discrimination Scale, Lifetime Discrimination Scale)

General Description of Discrimination Scales.

Each respondent was asked to answer 9 questions relating to occurrence of everyday or lifetime discrimination. Specifically, there were four questions pertaining to lifetime discrimination and 5 relating to everyday discrimination called DISCRM1-DISCRM4 and DISCRM5-DISCRM9, respectively, in the NHMS.

Table 9. Discrimination computed variables in the NHMS data set

<table>
<thead>
<tr>
<th>Variable</th>
<th>Label</th>
<th>N</th>
<th>Mean</th>
<th>SE</th>
</tr>
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The two discrimination scales were simply calculated by first reverse coding all items and then summing non-missing items. The potential range for the Lifetime scale is 0-4, with 0 being least discrimination and 4 the most; for the Everyday scale, the potential range is 0-25, with higher numbers being more discrimination. For more information regarding the specific questions see the CATI and Codebook documents.

References.

Computed Variables SAS Code.

The discrimination items are called DISCRM1 through DISCRM9 in the NHMS data set, whereas DISCRM1-DISCRM4 pertain to lifetime discrimination and DISCRM5-DISCRM9 ask about everyday discrimination.

```sas
* Create lifetime and everyday discrimination scales  ;
*-------------------------------------------------------------------------;
array disold discrm1-discrm9;
array disnew disnew1-disnew9;
*lifetime;
do j=1 to 4;
   *disnew[j]=.;
   if disold[j]=2 then disnew[j]=0;
   if disold[j]=1 then disnew[j]=1;
end;
```
11. Body Mass Index

**General Description of Body Mass Index Scale.**

Each respondent in the NHMS was asked to self-report height in feet and inches (without shoes), and body weight in pounds.

Note: height is recorded as 2 variables, the "feet" portion (HEIGHT_FT) and the "inches" portion of "height in feet and inches", (HEIGHT_IN). Total height in inches is:

\[(12 \times \text{HEIGHT_FT} + \text{HEIGHT_IN}).\]

This information was used to estimate body mass index (BMI) of each respondent in NHMS using the standard formula [1]:

\[
\text{BMI} = 703 \times \frac{\text{weight in pounds}}{(\text{height in inches}) \times (\text{height in inches})}
\]

The continuous BMI scale was further categorized into four categories: 1 = "<18.5", 2="18.5-< 25", 3=">=25-<30", and 4=">=30" with defining weight conditions of underweight, normal weight, overweight and obese, respectively [1].

**Table 10. Unweighted Mean of BMI in the NHMS data set**

<table>
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<tr>
<th>Variable</th>
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<td>BMI*</td>
<td>Body Mass Index</td>
<td>3783</td>
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*Estimated based on variables height_ft or height_in and weight_lb.

**Reference.**


NHMS elicited self-report about 11 health conditions. The first question for each used the National Health Interview Survey format, “Has a doctor or other health professional ever told you that you have <fill in condition>?” If the answer was “no” the interviewer skipped on to the next condition question. If the answer was “yes” then for some conditions there were follow-up questions about the nature and treatment of the condition. These skip conditions make the raw indicator variables for health conditions somewhat problematic to work with. We thus created single categorical variables using all logical combinations of skip conditions. These are listed in the appendix.
APPENDIX

NHMS SUMMARY OF COMPUTED OR DERIVED VARIABLES

TRAKEDWT Final poststratified and trimmed sample person weight
BMI Body Mass Index

SF-36V2™ SCORING

MCS36V2 SF36 MENTAL COMPONENT SCORE
PCS36V2 SF36 PHYSICAL COMPONENT SCORE
pf36 SF36 Physical Functioning Component
rp36 SF36 Role-Physical Component
bp36 SF36 Bodily Pain Component
gh36 SF36 General Health Component
vt36 SF36 Vitality Component
re36 SF36 Role-Emotional Component
mh36 SF36 Mental Health Component
sf36a SF36 Social Functioning Component

SF-6D SCORING

SF6D_36V2 SF-6D Score (from SF-36V2)
pf6d SF6d36 Physical Component
rl6d SF6d36 Role Component
sc6d SF6d36 Social Component
pn6d SF6d36 Pain Component
mh6d SF6d36 Mental Component
vit6d SF6d36 Vitality Component
SF6D_12v2 SF6 Score (from SF12V2 items embedded in SF-36V2)

SF-12V2™ SCORING

MCS12 SF12 Mental Component Score (From SF12V2 items embedded in SF-36V)
PCS12 SF12 Physical Component Score (From SF12V2 items embedded in SF-36V)

QWB-SA SCORING

QWBScore Total QWB-SA Score
QWB_CPX QWB-SA acute and chronic symptoms score
QWB_MOB QWB-SA self-care and mobility score
QWB_PAC QWB-SA physical activity score
QWB_SAC QWB-SA self-care and usual activity score

**EQ-5D SCORING**

EQ5DSCORE EQ5D Score (US weights)

**HUI2 SCORING**

HUI2SCORE Overall HUI2 Score

**HUI2 Single Attribute Utility Scores**

HUI2_SEN HUI2 Sensation Utility Score
HUI2_MOB HUI2 Mobility Utility Score
HUI2_EMO HUI2 Emotion Utility Score
HUI2_COG HUI2 Cognition Utility Score
HUI2_SC HUI2 Self-Care Utility Score
HUI2_PAIN HUI2 Pain Utility Score

**HUI 3 SCORING**

HUI3SCORE Overall HUI3 Score

**HUI3 Single Attribute Utility Scores**

HUI3_VIS HUI3 Vision Utility Score
HUI3_HEAR HUI3 Hearing Utility Score
HUI3_SPCH HUI3 Speech Utility Score
HUI3_AMB HUI3 Ambulation Utility Score
HUI3_DEX HUI3 Dexterity Utility Score
HUI3_EMO HUI3 Emotion Utility Score
HUI3_COG HUI3 Cognition Utility Score
HUI3_PAIN HUI3 Pain Utility Score

**HALex SCORING**

HALEXSCORE Score of HALex

**SCALES OF PSYCHOLOGICAL WELL-BEING QUESTIONS AND SCORES**

PWBS PWB Self-acceptance Score (0-100)
PWBP PWB Purpose in life score (0-100)
**DISCRIMINATION QUESTIONS**

EVERYDAY_DISC  Everyday Discrimination Scale  
0-25

LIFETIME_DISC  Lifetime Discrimination Scale  
0-5

**HEALTH CONDITIONS (combined variables across skip patterns)**

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