Physical Activity – Survey 2 and later surveys

Age Cohorts	1973-78, 1946-51 and 1921-26 cohorts
Surveys	Survey 2 and later (excluding Survey 2 of 1946-51 cohort)
Derived Variables	ExStat, metmin, exgrp, metminexgrp
Definition	Recreational physical activity
Source Items (Index numbers)	PA1 (EXER-004 to EXER-006)
	PA2 (EXER-007 to EXER- 009)
	PA3 (EXER-012)
Statistical form	Continuous variable
Index Number	EXER-016
Prepared by	Anne Russell, Jean Ball, Wendy Brown, Melanie Spallek
Endorsed	2001 (updated June 2006, March 2009, January 2016)

Please note the recommendation and the code/syntax for Physical Activity at the end of this document.

Background

Physical activity has been measured in mets.mins from Survey 2 onwards, using items from Active Australia's 1999 National Physical Activity Survey[1]. However, the items included on Survey 2 of the 1946-51 cohort (1998) differed from all subsequent surveys of the 1946-51 and other cohorts; all surveys conducted after 1998 have used the same items.

In June 2006 the validity of using the same estimate of physical activity based on different survey items was examined (see Appendix 1), concluding the calculation of mets.mins from the Survey 2 responses for 1946-51 cohort women was inappropriate. Consequently this variable was not included in datasets distributed after this time.

Additionally, in August of 2006 it was noted that a number of different approaches were being used to categorise mets.mins and so it was decided to omit categories from datasets (although this had been done throughout most of the life of the project) but to provide recommendations to data users here.

The maximum number of hours per week allowed for any activity was set at 100. Any self-reported time above this was set to missing.

Source items – Survey 2

Physical activity was measured from Survey 2 onwards using items from Active Australia's 1999 National Physical Activity Survey.[1]

PA1   How many times did you do each type of activity LAST WEEK?
Only count the number of times when the activity lasted for 10 minutes or more.
(If you did __not__ do an activity, please write "0" in the box)

PA2   If you add up all the times you spent in each activity LAST WEEK, how much time did you spend ALTOGETHER doing each type of activity?
(If you did __not__ do an activity, please write "0" in the box)

a   **Walking briskly** (for recreation or exercise, or to get from place to place)

b   **Moderate leisure activity** (like social tennis, moderate exercise classes, recreational swimming, dancing)

c   **Vigorous leisure activity** (that makes you breathe harder or puff and pant like aerobics, competitive sport, vigorous cycling, running, swimming)

PA3   d   **Vigorous household or garden chores** (that make you breathe harder of puff and pant)

Responses to PA1 are recorded as 'number of times'

Responses to PA2 and PA3 are recorded in 'hours' and 'minutes'

ALSWH Re-codes
The rules listed below are applied to all sets of physical activity items of this format used in ALSWH surveys. These rules deal with assignment of values to missing data, rationalisation of outliers and the calculation of a physical activity summary variable.

1.   Coding Missing Values and Zeros
a) PA1 (Number of times doing leisure activities)
    If some items in this group have a non-zero response AND no items in this group have a response of 'zero' THEN code missing values to zero

b) PA2 (Hours & minutes spent doing leisure activities)
    If hours spent doing activities is not missing AND the corresponding minutes are missing THEN code missing values in minutes to 0. (Similarly, for minutes not missing and hours missing).

c) PA2 and PA3 (Total minutes doing leisure activities)
    Total minutes calculated as the total time reported in PA3 and the 3 items in PA2.

    If some items in this group have a non-zero response AND no items in this group have a response of 'zero' THEN code missing values to zero.

    PA3 is included in this group because editing of surveys strongly suggested that respondents treated these questions as a single block and is consistent with subsequent surveys, in which these 4 items are presented as a block.

d) Cross-referencing values for PA1 and PA2
    If the number of times is zero AND the corresponding total minutes is missing THEN code the missing value for total minutes to zero (similarly for zero in PA2 and missing in PA1).

    There was some concern that values coded to zero in parts a) and c) may be re-coded here. However it was decided that since each step was logical that any such re-coding was acceptable.

2. Re-coding Outliers
a) PA1 (Number of times doing leisure activities)

Principle: The plausible maxima for the week was set at 21 times (3 per day * 7) for walking and moderate exercise and 14 times (2 per day * 7) for vigorous exercise, giving a maximum plausible number of times for all 3 activities of 56. These maxima are acknowledged as generous.

Rule: If the total of number of times reported for leisure activity (PA1: a+ b + c) exceeds 56 THEN reduce the number of times for each activity in the proportion reported, to give a total of 56
<div align="center">OR</div>
If total number of times cannot be calculated because the number of times for 1 or 2 activities is missing THEN those values which are reported should be proportionally reduced, to give a total of 56.

b) PA2 (Hours & minutes spent doing leisure activities)
The possibility of assigning a time of 10 minutes when a number of times is reported but the amount is missing was considered and rejected. The option of setting times to missing if the maximum plausible total was exceeded was also rejected.

Principle: The maximum plausible value for all leisure exercise types was set at 8 hours a day (480 minutes a day) on 5 days per week, ie. 40 hours per week. Eight hours on all 7 days was deemed too extreme. This maximum is acknowledged as generous.

Rule: If the total of leisure time reported (PA2 hours-a+b+c) exceeds 40 THEN reduce the hours for each activity in the proportion reported, to give a total of 40.
<div align="center">OR</div>
If total leisure time cannot be calculated because the time for 1 or 2 activities is missing THEN those values that are reported should be proportionally reduced, to give a total of 40.

3. Combinations of Number of times (PA1) and Amount of time (PA2)
A number of cases of unusual combinations for a particular exercise type of the number of times and the amount of time reported were reviewed.
- Number of times is zero but amount of time is greater than zero
- Amount of time is zero but number of times is greater than zero
- Relatively high values of minutes per time
- Relatively low values of minutes per time
- Specific combinations: more than 480 minutes when the number of times reported is 1
- Specific combinations: number of times greater than 24 and total time less than 240 minutes

No systematic methods for dealing with these extremes were found.

Derived Variable
Physical activity (PA) can be assessed in terms of energy used, and measured in either kilocalories (kcal) or METS. METS is a unit of resting metabolic rate (RMR) which varies with sex, age, height and weight and is usually taken to be 3.5ml oxygen/kg/minute.

1 MET is defined as RMR, which for an average person is equivalent to 3.5ml oxygen/kg/minute. As each litre of oxygen provides approximately 5 kcal energy/minute, 1 MET is equivalent to 0.0175 kcal/minute.

MET values have been estimated for many activities and "generic" values of 3, 4 and 7.5 have been assigned for walking, moderate activity and vigorous activity respectively. The MET values for moderate and vigorous activities are based on published values of actual activities[2] and on the actual activities reported in responses to questions about moderate and vigorous activity in a 1996 NSW physical activity survey.[3] The value of 3 for walking is the mean of values for slow, moderate and brisk walking.

A score for PA, in MET minutes, has been developed[4] and is calculated as

$$\text{MET minutes} = \begin{aligned} &3 * \text{minutes walking} \\ &+ 4.0 * \text{minutes moderate activities} \\ &+ 7.5 * \text{minutes vigorous activities} \end{aligned}$$

Statistical use
Many women do not exercise at all and so have zero MET minutes of recreational physical activity. There are in fact so many zeros that the variable cannot be used as continuous variable for statistical analyses. Options for analysis are:

a) Create a binary variable that takes the value 0 when MET minutes is zero and 1 when MET minutes is positive. That is classifying women as exercisers or non-exercisers. Further analyses of exercisers alone could be undertaken, using MET minutes as a continuous variable. However, neither the raw or log transformed values were approximately normally distributed and so this approach is also unsuitable.

b) Define ordinal categories of exercise use. This is the recommended method for analysis.

Categories
While there is no national or international standard for categorising mets.mins, a number of approaches are in common use.

1. Moderate activity for 30 minutes 5 times per week (150 minutes) has been defined as a 'threshold' for health benefit. So the cut-point for health benefit versus no healthy benefit is 150 mins * 4 METs, or 600 MET minutes. This threshold can be achieved through combinations of walking, moderate and vigorous activities.

The conversion from kcals to MET minutes is based on the assumption that 1kcal is equivalent to 1 MET for a 60kg person.

Categories commensurate with those used in previous national PA surveys have been assigned in terms of kcal, MET minutes and minutes of moderate intensity activity per week (see below). Categories for kcal[5] were based on calculations for an 80kg person. MET minutes is independent of body weight.

PA Categories	kcal/week	MET minutes /week	Mins of moderate activity/week
Nil/sedentary	0-<50	0-<40	0-10
Low	50-<800	40-<600	11-150
Moderate	800-<1600	600-<1200	151-300
High	>= 1600	>= 1200	>300

In some work the first 2 of the above categories have been redefines as None (<40 MET minutes), Very Low (40-<300 MET minutes) and Low (300-<600 MET minutes) in order to better assess the dose response of physical activity with health outcomes (K Heesch, personal communication).

2. Categories referenced against 60 minutes of moderate activity per week have also been used.[6]

MET minutes /week	PA Categories
0-<240	Very low (represents one hour of moderate activity per week)
240-<600	Low
600-<1200	Moderate
>= 1200	High

Limitations for comparison of MET minutes with the physical activity measure from the baseline surveys
Physical activity was measured differently in the baseline surveys (see previous section, Index Number EXER-015). That variable has no units of measurement and is not comparable in any way with MET minutes.

References

1. Armstrong T, Bauman A, Davies J. *Physical activity patterns of Australian adults: Results of the 1999 National Physical Activity Survey.* Australian Institute of Health and Welfare, Canberra, 2000

2. Ainsworth BE, Haskel NL, Leon AS et al. Compendium of physical activities: classification of energy costs of human physical activities. *Medical Science Sports Exercise* 1993;25(1):71-80

3. Bauman A, Chey T, Brown WJ, Booth M. Validity and reproducibility of an Australian self reported generic physical activity questionnaire. *Medical Science Sports Exercise* 1998; S176: 1005

4. Brown WJ and Bauman AE. Comparison of estimates of population levels of physical activity using two measures. *Australian and New Zealand Journal of Public Health* 2000;24:520-525

5. Bauman A, Bellew B, Booth M, Hahn A, Stoker L, Thomas M for the NSW Health Promotion Survey. *Towards best practice for the promotion of physical activity in the areas of NSW.* Sydney: New South Wales Health Department, Centre for Disease Prevention and Health. 1996

6. Brown WJ, Ford JH, Burton NW, Marshall AL, Dobson AJ. Prospective study of physical activity and depressive symptoms in middle-aged women. *American Journal of Preventive Medicine* 2005;29(4):265-272

Appendix 1   Using the Active Australia's 1999 National Physical Activity Survey to develop a measure of physical activity in the ALSWH

Prepared by Melanie Spallek, June 2006

Physical activity was measured from Survey 2 onwards using items from Active Australia's 1999 National Physical Activity Survey[1] which are shown below.

We would like to ask you about the physical activity you did IN THE LAST WEEK:

IN THE LAST WEEK how many times have you walked continuously, for at least 10 minutes, for recreation/exercise or to get to or from places?

What do you estimate was the total time that you spent walking in this way IN THE LAST WEEK?

IN THE LAST WEEK how many times did you do any vigorous gardening or heavy work around the yard which made you breathe harder or puff and pant?

What do you estimate was the total time that you spent doing vigorous gardening or heavy work around the yard IN THE LAST WEEK?

The next question excludes household chores or gardening or yardwork

IN THE LAST WEEK, how many times did you do any vigorous physical activity which made you breathe harder or puff and pant? (e.g. jogging, cycling, aerobics, competitive tennis, etc.)

What do you estimate was the total time that you spent doing this vigorous physical activity IN THE LAST WEEK?

The next question excludes household chores or gardening or yardwork

IN THE LAST WEEK how many times did you do any other more moderate physical activity that you haven't already mentioned? (e.g. gentle swimming, social tennis, golf, etc.)

What do you estimate was the total time that you spent doing these activities IN THE LAST WEEK?

In 1998, the second survey of the 1946-51 cohort included 'gardening' as an example of moderate intensity activity, whereas in all subsequent surveys (of the 1946-51 cohort and all surveys after baseline for the other two cohorts) only included vigorous gardening as an example in the question about vigorous house and garden chores.

Items from Survey 2 of the 1946-51 cohort (1998)

PA1   How many times did you do each type of activity LAST WEEK?
(Only count the number of times when the activity lasted for 10 minutes or more. Please write "0" in the box for each activity you DO NOT do.)

PA2   If you add up all the times you spent in each activity LAST WEEK, how much time did you spend ALTOGETHER doing each type of activity?
(Example: Walking 3 times for 30minutes each time=3*30=90minutes or 1 hour 30minutes. Please write "0" in the box for each activity you DO NOT do.)?

a   Walking (fairly briskly, including walking to and from work)

b   Moderate activity (leisure-time activities (like golf, social tennis, moderate exercise classes, recreational swimming or cycling, and gardening)

c   Vigorous activity (leisure-time activities (the ones that make you puff and pant, like vigorous aerobics, competitive sport, vigorous cycling, running, swimming etc).

PA3 During the *LAST WEEK*, how much time did you spend *ALTOGETHER* in your *WORK* (paid or unpaid) doing VIGOROUS activity (that is, activity which made you puff or pant such as labouring, farm work, gardening, heavy work around the yard, heavy housework, etc.)**?**

Items from all ALWSH surveys after 1998

PA1   How many times did you do each type of activity LAST WEEK?
Only count the number of times when the activity lasted for 10 minutes or more.
(If you did not do an activity, please write "0" in the box)

PA2   If you add up all the times you spent in each activity LAST WEEK, how much time did you spend ALTOGETHER doing each type of activity?
(If you did not do an activity, please write "0" in the box)

   a   **Walking briskly** (for recreation or exercise, or to get from place to place)

   b   **Moderate leisure activity** (like social tennis, moderate exercise classes, recreational swimming, dancing)

   c   **Vigorous leisure activity** (that makes you breathe harder or puff and pant like aerobics, competitive sport, vigorous cycling, running, swimming)

   d   **Vigorous household or garden chores** (that make you breathe harder of puff and pant)

A measure of physical activity (PA) is derived from frequency and duration of walking, doing moderate intensity activities and doing vigorous activities. Although the frequency and duration of vigorous household and garden activities was also asked for, these activities are not included in the calculation of minutes of total activity when using the Active Australia algorithms. Therefore they are not included in the definitions of which women are categorised as 'sufficiently active for health benefit' and prevalence of 'active' women. This is because there is limited research on the validity of the self-reported intensity of these activities, and questions about whether they are conducted at sufficient intensity to have any health benefit. Nevertheless, the question about gardening and housework is included in the surveys to reduce the likelihood that these activities are reported with the other activities, which are likely to have a health benefit.[1]

If we explore the time spent in each of the four types of physical activity over time, (Figure 1) it is evident that there is an increase in time spent walking, no change in time spent in vigorous activity, an increase in house and garden work, but a decrease in time spent in moderate intensity activity, between Surveys 2 and 3. We cannot be certain whether this is a 'real' decrease in time spent in moderate intensity activities, or a reflection of the removal of 'gardening' as an example of moderate intensity activity in Survey 3.
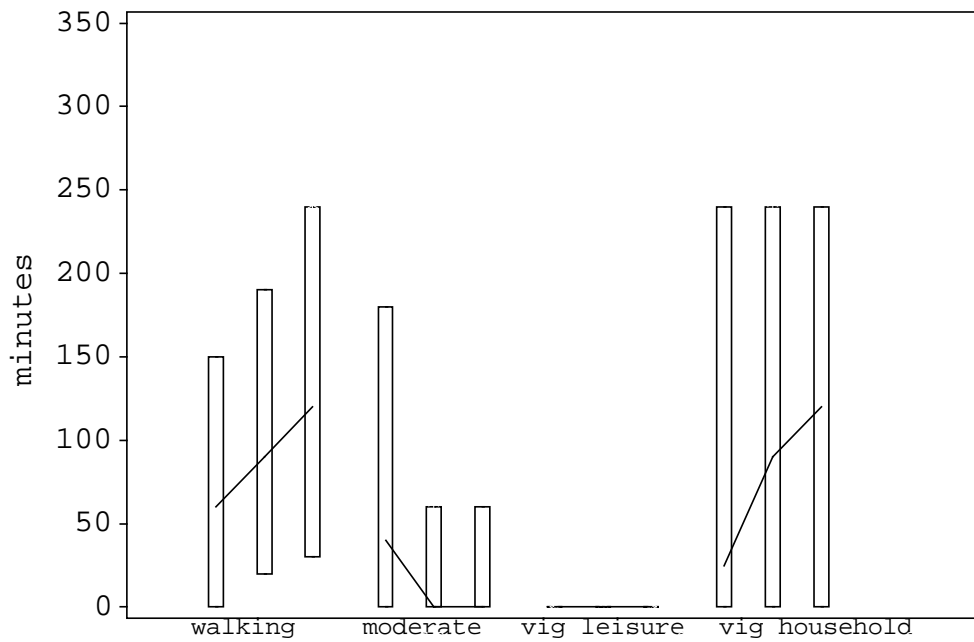
Figure 1 **Time trends from Survey 2 to Survey 4 for walking, moderate intensity activity, vigorous activity and vigorous household and garden activity in the 1946-51 cohort.**

Figure 2 shows time trends in total physical activity measured in MET minutes in the 1946-51 cohort. Time spent in house and garden work is not included in these estimates. It is likely that the apparent decrease in total activity time reflects the change in the question, rather than a 'real' decrease between Surveys 2 and 3.

Figure 2 **Time trend in total physical activity measured in MET minutes at Survey 2, Survey 3 and Survey 4 in the 1946-51 cohort.**

Recommendation
As we cannot be certain about this, it is recommended that longitudinal analyses of overall physical activity (MET.mins) in the 1946-51 cohort should not include the Survey 2 data. However, as there were no changes to the qu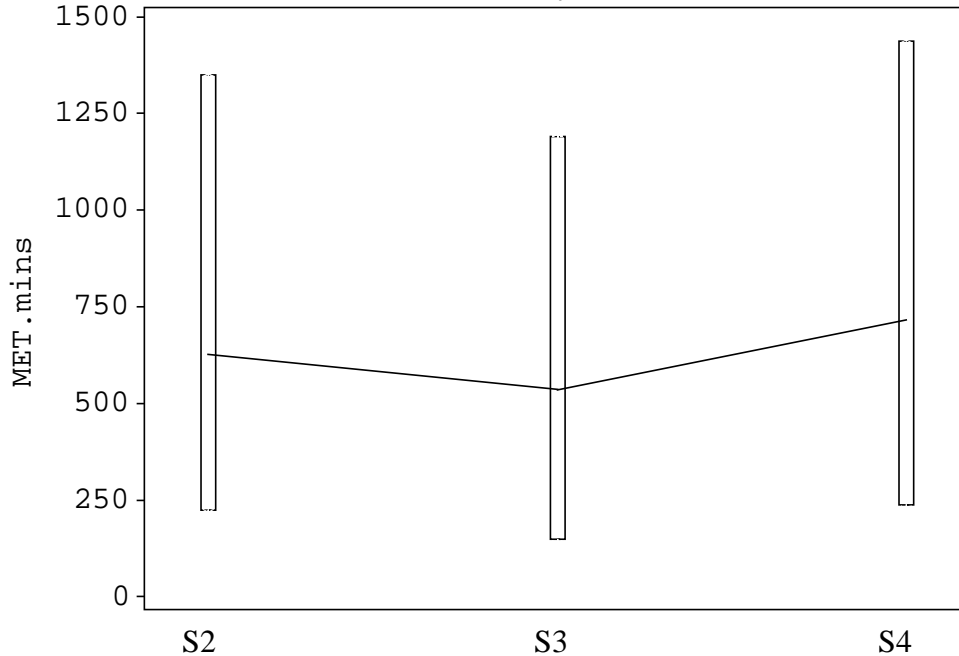estions about time spent walking and doing vigorous leisure activities, changes in these activities can be analysed over time from Survey 2 (included) onwards.

Code / Syntax for Physical Activity used in Surveys 2 onwards
This example is from the second survey of the 1973-78 cohort. (Young 2)

```
***   First recode missing values using standard logical methods ***
***      Allocate exercise status variable - y2exstat
           (metsmins)

array leisure{3}  y2q65a   y2q65b   y2q65c ;
array numtimes{4} y2q65a   y2q65b   y2q65c   y2q65d ;

array hours{4}    y2q66ah  y2q66bh  y2q66ch  y2q66dh ;
array minutes{4}  y2q66am  y2q66bm  y2q66cm  y2q66dm ;

array totmins{3}  totmina   totminb   totminc ;


/***************************************************************
      # times doing leisure activities

      If some items in this group have a nonzero response AND
      no items in this group have a response of 'zero'
      THEN code missing values to zero.
****************************************************************/
           if nmiss (of numtimes{*}) in (0,4) then ;
      else if y2q65a=0 or y2q65b=0 or y2q65c=0 or y2q65d=0 then ;
      else do i = 1 to 4 ;
           if numtimes{i}=.  then numtimes{i}=0 ;
      end ;



/***************************************************************
      hours & minutes spent doing leisure activities

      If hours spent doing activities is not missing AND
      the corresponding minutes are missing
      THEN code missing values in minutes to 0.

      (Similarly, for minutes not missing and hours missing)
 ****************************************************************/
      do i = 1 to 4 ;
           if hours{i} ne . and minutes{i} = .  then minutes{i} = 0
;
           if hours{i} = .  and minutes{i} ne . then hours{i} = 0 ;
      end ;
```

```
/***************************************************
 ***                                             ***
 ***   If number of times=0 and hours=. and mins=.  ***
 ***   then set hours and mins to 0.               ***
 ***                                             ***
 ***   If hours=0 and mins=0 and number of times=.  ***
 ***   then set number of times to 0.             ***
 ***                                             ***
 ***************************************************/
do a=1 to 4 ;
     if numtimes(a)=0 and hours(a)=. and minutes(a)=. then do ;
          hours(a)=0 ;
          minutes(a)=0 ;
     end ;
end ;

do a=1 to 4 ;
     if numtimes(a)=. and hours(a)=0 and minutes(a)=0 then
numtimes(a)=0 ;
end ;



/***************************************************
 ***                                             ***
 ***   If hours>0 and mins>0 and number of times=.  ***
 ***   then set number of times to 0.             ***
 ***                                             ***
 ***************************************************/
     do a=1 to 4 ;
          if numtimes(a)=. and 0<=hours(a)<=99 and
0<=minutes(a)<=90 then numtimes(a)=0 ;
     end ;



/****************************************************
     Calculate total # times leisure activity reported
 ****************************************************/
     y2q65tot = y2q65a + y2q65b + y2q65c ;



/*********************************************************************
     Re-assign extreme values for the # times reported doing
     leisure activities, that is totals > 56 times
 *********************************************************************/
if y2q65tot >56 then do i = 1 to 3 ;
     leisure{i} = round ( ((56/y2q65tot) * leisure{i}), 1) ;
     end ;

else if y2q65tot = . then do ;
     if (y2q65a+y2q65b) >56 then do ;
          y2q65a = round ( ( (56/(y2q65a+y2q65b) ) * y2q65a), 1) ;
          y2q65b = round ( ( (56/(y2q65a+y2q65b) ) * y2q65b), 1) ;
          end ;
     else if (y2q65a+y2q65c) > 56 then do ;
```

```
            y2q65a = round ( ( (56/(y2q65a+y2q65c) ) * y2q65a), 1) ;
            y2q65c = round ( ( (56/(y2q65a+y2q65c) ) * y2q65c), 1) ;
            end ;
      else if (y2q65b+y2q65c) >56 then do ;
            y2q65b = round ( ( (56/(y2q65b+y2q65c) ) * y2q65b), 1) ;
            y2q65c = round ( ( (56/(y2q65b+y2q65c) ) * y2q65c), 1) ;
            end ;
      else do i = 1 to 3 ;
            if leisure{i} >56 then leisure{i}=56 ;
            end ;
      end ;

if y2q65d>56 then y2q65d=56 ;


/************************************************************
      Calculate the total minutes doing each leisure activity
 ************************************************************/
      do i = 1 to 3 ;
            totmins{i} = (60*hours{i}) + minutes{i} ;
      end ;



/************************************************************
      Calculate total minutes of leisure activity reported
 ************************************************************/
      y2q66min = round ((totmina + totminb + totminc), .01);



/****************************************************************
      Re-assign extreme values for the total time reported doing
      leisure activities, that is totals > 40 hrs (>2400 minutes)
 ****************************************************************/
if y2q66min >2400 then do i = 1 to 3 ;
      totmins{i} = round ( ((2400/y2q66min) * totmins{i}), .01) ;
      end ;

else if y2q66min = . then do ;
      if (totmina + totminb) >2400 then do ;
            totmina = round ( ( (2400/(totmina + totminb) ) *
totmina), .01) ;
            totminb = round ( ( (2400/(totmina + totminb) ) *
totminb), .01) ;
            end ;
      else if (totmina + totminc) > 2400 then do ;
            totmina = round ( ( (2400/(totmina + totminc) ) *
totmina), .01) ;
            totminc = round ( ( (2400/(totmina + totminc) ) *
totminc), .01) ;
            end ;
      else if (totminb + totminc) >2400 then do ;
            totminb = round ( ( (2400/(totminb + totminc) ) *
totminb), .01) ;
```

```
            totminc = round ( ( (2400/(totminb + totminc) ) *
totminc), .01) ;
            end ;
      else do i = 1 to 3 ;
            if totmins{i} >2400 then totmins{i}=2400 ;
            end ;
      end ;



/****************************************************************
*
      Create an overall measure of leisure time physical activity
      which is the sum of minutes for each activity, each weighted
      for level of intensity of that activity.

As per Brown et al, 'A new method for estimating adequate physical
activity for people of different ages'
****************************************************************
/
y2exstat = (3*totmina) + (4*totminb) + (7.5*totminc) ;



if y2exstat=. then y2exgrp=. ;
else if y2exstat<37.5 then y2exgrp =  1 ;
else if 37.5<=y2exstat<600 then y2exgrp = 2 ;
else if  600<=y2exstat<1200 then y2exgrp = 3 ;
else if 1200<=y2exstat then y2exgrp = 4 ;




/**************************************************************/



y2metmin=sum((totmina*3.33),(totminb*3.33),(totminc*6.66));

if 0<=y2metmin<33.3 then y2metminexgrp=1;
else if 33.3<=y2metmin<500 then y2metminexgrp=2;
else if 500<=y2metmin <1000   then y2metminexgrp=3;
else if y2metmin>=1000 then y2metminexgrp=4;
**label y2metminexgrp=' ALSWH metmin exercise groups';



drop  a  i  y2q65tot  totmina totminb totminc y2q66min ;
```