Cancer occurrence in Danish diabetes patients: Duration and insulin effects

Data processing and statistical analysis programs.

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Contents

Chapter 1

Data processing

This chapter gives a detailed overview of the data acquisition and statistical analyses. The first part is a description and printout of as SAS-prgram used for tabulation. The second is a description and printout of the R-programs that does all analyses of data and produces all graphs (and a couple more).

Data is collected from 1) The national Diabetes Register 2) The Danish Cancer Register (individual records with dates of birth, diagnosis and death) and 3) Statistics Denmark (tabulated data of risk time and deaths).

1.1 Merging registers: `DMCA`

```
1                                      "Program: DMCA.sas"        13:55 Thursday, March 31, 2011

NOTE: Copyright (c) 2002-2008 by SAS Institute Inc., Cary, NC, USA.
NOTE: SAS (r) Proprietary Software 9.2 (TS2M0)
      Licensed to NNIT -BASIC PACKAGE AND ADDITIONAL PACKAGE, Site 50800704.
NOTE: This session is executing on the XP_PRO  platform.
NOTE: SAS initialization used:
      real time           1.34 seconds
      cpu time            0.53 seconds


NOTE: AUTOEXEC processing beginning; file is c:\stat\sas\autoexec.sas.

---------------------------------------------------------------
C:\Bendix\Steno\DM-register\NDR\projects\Cancer\sas\DMCA.sas
---------------------------------------------------------------
NOTE: Libref HER was successfully assigned as follows:
      Engine:        V9
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\sas
NOTE: Libref DATA was successfully assigned as follows:
      Engine:        V9
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data

NOTE: AUTOEXEC processing completed.

1          ****************************************************************
2          NOTE: This version of the program also splits follow-up by
3                DM-duration and Ins-duration
4                Datasets are produced for the entire available follow-up
5                too, NOT classified by the duration variables the names of
6                these are preceded with "x" (for eXtended).
7
8          This particular version subdivides the state DM/Ins>=1995 by
9          diabetes type, that is whether age at diagnosis is before 30
10         and date of insulin is within 3 months of diagnosis.
11         **************************************************************** ;
12
13         * The date from which we trust the inclusion date to be the first ;
14         %let  validdate = '01JAN1995'd ;
15         * Set the entry and exit dates for the entire follow-up endeavour ;
16         %let  truncdate = '01JAN1995'd ;
17         %let   censdate = '31DEC2009'd ;
18         * Where do we break the duration of DM and Ins - note we start at 1 month (1/12=0.08333);
19         %let  durbreaks = %str(0, 0.08333, 0.25 to 2 by 0.25, 2.5 to 5 by 0.5, 6, 7 to 19 by 2) ;
20         * Define the ranges for period-tabulation ;
```

```
21         data _null_ ;
22          call symput( 'Plo'   , year( &truncdate. ) - 1 ) ; * Last year before FU ;
23          call symput( 'Phi'   , year(  &censdate. ) + 1 ) ; * First year after FU ;
24          call symput( 'Pfirst', year( &truncdate. ) - 1900 ) ; * 1st tab break ;
25          call symput( 'Plast' , year(  &censdate. ) - 1900 + 1 ) ; * last tab break ;
26         run ;

NOTE: Numeric values have been converted to character values at the places given by: (Line):(Column).
      22:45   23:45   24:45   25:52
NOTE: DATA statement used (Total process time):
      real time           0.07 seconds
      cpu time            0.00 seconds


27         * Just to check it all wemt well ;
28         %put validdate = &validdate.
29              trumcdate = &truncdate.
30               censdate = &censdate. ;
validdate = '01JAN1995'd      trumcdate = '01JAN1995'd       censdate = '31DEC2009'd
31         %put       Plo = &Plo.
32                    Phi = &Phi.
33                 Pfirst = &Pfirst.
34                  Plast = &Plast. ;
Plo =         1994            Phi =         2010         Pfirst =           95          Plast =          110
35         %put durbreaks = &durbreaks ;
durbreaks = 0, 0.08333, 0.25 to 2 by 0.25, 2.5 to 5 by 0.5, 6, 7 to 19 by 2
36         * Set the selector of subgroups to analyse ;
37         %let dgrp = 21,22,241,242,243,249,251,26,28,
38                     33,
39                     51,
40                     70,
41                     82,83,84,
42                     91,92,
43                    101,103,
44                    113,
45                    121,
46                    131,132,133,139 ;
47         %let diagselect = diag in (&dgrp.) ;
48         * Variable names for tabulation purposes, note DX and D259 here ;
49         %let dvars = D0 D999
50                     D21 D22 D241 D242 D243 D249 D251 D259 D26 D28
51                     D33
52                     D51
53                     D70
54                     D82 D83 D84
55                     D91 D92
56                    D101 D103
57                    D113
58                    D121
59                    D131 D132 D133 D139 ;
60
61         * Get the formats and the Lexis macro ;
62         options nosource2 ;
63         %inc "CRG-fmts.sas" ;
NOTE: Format SEX has been output.
NOTE: Format DIAG has been output.

NOTE: PROCEDURE FORMAT used (Total process time):
      real time           0.14 seconds
      cpu time            0.00 seconds


148        %inc "C:\stat\sas\macro\Lexis.sas" ;
306
307        *---------------------------------------------------------------------;
308        * Preprocessing of the cancer register to first primary tumours ;
309
310        * First take the cancer registry, remove all non-cancers ;
311        data cancer ;
312          set data.cancer ;
313        * Remove 'not counted as cancer' and non-melanoma skin cancer ;
314          if ( diag in (52,150) ) then delete ;
315        * Recode the leukaemias to one group (139 is a not used value in formats) ;
316          if diag in (134,135,136,137) then diag = 139 ;
317        * Recode the colon cancers to the three separate subsites and the rest ;
318          * 24.1 Ascending colon C18.0, C18.1, C18.2
319          * 24.2 Transverse colon C18.3, C18.4, C18.5
320          * 24.3 Descending and sigmoid colon C18.6, C18.7, C19, C19.9
321          * 24.9 Other colon (unspec. or multiple)
322          * 25.1 Rectum (excl. anus) C20, C209
323          * This means that colorectal cancers are to be taken as the sum of these
324          * 5 groups, but also that the group 24.9 is NOT of interest per se ;
325          if( diag eq 24 )                              then diag = 249 ;
326          if( icdpyrs in ("C180","C181","C182") )       then diag = 241 ;
327          if( icdpyrs in ("C183","C184","C185") )       then diag = 242 ;
328          if( icdpyrs in ("C186","C187","C19","C199") ) then diag = 243 ;
329          if( icdpyrs in ("C20","C209") )               then diag = 251 ;
330          * Finally make a singe code for the sites not among those anlysed ;
331          if not ( diag in ( &dgrp. ) ) then diag = 999 ;
```

```
332        run ;

NOTE: There were 1748815 observations read from the data set DATA.CANCER.
NOTE: The data set WORK.CANCER has 1286419 observations and 31 variables.
NOTE: DATA statement used (Total process time):
      real time           12.81 seconds
      cpu time            1.25 seconds


333
334        * Sort by id and date of diagnosis ;
335        proc sort data = cancer ;
336          by id d_diagnosedato ;
337        run ;

NOTE: There were 1286419 observations read from the data set WORK.CANCER.
NOTE: The data set WORK.CANCER has 1286419 observations and 31 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           19.81 seconds
      cpu time            2.71 seconds


338
339        * Select only the first real tumor ;
340        data cancer ;
341          set cancer ;
342          by id ;
343          if first.id ;
344        run ;

NOTE: There were 1286419 observations read from the data set WORK.CANCER.
NOTE: The data set WORK.CANCER has 1195147 observations and 31 variables.
NOTE: DATA statement used (Total process time):
      real time           11.01 seconds
      cpu time            0.98 seconds


345
346        * Check the total number of first primary cancers ;
347        title "All cancers diagnosed 1995 ff." ;
348        &tab. cancer ;
349          where ( D_diagnosedato ge &truncdate. ) ;
350          class diag D_diagnosedato ;
351          table all diag = "Diag",
352                D_diagnosedato * f = comma6.
353                all * f = comma10.
354                / rts = 6 ;
355          format  D_diagnosedato  year4. ;
356          keylabel n = " " ;
357        run ;

NOTE: There were 382049 observations read from the data set WORK.CANCER.
      WHERE D_diagnosedato>='01JAN1995'D;
NOTE: The PROCEDURE TABULATE printed pages 1-2.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           1.01 seconds
      cpu time            0.62 seconds


358
359        * Then merge with the diabetes register ;
360        data data.candi;
361          merge cancer
362                data.diabetes ;
363          by id ;
364          keep sex diag diaggrp DMtype
365               doBT doDM doI doCA doX doDD ;
366          format sex sex.
367                 doBT doDM doI doCA doX doDD ddmmyy10. ;
368        * Demografic dates collected from CRG and NDR ;
369          doBT = min( D_foddto  , D_fdsdato ) ;
370          doDD = min( D_statdato, D_dodsdto ) ;
371          doX  = min( D_statdato, D_dodsdto, &censdate. ) ;
372        * Event-dates ;
373          doDM = D_inkldto ;
374          doI  = D_ins ;
375          doCA = D_diagnosedato ;
376        * If DM-duration can be trusted set DMtype to 2 otherwise 0, missing if no DM ;
377          DMtype = ( doDM ge &validdate. ) * 2 + doDM - doDM ;
378        * Change to a value 1 for those considered to be T1D ;
379          if (       DMtype > 0         and /* Diagnosed after 1.1.1995 */
380               (DoDM-doBT) < 35*365.25 and /* Diagnosed before age 35, */
381                       doI > .z        and /* on insulin               */
382                (doI-doDM) < 60 )           /* within 2 months of incl. */
383          then DMtype = 1 ;
384        run ;

NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
```

```
      449181 at 370:10    1119643 at 377:40
NOTE: There were 1195147 observations read from the data set WORK.CANCER.
NOTE: There were 437593 observations read from the data set DATA.DIABETES.
NOTE: The data set DATA.CANDI has 1557236 observations and 10 variables.
NOTE: DATA statement used (Total process time):
      real time           5.43 seconds
      cpu time            1.71 seconds


385
386          * The dataset data.candi now has a record for each person who has either a
387          * first primary cancer diagnosis or a diabetes diagnosis ;
388
389          *-------------------------------------------------------------------;
390          * Compute the person-years to be removed from the Well state ;
391
392          data Well ;
393            set data.candi ;
394            * Anyone dead before period of interest is excluded ;
395            if ( .z < doDD < &truncdate.) then delete ;
396            * The Lexis variables ;
397            entry = min( doDM, doCA ) ;
398            exit  = doX ;
399            fail  = 0 ;
400          run ;

NOTE: There were 1557236 observations read from the data set DATA.CANDI.
NOTE: The data set WORK.WELL has 862016 observations and 13 variables.
NOTE: DATA statement used (Total process time):
      real time           2.98 seconds
      cpu time            0.59 seconds


401
402          * Split by calendar time ;
403          %Lexis( data = Well,
404                   out = WellP,
405                breaks = &Pfirst. to &Plast. by 1,
406                origin = '01Jan1900'd,
407                 scale = 365.25,
408                  left = P,
409                  risk = Yx )

NOTE: There were 862016 observations read from the data set WORK.WELL.
NOTE: The data set WORK.DISCRD has 0 observations and 16 variables.
NOTE: The data set WORK.WELLP has 5497068 observations and 16 variables.
NOTE: DATA statement used (Total process time):
      real time           18.82 seconds
      cpu time            4.14 seconds


410          * Split by age ;
411          %Lexis( data = WellP,
412                   out = WellAP,
413                breaks = 0 to 100 by 1,
414                origin = doBT,
415                 scale = 365.25,
416                  left = A,
417                  risk = Yx )

NOTE: There were 5497068 observations read from the data set WORK.WELLP.
NOTE: The data set WORK.DISCRD has 0 observations and 17 variables.
NOTE: The data set WORK.WELLAP has 10462327 observations and 17 variables.
NOTE: DATA statement used (Total process time):
      real time           51.01 seconds
      cpu time            45.14 seconds


418
419          * Establish the correct calendar time and birth date variables ;
420          data WellAP ;
421            set WellAP ;
422            P = P + 1900 ;
423            C = min( max( year( doBT ), P-A-1 ), P-A ) ;
424          run ;

NOTE: There were 10462327 observations read from the data set WORK.WELLAP.
NOTE: The data set WORK.WELLAP has 10462327 observations and 18 variables.
NOTE: DATA statement used (Total process time):
      real time           1:19.12
      cpu time            11.14 seconds


425
426          proc summary  data = WellAP  nway ;
427            class sex A P C ;
428            var Yx ;
429            output out = WellYx ( keep = sex A P C Yx )
430                   sum = Yx ;
```

```
431        run ;

NOTE: There were 10462327 observations read from the data set WORK.WELLAP.
NOTE: The data set WORK.WELLYX has 6000 observations and 5 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           8.21 seconds
      cpu time            8.40 seconds


432
433        * The dataset WellYx now has the Person-years lived in Other Ca
434          and DM together, in the variable Yx, classified by sex, A, P, C ;
435
436        *-------------------------------------------------------------------;
437        * Get the population data and subtract the risk time in other states ;
438
439        libname demo 'c:\Bendix\demodb\data' ;
NOTE: Directory for library DEMO contains files of mixed engine types.
NOTE: Libref DEMO was successfully assigned as follows:
      Engine:        V9
      Physical Name: c:\Bendix\demodb\data
440
441        data demo ;
442          set demo.ydk1971ff ( rename = ( agr = A
443                                          per = P
444                                          coh = C
445                                         risk = Ytot ) ) ;
446          keep sex A P C Ytot upper ;
447          if ( &Plo. < P < &Phi. and A < 100 ) ;
448        run ;

NOTE: There were 15600 observations read from the data set DEMO.YDK1971FF.
NOTE: The data set WORK.DEMO has 6000 observations and 6 variables.
NOTE: DATA statement used (Total process time):
      real time           0.14 seconds
      cpu time            0.04 seconds


449
450        proc sort data=demo ;
451          by sex A P C ;
452        run ;

NOTE: There were 6000 observations read from the data set WORK.DEMO.
NOTE: The data set WORK.DEMO has 6000 observations and 6 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.10 seconds
      cpu time            0.03 seconds


453
454        * Merge with the risk time dataset and compute the correct Ys ;
455        data WellY ;
456          merge WellYx
457                demo ( in = pop );
458          by sex A P C ;
459          keep sex A P C Y ;
460          if pop ;
461          if Yx le .z then Yx = 0 ;
462          Y  = Ytot - Yx ;
463        run ;

NOTE: There were 6000 observations read from the data set WORK.WELLYX.
NOTE: There were 6000 observations read from the data set WORK.DEMO.
NOTE: The data set WORK.WELLY has 6000 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


464
465        * The dataset WellY now has the risk time in the "Well" state classified
466          by sex, A, P and C. This datataset will since be amended by events of
467          the cancers in question ;
468
469        *-------------------------------------------------------------------;
470        * Extract the events in the transition Well -> Ca ;
471
472        data WellCa ;
473          set data.candi ;
474        * Only cancer diagnoses prior to DM or in persons without DM ;
475          if ( '31DEC1994'd < doCA  <   doDM ) or
476             ( '31DEC1994'd < doCA and  doDM le .z ) ;
477          A = floor( ( doCA - doBT ) / 365.25 ) ;
478          * Remove persons with date of birth > date of Ca diagnosis ;
479          if ( A ge 0 ) ;
480          P = year( doCa ) ;
481        * Make sure that the date of birth fits with A and P ;
482          C = min( max( year( doBT ), P-A-1 ), P-A ) ;
```

```
483         run ;

NOTE: There were 1557236 observations read from the data set DATA.CANDI.
NOTE: The data set WORK.WELLCA has 346198 observations and 13 variables.
NOTE: DATA statement used (Total process time):
      real time           8.21 seconds
      cpu time            0.53 seconds


484
485         * Cancers subdivided into the relevant subgroups ;
486         proc summary  data = WellCa ;
487           class sex A P C diag ; * Note that 2^5=32 ;
488           output out = WellCaD ( rename = ( _freq_ = D )
489                                  keep = diag sex A P C _freq_ _type_
490                                 where = ( _type_ in (30,31) ) ) ;
491         run ;

NOTE: There were 346198 observations read from the data set WORK.WELLCA.
NOTE: The data set WORK.WELLCAD has 72601 observations and 7 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           0.70 seconds
      cpu time            0.78 seconds


492
493         data Well ;
494           set WellCaD ;
495           keep diag sex A P C D ;
496           if A < 100  and  &Plo. < P < &Phi. ;
497           if diag le .z then diag = 0 ; * Corresponds to the sum over all diagnoses ;
498           if D le .z then D = 0 ;
499         run ;

NOTE: There were 72601 observations read from the data set WORK.WELLCAD.
NOTE: The data set WORK.WELL has 72490 observations and 6 variables.
NOTE: DATA statement used (Total process time):
      real time           0.17 seconds
      cpu time            0.04 seconds


500
501         proc sort  data = Well ;
502           by sex A P C diag ;
503         run ;

NOTE: There were 72490 observations read from the data set WORK.WELL.
NOTE: The data set WORK.WELL has 72490 observations and 6 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.25 seconds
      cpu time            0.10 seconds


504
505         * Transpose the dataset to have one column per diag ;
506         proc transpose  data = Well
507                          out = WellD ( drop = _NAME_ )
508                       prefix = D ;
509           by sex A P C ;
510           id diag ;
511           format diag ;
512           var D ;
513         run ;

NOTE: There were 72490 observations read from the data set WORK.WELL.
NOTE: The data set WORK.WELLD has 5844 observations and 31 variables.
NOTE: PROCEDURE TRANSPOSE used (Total process time):
      real time           0.54 seconds
      cpu time            0.32 seconds


514
515         * Dataset WellD now have all the cancer transitions out of Well,
516           each type in a separate variable, data classified by sex A P C,
517           instances with no cancers are missing and other cancers coded 999 ;
518
519         *-------------------------------------------------------------------;
520         * Merge the events in Well with the person-years in Well ;
521
522         data WellCa ;
523           merge WellY
524                 WellD ;
525           by sex A P C ;
526         * This is the non-Diabetic state ;
527           state = "Well  " ;
528           DMtype = 0 ;
529         run ;

NOTE: There were 6000 observations read from the data set WORK.WELLY.
```

```
NOTE: There were 5844 observations read from the data set WORK.WELLD.
NOTE: The data set WORK.WELLCA has 6000 observations and 34 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds


530
531        proc contents  data = WellCa            ; run ;

NOTE: PROCEDURE CONTENTS used (Total process time):
      real time           0.34 seconds
      cpu time            0.03 seconds

NOTE: The PROCEDURE CONTENTS printed page 3.

532        proc print     data = WellCa ( obs=20 ) ; run ;

NOTE: There were 20 observations read from the data set WORK.WELLCA.
NOTE: The PROCEDURE PRINT printed page 4.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.06 seconds
      cpu time            0.00 seconds


533
534        * The dataset WellCa now has the person-years in Well and the transitions to
535          the different Cancers out of that state ;
536
537        *----------------------------------------------------------------------;
538        * The person-years and total cancers for the transition DM -> (DM+Ca),
539          but before the DM -> DM/Ins transition ;
540
541        data DM ;
542          set data.candi ;
543          * NOTE: Only include persons with cancer at least 30 days after DM or no cancer
544          *       and of course only persons with a DM diagnosis after 1.1.1995;
545          if ( doDM gt .z ) and
546             ( doDM lt (doCA+31) or doCa le .z ) ;
547          * The Lexis variables defining the follow-up ;
548          entry = doDM ;
549          exit  = min( doCA, doI, doX ) ;
550          fail  = max( 0, diag ) * ( abs(doCA-exit)<0.5 ) ; * Set to 0 if no cancer diagnosis ;
551        run ;

NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      362089 at 546:21   362089 at 550:30   362089 at 550:38
NOTE: There were 1557236 observations read from the data set DATA.CANDI.
NOTE: The data set WORK.DM has 403959 observations and 13 variables.
NOTE: DATA statement used (Total process time):
      real time           0.75 seconds
      cpu time            0.46 seconds


552
553        * split by calendar time ;
554        %Lexis( data = DM,
555                 out = DMP,
556              breaks = &Pfirst. to &Plast. by 1,
557              origin = '01Jan1900'd,
558               scale = 365.25,
559                left = P ) ;

NOTE: There were 403959 observations read from the data set WORK.DM.
NOTE: The data set WORK.DISCRD has 0 observations and 16 variables.
NOTE: The data set WORK.DMP has 1951044 observations and 16 variables.
NOTE: DATA statement used (Total process time):
      real time           9.96 seconds
      cpu time            1.57 seconds


560        * Split by age ;
561        %Lexis( data = DMP,
562                 out = DMAP,
563              breaks = 0 to 100 by 1,
564              origin = doBT,
565               scale = 365.25,
566                left = A ) ;

NOTE: There were 1951044 observations read from the data set WORK.DMP.
NOTE: The data set WORK.DISCRD has 0 observations and 17 variables.
NOTE: The data set WORK.DMAP has 3676132 observations and 17 variables.
NOTE: DATA statement used (Total process time):
      real time           15.85 seconds
      cpu time            15.07 seconds


567        * Fix the period and cohort variables ;
```

```
568        data DMAP ;
569          set DMAP ;
570          P = P + 1900 ;
571          C = min( max( year( doBT ), P-A-1 ), P-A ) ;
572        run ;

NOTE: There were 3676132 observations read from the data set WORK.DMAP.
NOTE: The data set WORK.DMAP has 3676132 observations and 18 variables.
NOTE: DATA statement used (Total process time):
      real time           12.48 seconds
      cpu time            3.06 seconds


573        * Split by diabetes duration ;
574        %Lexis( data = DMAP,
575                 out = DMAPD,
576              breaks = &durbreaks.,
577              origin = doDM,
578               scale = 365.25,
579                left = DMdur ) ;

NOTE: There were 3676132 observations read from the data set WORK.DMAP.
NOTE: The data set WORK.DISCRD has 0 observations and 19 variables.
NOTE: The data set WORK.DMAPD has 7331956 observations and 19 variables.
NOTE: DATA statement used (Total process time):
      real time           30.57 seconds
      cpu time            10.90 seconds


580
581        *---------------------------------------------------------------------;
582        * Summarizing the split data ;
583
584        * Tabulation of risktime ;
585        proc summary  data = DMAPD  nway ;
586          where DMtype > 0 ;
587          class sex A P C DMdur DMtype ;
588          var risk ;
589          output out = DMY ( rename = ( risk = Y )
590                             keep = sex A P C DMdur DMtype risk )
591                 sum = ;
592        run ;

NOTE: There were 5951846 observations read from the data set WORK.DMAPD.
      WHERE DMtype>0;
NOTE: The data set WORK.DMY has 89019 observations and 7 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           2.76 seconds
      cpu time            7.95 seconds


593
594        * Tabulation of cases by classification variables and cancer type ;
595        proc summary  data = DMAPD ;
596          where DMtype > 0 and fail > 0 ;
597          class sex A P C DMdur DMtype fail ; * OBS: 2^7=128 ;
598          output out = DMDl ( rename = ( _freq_ = D
599                                            fail = diag )
600                              keep = sex A P C DMdur DMtype fail _freq_ _type_
601                             where = ( _type_ in (126,127) ) ) ;
602        run ;

NOTE: There were 20872 observations read from the data set WORK.DMAPD.
      WHERE (DMtype>0) and (fail>0);
NOTE: The data set WORK.DMDL has 34691 observations and 9 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           2.12 seconds
      cpu time            2.06 seconds


603
604        data DMDl ;
605          set DMDl ;
606          if diag le .z then diag=0 ;
607        run ;

NOTE: There were 34691 observations read from the data set WORK.DMDL.
NOTE: The data set WORK.DMDL has 34691 observations and 9 variables.
NOTE: DATA statement used (Total process time):
      real time           0.06 seconds
      cpu time            0.01 seconds


608
609        proc sort  data = DMDl ;
610          by sex A P C DMdur DMtype diag ;
611        run ;

NOTE: There were 34691 observations read from the data set WORK.DMDL.
```

```
NOTE: The data set WORK.DMDL has 34691 observations and 9 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.09 seconds
      cpu time            0.07 seconds


612
613        * Transpose the dataset to have one column per diag ;
614        proc transpose  data = DMDl
615                         out = DMD
616                      prefix = D ;
617          by sex A P C DMdur DMtype ;
618          id diag ;
619          format diag ;
620          var D ;
621        run ;

NOTE: There were 34691 observations read from the data set WORK.DMDL.
NOTE: The data set WORK.DMD has 14746 observations and 34 variables.
NOTE: PROCEDURE TRANSPOSE used (Total process time):
      real time           0.21 seconds
      cpu time            0.22 seconds


622
623        data DMCa ;
624          merge DMD DMY ;
625          by sex A P C DMdur DMtype ;
626          state = "DM    " ;
627        run ;

NOTE: There were 14746 observations read from the data set WORK.DMD.
NOTE: There were 89019 observations read from the data set WORK.DMY.
NOTE: The data set WORK.DMCA has 89019 observations and 36 variables.
NOTE: DATA statement used (Total process time):
      real time           0.70 seconds
      cpu time            0.17 seconds


628
629        * The dataset DMCaA now has the Person-years and different cancers from
630          state DM, subdivided by the factors of interest including duration ;
631
632        proc contents  data = DMCa            ; run ;

NOTE: PROCEDURE CONTENTS used (Total process time):
      real time           0.03 seconds
      cpu time            0.01 seconds

NOTE: The PROCEDURE CONTENTS printed page 5.

633        proc print     data = DMCa ( obs=20 ) ; run ;

NOTE: There were 20 observations read from the data set WORK.DMCA.
NOTE: The PROCEDURE PRINT printed page 6.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


634
635        *-------------------------------------------------------------------;
636        * The person-years and total cancers for the transition
637        * DM/ins -> (DM/ins+Ca) ;
638
639        data Ins ;
640          set data.candi ;
641          if ( doI gt .z ) and
642             ( doI lt doCA or doCa le .z ) ;
643          * The Lexis variables ;
644          entry = doI ;
645          exit  = min( doCA, doX ) ;
646          fail  = max( 0, diag ) * ( abs(doCA-exit)<0.5 ) ; * Set to 0 if no cancer diagnosis ;
647        run ;

NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      91991 at 646:30   91991 at 646:38
NOTE: There were 1557236 observations read from the data set DATA.CANDI.
NOTE: The data set WORK.INS has 99674 observations and 13 variables.
NOTE: DATA statement used (Total process time):
      real time           20.87 seconds
      cpu time            0.43 seconds


648
649        * Split by calendar time ;
650        %Lexis( data = Ins,
651                 out = InsP,
```

```
652              breaks = &Pfirst. to &Plast. by 1,
653              origin = '01Jan1900'd,
654               scale = 365.25,
655                left = P )

NOTE: There were 99674 observations read from the data set WORK.INS.
NOTE: The data set WORK.DISCRD has 0 observations and 16 variables.
NOTE: The data set WORK.INSP has 741361 observations and 16 variables.
NOTE: DATA statement used (Total process time):
      real time           3.57 seconds
      cpu time            0.42 seconds


656        * Split by age ;
657        %Lexis( data = InsP,
658                 out = InsAP,
659              breaks = 0 to 100 by 1,
660              origin = doBT,
661               scale = 365.25,
662                left = A )

NOTE: There were 741361 observations read from the data set WORK.INSP.
NOTE: The data set WORK.DISCRD has 0 observations and 17 variables.
NOTE: The data set WORK.INSAP has 1430192 observations and 17 variables.
NOTE: DATA statement used (Total process time):
      real time           6.40 seconds
      cpu time            5.93 seconds


663        * Fix the period and cohort variables ;
664        data InsAP ;
665          set InsAP ;
666          P = P + 1900 ;
667          C = min( max( year( doBT ), P-A-1 ), P-A ) ;
668        run ;

NOTE: There were 1430192 observations read from the data set WORK.INSAP.
NOTE: The data set WORK.INSAP has 1430192 observations and 18 variables.
NOTE: DATA statement used (Total process time):
      real time           5.28 seconds
      cpu time            1.04 seconds


669        * Split by DM duration ;
670        %Lexis( data = InsAP,
671                 out = InsAPD,
672              breaks = &durbreaks.,
673              origin = doDM,
674               scale = 365.25,
675                left = DMdur )

NOTE: There were 1430192 observations read from the data set WORK.INSAP.
NOTE: The data set WORK.DISCRD has 0 observations and 19 variables.
NOTE: The data set WORK.INSAPD has 2152911 observations and 19 variables.
NOTE: DATA statement used (Total process time):
      real time           9.21 seconds
      cpu time            4.03 seconds


676        * Split by Insulin duration ;
677        %Lexis( data = InsAPD,
678                 out = InsAPDI,
679              breaks = &durbreaks.,
680              origin = doI,
681               scale = 365.25,
682                left = Insdur )

NOTE: There were 2152911 observations read from the data set WORK.INSAPD.
NOTE: The data set WORK.DISCRD has 0 observations and 20 variables.
NOTE: The data set WORK.INSAPDI has 3336990 observations and 20 variables.
NOTE: DATA statement used (Total process time):
      real time           12.59 seconds
      cpu time            6.48 seconds


683
684        *-----------------------------------------------------------------------;
685        * Summarizing the split data for DM/Ins diagnosed after 1995 ;
686
687        * Tabulation of risktime ;
688        proc summary  data = InsAPDI  nway ;
689          where DMtype > 0 ;
690          class sex A P C DMdur Insdur DMtype ;
691          var risk ;
692          output out = InsY ( rename = ( risk = Y )
693                                keep = sex A P C DMdur Insdur DMtype risk )
694                 sum = ;
695        run ;
```

```
NOTE: There were 1453822 observations read from the data set WORK.INSAPDI.
      WHERE DMtype>0;
NOTE: The data set WORK.INSY has 456261 observations and 8 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           2.20 seconds
      cpu time            3.57 seconds


696
697        * Tabulation of cases by classification variables and cancer type ;
698        proc summary  data = InsAPDI ;
699          where DMtype > 0 and fail > 0 ;
700          class sex A P C DMdur Insdur DMtype fail ; * OBS: 2^8=256 ;
701          output out = Insl ( rename = ( _freq_ = D
702                                         fail = diag )
703                              keep = sex A P C DMdur Insdur DMtype fail _freq_ _type_
704                             where = ( _type_ in (254,255) ) ) ;
705        run ;

NOTE: There were 2974 observations read from the data set WORK.INSAPDI.
      WHERE (DMtype>0) and (fail>0);
NOTE: The data set WORK.INSL has 5912 observations and 10 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           1.12 seconds
      cpu time            1.10 seconds


706
707        data Insl ;
708          set Insl ;
709          if diag le .z then diag=0 ;
710        run ;

NOTE: There were 5912 observations read from the data set WORK.INSL.
NOTE: The data set WORK.INSL has 5912 observations and 10 variables.
NOTE: DATA statement used (Total process time):
      real time           0.04 seconds
      cpu time            0.01 seconds


711
712        proc sort  data = Insl ;
713          by sex A P C DMdur Insdur DMtype diag ;
714        run ;

NOTE: There were 5912 observations read from the data set WORK.INSL.
NOTE: The data set WORK.INSL has 5912 observations and 10 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


715
716        * Transpose the dataset to have one column per diag ;
717        proc transpose  data = Insl
718                         out = InsD
719                      prefix = D ;
720          by sex A P C DMdur Insdur DMtype ;
721          id diag ;
722          format diag ;
723          var D ;
724        run ;

NOTE: There were 5912 observations read from the data set WORK.INSL.
NOTE: The data set WORK.INSD has 2943 observations and 35 variables.
NOTE: PROCEDURE TRANSPOSE used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds


725
726        data InsCa ;
727          merge InsD InsY ;
728          by sex A P C DMdur Insdur DMtype ;
729          state = "DM/Ins" ;
730        * Because of date uncertainty we do not count the first month on
731          insulin in the insulin group --- to avoid insulin treatment after
732          diagnosis of cancer being clssidied as insulin exposure prior to cancer ;
733          if( Insdur eq 0 ) then state="DM    " ;
734        run ;

NOTE: There were 2943 observations read from the data set WORK.INSD.
NOTE: There were 456261 observations read from the data set WORK.INSY.
NOTE: The data set WORK.INSCA has 456261 observations and 37 variables.
NOTE: DATA statement used (Total process time):
      real time           2.84 seconds
      cpu time            0.87 seconds
```

```
735
736        * The dataset InsCa now has the Person-years and different cancers from
737             state DM/Ins, subdivided by the factors of interest including durations ;
738
739        proc contents  data = InsCa            ; run ;

NOTE: PROCEDURE CONTENTS used (Total process time):
      real time           0.03 seconds
      cpu time            0.01 seconds

NOTE: The PROCEDURE CONTENTS printed page 7.

740        proc print     data = InsCa ( obs=20 ) ; run ;

NOTE: There were 20 observations read from the data set WORK.INSCA.
NOTE: The PROCEDURE PRINT printed page 8.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.00 seconds
      cpu time            0.00 seconds


741
742        *-----------------------------------------------------------------------;
743        * Combine the three datasets to the final one - the duration case ;
744
745        data data.DMCaD ;
746          set WellCa
747                DMCa ( in = DM )
748               InsCa ( in = Ins ) ;
749          drop upper _name_ i ;
750          label A  = "Agr"
751                P  = "Pgr"
752                C  = "Cgr"
753                Ax = "Age"
754                Px = "Per"
755                Cx = "Coh"
756             state = "State"
757            DMtype = "DM type"
758             DMdur = "Time since DoDM (inclusion)"
759            Insdur = "Time since DoI (1st insulin)"
760                 Y = "Person-years"
761                D0 = "All malignant neoplasms"
762               D21 = "Oesophagus"
763               D22 = "Stomach"
764               D24 = "Colon"
765              D241 = "Ascending colon"
766              D242 = "Transverse colon"
767              D243 = "Descending colon"
768              D249 = "Other colon"
769              D251 = "Rectum"
770              D259 = "Colorectal"
771               D26 = "Liver"
772               D28 = "Pancreas"
773               D33 = "Lung"
774               D51 = "Melanoma"
775               D70 = "Breast"
776               D82 = "Cervix"
777               D83 = "Uterus"
778               D84 = "Ovary"
779               D91 = "Prostate"
780               D92 = "Testis"
781              D101 = "Kidney"
782              D103 = "Bladder"
783              D113 = "Brain"
784              D121 = "Thyroid"
785              D131 = "Hodgkin's lymphoma"
786              D132 = "Non-Hodgkin lymphoma"
787              D133 = "Multiple myeloma"
788              D139 = "Leukaemia"
789              D999 = "Other" ;
790        * Correct triangle means in a Lexis diagram ;
791          upper = P-A-C ;
792          Ax = A + (1+upper)/3 ;
793          Px = P + (2-upper)/3 ;
794          Cx = Px - Ax ;
795        * Anchor the two duration scales in 0 ;
796          if  DMdur le .z then  DMdur = 0 ;
797          if Insdur le .z then Insdur = 0 ;
798        * Stick a 0 in for all the missing values where no cancers were observed ;
799          array allnum{*} _numeric_ ;
800          do i = 1 to dim(allnum) ;
801             allnum{i} = max( allnum{i}, 0 ) ;
802          end ;
803        * Define colon and colorectal cancers excl. anus ;
804          D24  = D241 + D242 + D243 + D249 ;
805          D259 = D241 + D242 + D243 + D249 + D251 ;
806        run ;

NOTE: There were 6000 observations read from the data set WORK.WELLCA.
```

```
NOTE: There were 89019 observations read from the data set WORK.DMCA.
NOTE: There were 456261 observations read from the data set WORK.INSCA.
NOTE: The data set DATA.DMCAD has 551280 observations and 41 variables.
NOTE: DATA statement used (Total process time):
      real time           5.42 seconds
      cpu time            2.46 seconds


807
808         title 'Dataset with duration variables (only doDM > 31.12.1994)' ;
809         proc contents  data = data.DMCaD ;
810         run ;

NOTE: PROCEDURE CONTENTS used (Total process time):
      real time           0.06 seconds
      cpu time            0.04 seconds

NOTE: The PROCEDURE CONTENTS printed page 9.

811
812         proc tabulate  data=data.DMCaD  order=data  missing
813                        noseps formchar="           ";
814           class state P DMtype ;
815           var Y &dvars. ;
816           table all
817                 state*DMtype
818                 state*DMtype*P,
819                 ( Y * f=comma13.1
820                   (n="No. cells" D0 D259 D33 D70 D91 D999) * f=comma10.0 )
821                 / rts = 25 ;
822           table Y * f=comma10.0
823                 ( &dvars. ) * f=comma10.0 ,
824                 sum="" * ( all state )
825                 / rts = 14 ;
826           keylabel sum=" "
827                    n=" " ;
828         run ;

NOTE: There were 551280 observations read from the data set DATA.DMCAD.
NOTE: The PROCEDURE TABULATE printed pages 10-11.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           0.45 seconds
      cpu time            0.73 seconds


829
830         *----------------------------------------------------------------------;
831         * Tabulate witout duration using the DMSP and InsAP datasets ;
832
833         *----------------------------------------------------------------------;
834         * First the DM state ;
835
836         * Tabulation of risktime ;
837         proc summary  data = DMAPD  nway ;
838           class sex A P C DMtype ;
839           var risk ;
840           output out = DMY ( rename = ( risk = Y )
841                              keep = sex A P C DMtype risk )
842                  sum = ;
843         run ;

NOTE: There were 7331956 observations read from the data set WORK.DMAPD.
NOTE: The data set WORK.DMY has 13030 observations and 6 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           7.84 seconds
      cpu time            6.68 seconds


844
845         * Tabulation of cases by classification variables and cancer type ;
846         proc summary  data = DMAPD ;
847           where fail > 0 ;
848           class sex A P C DMtype fail ; * OBS: 2^6=64 ;
849           output out = DMDl ( rename = ( _freq_ = D
850                                          fail = diag )
851                               keep = sex A P C DMtype fail _freq_ _type_
852                              where = ( _type_ in (62,63) ) ) ;
853         run ;

NOTE: There were 27809 observations read from the data set WORK.DMAPD.
      WHERE fail>0;
NOTE: The data set WORK.DMDL has 23695 observations and 8 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           20.43 seconds
      cpu time            1.71 seconds


854
855         data DMDl ;
```

```
856           set DMDl ;
857           if diag le .z then diag=0 ;
858         run ;

NOTE: There were 23695 observations read from the data set WORK.DMDL.
NOTE: The data set WORK.DMDL has 23695 observations and 8 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.01 seconds


859
860         proc sort  data = DMDl ;
861           by sex A P C DMtype diag ;
862         run ;

NOTE: There were 23695 observations read from the data set WORK.DMDL.
NOTE: The data set WORK.DMDL has 23695 observations and 8 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds


863
864         * Transpose the dataset to have one column per diag ;
865         proc transpose  data = DMDl
866                          out = DMD
867                       prefix = D ;
868           by sex A P C DMtype ;
869           id diag ;
870           format diag ;
871           var D ;
872         run ;

NOTE: There were 23695 observations read from the data set WORK.DMDL.
NOTE: The data set WORK.DMD has 4907 observations and 33 variables.
NOTE: PROCEDURE TRANSPOSE used (Total process time):
      real time           0.12 seconds
      cpu time            0.12 seconds


873
874         data DMCa ;
875           merge DMD DMY ;
876           by sex A P C DMtype ;
877           state = "DM    " ;
878         run ;

NOTE: There were 4907 observations read from the data set WORK.DMD.
NOTE: There were 13030 observations read from the data set WORK.DMY.
NOTE: The data set WORK.DMCA has 13030 observations and 35 variables.
NOTE: DATA statement used (Total process time):
      real time           0.07 seconds
      cpu time            0.03 seconds


879
880         * The dataset DMCa now has the Person-years and different cancers from
881           state DM, subdivided by the factors of interest ;
882
883         *---------------------------------------------------------------------;
884         * Then the DM/Ins state ;
885
886         * Tabulation of risktime ;
887         proc summary  data = InsAPDI  nway ;
888           class sex A P C DMtype ;
889           var risk ;
890           output out = InsY ( rename = ( risk = Y )
891                                 keep = sex A P C DMtype risk )
892                  sum = ;
893         run ;

NOTE: There were 3336990 observations read from the data set WORK.INSAPDI.
NOTE: The data set WORK.INSY has 13538 observations and 6 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           0.87 seconds
      cpu time            2.86 seconds


894
895         * Tabulation of cases by classification variables and cancer type ;
896         proc summary  data = InsAPDI ;
897           where fail > 0 ;
898           class sex A P C DMtype fail ; * OBS: 2^6=64 ;
899           output out = Insl ( rename = ( _freq_ = D
900                                          fail = diag )
901                                 keep = sex A P C DMtype fail _freq_ _type_
902                                where = ( _type_ in (62,63) ) ) ;
903         run ;
```

```
NOTE: There were 7424 observations read from the data set WORK.INSAPDI.
      WHERE fail>0;
NOTE: The data set WORK.INSL has 10207 observations and 8 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           0.57 seconds
      cpu time            0.56 seconds


904
905        data Insl ;
906          set Insl ;
907          if diag le .z then diag=0 ;
908        run ;

NOTE: There were 10207 observations read from the data set WORK.INSL.
NOTE: The data set WORK.INSL has 10207 observations and 8 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.01 seconds


909
910        proc sort  data = Insl ;
911          by sex A P C DMtype diag ;
912        run ;

NOTE: There were 10207 observations read from the data set WORK.INSL.
NOTE: The data set WORK.INSL has 10207 observations and 8 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.04 seconds
      cpu time            0.01 seconds


913
914        * Transpose the dataset to have one column per diag ;
915        proc transpose  data = Insl
916                         out = InsD
917                      prefix = D ;
918          by sex A P C DMtype ;
919          id diag ;
920          format diag ;
921          var D ;
922        run ;

NOTE: There were 10207 observations read from the data set WORK.INSL.
NOTE: The data set WORK.INSD has 3499 observations and 33 variables.
NOTE: PROCEDURE TRANSPOSE used (Total process time):
      real time           0.06 seconds
      cpu time            0.06 seconds


923
924        data InsCa ;
925          merge InsD InsY ;
926          by sex A P C DMtype ;
927          state = "DM/Ins" ;
928        run ;

NOTE: There were 3499 observations read from the data set WORK.INSD.
NOTE: There were 13538 observations read from the data set WORK.INSY.
NOTE: The data set WORK.INSCA has 13538 observations and 35 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds


929
930        * The dataset InsCa now has the Person-years and different cancers from
931          state DM/Ins, subdivided by the factors of interest ;
932
933        *----------------------------------------------------------------------;
934        * Combine the three datasets to the final one - the duration case ;
935
936        data data.DMCaA ;
937          set WellCa
938                DMCa ( in = DM )
939               InsCa ( in = Ins ) ;
940          drop upper _name_ i ;
941          label A  = "Agr"
942                P  = "Pgr"
943                C  = "Cgr"
944                Ax = "Age"
945                Px = "Per"
946                Cx = "Coh"
947             state = "State"
948            DMtype = "DM type"
949                 Y = "Person-years"
950                D0 = "All malignant neoplasms"
```

```
951               D21 = "Oesophagus"
952               D22 = "Stomach"
953               D24 = "Colon"
954              D241 = "Ascending colon"
955              D242 = "Transverse colon"
956              D243 = "Descending colon"
957              D249 = "Other colon"
958              D251 = "Rectum"
959              D259 = "Colorectal"
960               D26 = "Liver"
961               D28 = "Pancreas"
962               D33 = "Lung"
963               D51 = "Melanoma"
964               D70 = "Breast"
965               D82 = "Cervix"
966               D83 = "Uterus"
967               D84 = "Ovary"
968               D91 = "Prostate"
969               D92 = "Testis"
970              D101 = "Kidney"
971              D103 = "Bladder"
972              D113 = "Brain"
973              D121 = "Thyroid"
974              D131 = "Hodgkin's lymphoma"
975              D132 = "Non-Hodgkin lymphoma"
976              D133 = "Multiple myeloma"
977              D139 = "Leukaemia"
978              D999 = "Other" ;
979        * Correct triangle means in a Lexis diagram ;
980          upper = P-A-C ;
981          Ax = A + (1+upper)/3 ;
982          Px = P + (2-upper)/3 ;
983          Cx = Px - Ax ;
984        * Stick a 0 in for all the missing values where no cancers were observed ;
985          array allnum{*} _numeric_ ;
986          do i = 1 to dim(allnum) ;
987             allnum{i} = max( allnum{i}, 0 ) ;
988          end ;
989        * Define colon and colorectal cancers excl. anus ;
990          D24  = D241 + D242 + D243 + D249 ;
991          D259 = D241 + D242 + D243 + D249 + D251 ;
992        run ;

NOTE: There were 6000 observations read from the data set WORK.WELLCA.
NOTE: There were 13030 observations read from the data set WORK.DMCA.
NOTE: There were 13538 observations read from the data set WORK.INSCA.
NOTE: The data set DATA.DMCAA has 32568 observations and 39 variables.
NOTE: DATA statement used (Total process time):
      real time           0.40 seconds
      cpu time            0.14 seconds


993
994        title 'Dataset without duration variables' ;
995        proc contents  data = data.DMCaA ;
996        run ;

NOTE: PROCEDURE CONTENTS used (Total process time):
      real time           0.03 seconds
      cpu time            0.01 seconds

NOTE: The PROCEDURE CONTENTS printed page 12.

997
998        proc tabulate  data=data.DMCaA  order=data  missing
999                       noseps formchar="           ";
1000         class state P DMtype ;
1001         var Y &dvars. ;
1002         table all
1003               state*DMtype
1004               state*DMtype*P,
1005               ( Y * f=comma13.1
1006                 (n="No. cells" D0 D259 D33 D70 D91 D999) * f=comma10.0 )
1007               / rts = 25 ;
1008         table Y * f=comma10.0
1009               ( &dvars. ) * f=comma10.0 ,
1010               sum="" * ( all state )
1011               / rts = 14 ;
1012         keylabel sum=" "
1013                    n=" " ;
1014       run ;

NOTE: There were 32568 observations read from the data set DATA.DMCAA.
NOTE: The PROCEDURE TABULATE printed pages 13-15.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           0.09 seconds
      cpu time            0.09 seconds
```

```
1015
1016       * Finally export the relevant data for analysis in XPT format ;
1017       libname xptA xport '../data/DMCaA.xpt';
NOTE: Libref XPTA was successfully assigned as follows:
      Engine:        XPORT
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data\DMCaA.xpt
1018       libname xptD xport '../data/DMCaD.xpt';
NOTE: Libref XPTD was successfully assigned as follows:
      Engine:        XPORT
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data\DMCaD.xpt
1019       proc copy in=data out=xptA memtype=data;  select DMCaA ; run;

NOTE: Copying DATA.DMCAA to XPTA.DMCAA (memtype=DATA).
NOTE: There were 32568 observations read from the data set DATA.DMCAA.
NOTE: The data set XPTA.DMCAA has 32568 observations and 39 variables.
NOTE: PROCEDURE COPY used (Total process time):
      real time           0.68 seconds
      cpu time            0.15 seconds


1020       proc copy in=data out=xptD memtype=data;  select DMCaD ; run;

NOTE: Copying DATA.DMCAD to XPTD.DMCAD (memtype=DATA).
NOTE: There were 551280 observations read from the data set DATA.DMCAD.
NOTE: The data set XPTD.DMCAD has 551280 observations and 41 variables.
NOTE: PROCEDURE COPY used (Total process time):
      real time           3.95 seconds
      cpu time            1.64 seconds


NOTE: SAS Institute Inc., SAS Campus Drive, Cary, NC USA 27513-2414
NOTE: The SAS System used:
      real time           6:46.68
      cpu time            2:42.42

All cancers diagnosed 1995 ff.                                       13:55 Thursday, March 31, 2011   1


                                                    Diagnosedato

       1995   1996   1997   1998   1999   2000   2001   2002   2003   2004   2005   2006   2007   2008   2009

 All  22,430 22,654 23,009 23,649 24,018 24,121 24,408 24,912 25,332 26,128 26,850 27,810 28,049 28,887 29,792
 Diag
 21      282    325    331    311    315    327    362    370    349    375    344    358    338    354    369
 22      524    507    481    493    491    412    469    450    486    473    482    511    491    503    482
 26      247    218    223    241    270    258    258    283    266    252    219    244    247    272    269
 28      551    548    624    668    665    674    703    684    708    743    732    733    821    771    834
 33    3,100  3,013  3,164  3,040  3,222  3,305  3,324  3,412  3,291  3,504  3,491  3,591  3,738  3,584  3,597
 51      965    853    861    839    966  1,037    983  1,002  1,171  1,051  1,228  1,320  1,389  1,439  1,692
 70    3,093  3,308  3,272  3,403  3,471  3,545  3,658  3,857  3,735  3,688  3,727  3,851  3,866  4,473  5,317
 82      491    476    415    421    423    380    402    356    401    366    395    367    346    341    361
 83      601    574    570    575    579    578    630    581    615    613    604    619    594    673    683
 84      560    517    551    563    572    565    562    560    526    471    530    498    492    477    491
 91    1,285  1,431  1,496  1,641  1,736  1,823  1,905  2,108  2,286  2,673  3,092  3,192  3,502  3,684  3,587
 92      293    287    294    287    296    268    243    274    276    308    278    303    312    286    321
 101     413    453    421    490    452    491    482    430    464    509    500    550    526    552    589
 103   1,354  1,389  1,460  1,498  1,490  1,429  1,429  1,449  1,559  1,505  1,533  1,495  1,496  1,448  1,428
 113     627    621    616    703    649    675    623    629    625    655    652    657    688    753    725
 121     118    138    115    139    134    163    130    128    149    187    148    151    166    173    186
 131     110    114    123    125    110    107    119    131    137    102    114    142    137    114    122
 132     682    682    708    695    697    706    694    701    770    734    766    802    842    757    748
 133     297    299    282    274    283    310    311    283    301    313    338    392    378    355    368
 139     621    611    639    677    713    679    666    710    673    756    757    778    769    697    613
 241     600    574    631    632    612    578    681    598    664    693    701    771    728    763    739
 242     232    262    268    294    304    275    311    285    309    330    315    298    337    347    374
 243   1,000    979  1,010  1,031  1,027  1,036  1,025  1,094  1,034    986  1,107  1,127  1,010  1,027  1,001
 249     152    168    152    162    164    175    168    151    187    202    190    207    203    201    194
 251     958    972  1,058    996    999  1,021  1,060  1,090  1,085  1,205  1,147  1,316  1,222  1,291  1,278
 999   3,274  3,335  3,244  3,451  3,378  3,304  3,210  3,296  3,265  3,434  3,460  3,537  3,411  3,552  3,424


(Continued)
All cancers diagnosed 1995 ff.                                       13:55 Thursday, March 31, 2011   2


         All

 All     382,049
 Diag
 21        5,110
 22        7,255
 26        3,767
 28       10,459
 33       50,376
 51       16,796
 70       56,264
 82        5,941
 83        9,089
```

```
 84        7,935
 91       35,441
 92        4,326
 101       7,322
 103      21,962
 113       9,898
 121       2,225
 131       1,807
 132      10,984
 133       4,784
 139      10,359
 241       9,965
 242       4,541
 243      15,494
 249       2,676
 251      16,698
 999      50,575

All cancers diagnosed 1995 ff.                                                        13:55 Thursday, March 31, 2011   3

The CONTENTS Procedure

Data Set Name        WORK.WELLCA                         Observations          6000
Member Type          DATA                                Variables             34
Engine               V9                                  Indexes               0
Created              31 Mar 2011 Thu 13:58:55 o'clock    Observation Length    272
Last Modified        31 Mar 2011 Thu 13:58:55 o'clock    Deleted Observations  0
Protection                                               Compressed            NO
Data Set Type                                            Sorted                NO
Label
Data Representation  WINDOWS_32
Encoding             wlatin1  Western (Windows)


                                  Engine/Host Dependent Information

Data Set Page Size          16384
Number of Data Set Pages    101
First Data Page             1
Max Obs per Page            60
Obs in First Data Page      44
Number of Data Set Repairs  0
Filename                    C:\DOCUME~1\bxc\LOCALS~1\Temp\SAS Temporary Files\_TD1532\wellca.sas7bdat
Release Created             9.0202M0
Host Created                XP_PRO


                       Alphabetic List of Variables and Attributes

 #    Variable    Type    Len    Format    Label

 2    A           Num       8              Left endpoint of interval (transformed scale)
 4    C           Num       8              Cohort
 6    D0          Num       8
25    D21         Num       8
22    D22         Num       8
12    D26         Num       8
26    D28         Num       8
17    D33         Num       8
18    D51         Num       8
28    D70         Num       8
32    D82         Num       8
31    D83         Num       8
30    D84         Num       8
13    D91         Num       8
10    D92         Num       8
 7    D101        Num       8
16    D103        Num       8
 8    D113        Num       8
20    D121        Num       8
15    D131        Num       8
14    D132        Num       8
27    D133        Num       8
11    D139        Num       8
21    D241        Num       8
19    D242        Num       8
24    D243        Num       8
29    D249        Num       8
23    D251        Num       8
 9    D999        Num       8
34    DMtype      Num       8
 3    P           Num       8              Left endpoint of interval (transformed scale)
 5    Y           Num       8
 1    sex         Num       8    SEX.      Sex
33    state       Char      6
All cancers diagnosed 1995 ff.                                                        13:55 Thursday, March 31, 2011   4

                                                                                           D
                                                                                       s   M
```

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                                  D D D   D     D D D     D D D   D D     D   D        t   t
  O    s                          1 1 9 D 1 D D 1 1 1 D D 2 1 2 D 2 2 D D 1 D 2 D D D  a   y
  b    e                        D 0 1 9 9 3 2 9 3 3 0 3 5 4 2 4 2 5 4 2 2 3 7 4 8 8 8  t   p
  s    x   A   P    C      Y    0 1 3 9 2 9 6 1 2 1 3 3 1 2 1 1 2 1 3 1 8 3 0 9 4 3 2  e   e

   1 Males 0 1995 1994 17870.42 2 1 1 . . . . . . . . . . . . . . . . . . . . . . . . . Well 0
   2 Males 0 1995 1995 18024.75 4 1 1 2 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
   3 Males 0 1996 1995 18060.71 2 . 1 . 1 . . . . . . . . . . . . . . . . . . . . . . . Well 0
   4 Males 0 1996 1996 17425.55 2 1 1 . . . . . . . . . . . . . . . . . . . . . . . . . Well 0
   5 Males 0 1997 1996 17447.70 3 1 . . . 2 . . . . . . . . . . . . . . . . . . . . . . Well 0
   6 Males 0 1997 1997 17385.87 1 . . 1 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
   7 Males 0 1998 1997 17407.82 4 . . 4 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
   8 Males 0 1998 1998 17034.24 4 . . 4 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
   9 Males 0 1999 1998 17062.80 2 1 . 1 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
  10 Males 0 1999 1999 16950.96 4 . 3 1 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
  11 Males 0 2000 1999 16977.87 6 1 1 3 . . 1 . . . . . . . . . . . . . . . . . . . . . Well 0
  12 Males 0 2000 2000 17208.51 1 . . 1 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
  13 Males 0 2001 2000 17234.46 5 . 1 2 . 2 . . . . . . . . . . . . . . . . . . . . . . Well 0
  14 Males 0 2001 2001 16739.01 2 . 1 1 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
  15 Males 0 2002 2001 16766.37 2 . . 2 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
  16 Males 0 2002 2002 16493.67 5 . 2 3 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
  17 Males 0 2003 2002 16518.45 2 1 . 1 . . . . . . . . . . . . . . . . . . . . . . . . Well 0
  18 Males 0 2003 2003 16674.90 2 . . 1 . 1 . . . . . . . . . . . . . . . . . . . . . . Well 0
  19 Males 0 2004 2003 16669.08 3 . . 2 . 1 . . . . . . . . . . . . . . . . . . . . . . Well 0
  20 Males 0 2004 2004 16568.33 5 1 . 3 1 . . . . . . . . . . . . . . . . . . . . . . . Well 0
All cancers diagnosed 1995 ff.                                                        13:55 Thursday, March 31, 2011   5

The CONTENTS Procedure

Data Set Name        WORK.DMCA                                    Observations          89019
Member Type          DATA                                         Variables             36
Engine               V9                                           Indexes               0
Created              31 Mar 2011 Thu 14:00:10 o'clock             Observation Length    288
Last Modified        31 Mar 2011 Thu 14:00:10 o'clock             Deleted Observations  0
Protection                                                        Compressed            NO
Data Set Type                                                     Sorted                NO
Label
Data Representation  WINDOWS_32
Encoding             wlatin1  Western (Windows)


                                 Engine/Host Dependent Information

Data Set Page Size          16384
Number of Data Set Pages    1590
First Data Page             1
Max Obs per Page            56
Obs in First Data Page      41
Number of Data Set Repairs  0
Filename                    C:\DOCUME~1\bxc\LOCALS~1\Temp\SAS Temporary Files\_TD1532\dmca.sas7bdat
Release Created             9.0202M0
Host Created                XP_PRO


                       Alphabetic List of Variables and Attributes

 #    Variable    Type    Len    Format    Label

 2    A           Num       8              Left endpoint of interval (transformed scale)
 4    C           Num       8
 8    D0          Num       8
21    D21         Num       8
26    D22         Num       8
13    D26         Num       8
23    D28         Num       8
16    D33         Num       8
14    D51         Num       8
31    D70         Num       8
33    D82         Num       8
32    D83         Num       8
34    D84         Num       8
30    D91         Num       8
 9    D92         Num       8
19    D101        Num       8
22    D103        Num       8
11    D113        Num       8
18    D121        Num       8
12    D131        Num       8
15    D132        Num       8
25    D133        Num       8
20    D139        Num       8
28    D241        Num       8
29    D242        Num       8
24    D243        Num       8
17    D249        Num       8
27    D251        Num       8
10    D999        Num       8
 5    DMdur       Num       8              Left endpoint of interval (transformed scale)
 6    DMtype      Num       8
```

```
 3    P           Num       8             Left endpoint of interval (transformed scale)
35    Y           Num       8             Risktime in interval
 7    _NAME_      Char      8             NAME OF FORMER VARIABLE
 1    sex         Num       8    SEX.
36    state       Char      6
All cancers diagnosed 1995 ff.                                                         13:55 Thursday, March 31, 2011   6

                                D _
                           D    M N                                                               s
                           M    t A     D D D     D   D D D D   D   D D   D D D                   t
  O    s                   d    y M   D 9 1 1 D D 1 D 2 1 1 1 D 1 D 2 1 D 2 2 2 D D D D D         a
  b    e                   u    p E D 9 9 1 3 2 5 3 3 4 2 0 3 2 0 2 4 3 2 5 4 4 9 7 8 8 8         t
  s    x    A   P    C     r    e _ 0 2 9 3 1 6 1 2 3 9 1 1 9 1 3 8 3 3 2 1 1 2 1 0 3 2 4    Y    e

    1 Males 0 1995 1995 0.00000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.08333 DM
    2 Males 0 1995 1995 0.08333 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.16667 DM
    3 Males 0 1995 1995 0.25000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.25000 DM
    4 Males 0 1995 1995 0.50000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.25000 DM
    5 Males 0 1995 1995 0.75000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.05767 DM
    6 Males 0 1996 1995 0.75000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.03901 DM
    7 Males 0 1997 1996 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.07118 DM
    8 Males 0 1997 1997 0.00000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.08333 DM
    9 Males 0 1997 1997 0.08333 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.16667 DM
   10 Males 0 1997 1997 0.25000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.20859 DM
   11 Males 0 1998 1997 0.00000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.08333 DM
   12 Males 0 1998 1997 0.08333 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.10627 DM
   13 Males 0 1998 1997 0.25000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.04141 DM
   14 Males 0 1998 1997 0.50000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.25000 DM
   15 Males 0 1998 1997 0.75000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.23357 DM
   16 Males 0 1998 1998 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.01574 DM
   17 Males 0 1998 1998 0.00000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.08333 DM
   18 Males 0 1998 1998 0.08333 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.16667 DM
   19 Males 0 1998 1998 0.25000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.25000 DM
   20 Males 0 1998 1998 0.50000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.25000 DM
All cancers diagnosed 1995 ff.                                                         13:55 Thursday, March 31, 2011   7

The CONTENTS Procedure

Data Set Name        WORK.INSCA                                  Observations          456261
Member Type          DATA                                        Variables             37
Engine               V9                                          Indexes               0
Created              31 Mar 2011 Thu 14:01:12 o'clock            Observation Length    296
Last Modified        31 Mar 2011 Thu 14:01:12 o'clock            Deleted Observations  0
Protection                                                       Compressed            NO
Data Set Type                                                    Sorted                NO
Label
Data Representation  WINDOWS_32
Encoding             wlatin1  Western (Windows)


                                 Engine/Host Dependent Information

Data Set Page Size          16384
Number of Data Set Pages    8296
First Data Page             1
Max Obs per Page            55
Obs in First Data Page      39
Number of Data Set Repairs  0
Filename                    C:\DOCUME~1\bxc\LOCALS~1\Temp\SAS Temporary Files\_TD1532\insca.sas7bdat
Release Created             9.0202M0
Host Created                XP_PRO


                       Alphabetic List of Variables and Attributes

 #    Variable    Type    Len    Format    Label

 2    A           Num       8             Left endpoint of interval (transformed scale)
 4    C           Num       8
 9    D0          Num       8
18    D21         Num       8
29    D22         Num       8
24    D26         Num       8
17    D28         Num       8
15    D33         Num       8
13    D51         Num       8
31    D70         Num       8
33    D82         Num       8
34    D83         Num       8
35    D84         Num       8
28    D91         Num       8
11    D92         Num       8
19    D101        Num       8
27    D103        Num       8
14    D113        Num       8
26    D121        Num       8
10    D131        Num       8
22    D132        Num       8
21    D133        Num       8
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12    D139        Num       8
20    D241        Num       8
30    D242        Num       8
23    D243        Num       8
32    D249        Num       8
25    D251        Num       8
16    D999        Num       8
 5    DMdur       Num       8              Left endpoint of interval (transformed scale)
 7    DMtype      Num       8
 6    Insdur      Num       8              Left endpoint of interval (transformed scale)
 3    P           Num       8              Left endpoint of interval (transformed scale)
36    Y           Num       8              Risktime in interval
 8    _NAME_      Char      8              NAME OF FORMER VARIABLE
 1    sex         Num       8    SEX.
37    state       Char      6
All cancers diagnosed 1995 ff.                                                         13:55 Thursday, March 31, 2011   8

                                    I    D _
                            D       n    M N                                                               s
                            M       s    t A   D   D   D   D     D D D D D   D D D     D   D               t
   O     s                  d       d    y M   1 D 1 D 1 D 9 D D 1 2 1 1 2 D 2 1 1 D D 2 D 2 D D D         a
   b     e                  u       u    p E D 3 9 3 5 1 3 9 2 2 0 4 3 3 4 2 5 2 0 9 2 4 7 4 8 8 8         t
   s     x   A   P    C     r       r    e _ 0 1 2 9 1 3 3 9 8 1 1 1 3 2 3 6 1 1 3 1 2 2 0 9 2 3 4    Y    e

     1 Males 0 1997 1996 0.00000 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.01215 DM
     2 Males 0 1997 1996 0.08333 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.07118 DM
     3 Males 0 1997 1996 0.08333 0.08333 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.01865 DM/Ins
     4 Males 0 1999 1999 0.00000 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.05595 DM
     5 Males 0 1999 1999 0.08333 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.01797 DM
     6 Males 0 2000 1999 0.00000 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.08333 DM
     7 Males 0 2000 1999 0.00000 0.08333 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.00000 DM/Ins
     8 Males 0 2000 1999 0.08333 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.09274 DM
     9 Males 0 2000 1999 0.08333 0.08333 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.14922 DM/Ins
    10 Males 0 2000 1999 0.25000 0.08333 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.10678 DM/Ins
    11 Males 0 2000 1999 0.25000 0.25000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.04363 DM/Ins
    12 Males 0 2001 2000 0.00000 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.04774 DM
    13 Males 0 2001 2000 0.08333 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.01044 DM
    14 Males 0 2004 2003 0.25000 0.00000 2   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.03901 DM
    15 Males 0 2004 2004 0.00000 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.05048 DM
    16 Males 0 2004 2004 0.08333 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.03285 DM
    17 Males 0 2004 2004 0.08333 0.08333 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.11174 DM/Ins
    18 Males 0 2005 2004 0.00000 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.01488 DM
    19 Males 0 2005 2004 0.08333 0.00000 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.02687 DM
    20 Males 0 2005 2004 0.08333 0.08333 1   . . . . . . . . . . . . . . . . . . . . . . . . . . . 0.02207 DM/Ins
Dataset with duration variables (only doDM > 31.12.1994)                               13:55 Thursday, March 31, 2011   9

The CONTENTS Procedure

Data Set Name        DATA.DMCAD                          Observations         551280
Member Type          DATA                                Variables            41
Engine               V9                                  Indexes              0
Created              31 Mar 2011 Thu 14:01:16 o'clock    Observation Length   328
Last Modified        31 Mar 2011 Thu 14:01:16 o'clock    Deleted Observations 0
Protection                                               Compressed           NO
Data Set Type                                            Sorted               NO
Label
Data Representation  WINDOWS_32
Encoding             wlatin1  Western (Windows)


                               Engine/Host Dependent Information

Data Set Page Size          16384
Number of Data Set Pages    11251
First Data Page             1
Max Obs per Page            49
Obs in First Data Page      34
Number of Data Set Repairs  0
Filename                    C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data\dmcad.sas7bdat
Release Created             9.0202M0
Host Created                XP_PRO


              Alphabetic List of Variables and Attributes

 #    Variable    Type    Len    Format    Label

 2    A           Num       8              Agr
37    Ax          Num       8              Age
 4    C           Num       8              Cgr
39    Cx          Num       8              Coh
 6    D0          Num       8              All malignant neoplasms
25    D21         Num       8              Oesophagus
22    D22         Num       8              Stomach
40    D24         Num       8              Colon
12    D26         Num       8              Liver
26    D28         Num       8              Pancreas
17    D33         Num       8              Lung
18    D51         Num       8              Melanoma
```

```
28    D70         Num       8              Breast
32    D82         Num       8              Cervix
31    D83         Num       8              Uterus
30    D84         Num       8              Ovary
13    D91         Num       8              Prostate
10    D92         Num       8              Testis
 7    D101        Num       8              Kidney
16    D103        Num       8              Bladder
 8    D113        Num       8              Brain
20    D121        Num       8              Thyroid
15    D131        Num       8              Hodgkin's lymphoma
14    D132        Num       8              Non-Hodgkin lymphoma
27    D133        Num       8              Multiple myeloma
11    D139        Num       8              Leukaemia
21    D241        Num       8              Ascending colon
19    D242        Num       8              Transverse colon
24    D243        Num       8              Descending colon
29    D249        Num       8              Other colon
23    D251        Num       8              Rectum
41    D259        Num       8              Colorectal
 9    D999        Num       8              Other
35    DMdur       Num       8              Time since DoDM (inclusion)
34    DMtype      Num       8              DM type
36    Insdur      Num       8              Time since DoI (1st insulin)
 3    P           Num       8              Pgr
38    Px          Num       8              Per
 5    Y           Num       8              Person-years
 1    sex         Num       8    SEX.      Sex
33    state       Char      6              State
Dataset with duration variables (only doDM > 31.12.1994)                              13:55 Thursday, March 31, 2011  10

                                                     All
                                                  malignant
                         Person-years  No. cells  neoplasms  Colorectal    Lung      Breast    Prostate    Other

 All                      77,183,679.2    551,280    369,984     47,497     48,917     54,925     34,377     48,785
 State       DM type
 Well        0            75,637,670.4      6,000    346,138     44,079     45,585     52,488     31,713     45,606
 DM          2             1,305,668.9    117,114     21,050      3,098      2,933      2,185      2,437      2,804
             1                   823.4      6,456          2          0          0          0          0          0
 DM/Ins      2               195,089.4    366,155      2,767        318        398        249        226        372
             1                44,427.0     55,555         27          2          1          3          1          3
 State   DM type Pgr
 Well    0       1995      4,997,400.3        400     21,127      2,748      2,933      2,974      1,192      3,074
                 1996      5,017,439.1        400     21,264      2,742      2,847      3,140      1,322      3,102
                 1997      5,028,556.3        400     21,549      2,884      2,981      3,110      1,376      3,031
                 1998      5,036,218.0        400     22,042      2,896      2,872      3,244      1,508      3,176
                 1999      5,041,088.8        400     22,244      2,818      3,000      3,283      1,580      3,128
                 2000      5,045,750.8        400     22,197      2,828      3,015      3,337      1,640      3,004
                 2001      5,051,178.6        400     22,283      2,929      3,042      3,424      1,714      2,906
                 2002      5,052,995.1        400     22,800      2,908      3,129      3,639      1,906      2,975
                 2003      5,050,427.1        400     22,963      2,928      2,967      3,505      2,077      2,936
                 2004      5,047,109.5        400     23,339      2,998      3,110      3,411      2,381      3,054
                 2005      5,043,837.3        400     23,936      3,051      3,136      3,462      2,728      3,062
                 2006      5,043,879.0        400     24,590      3,213      3,137      3,527      2,847      3,100
                 2007      5,049,649.2        400     24,703      2,986      3,263      3,545      3,064      3,029
                 2008      5,061,199.4        400     25,235      3,107      3,115      4,073      3,246      3,069
                 2009      5,070,942.0        400     25,866      3,043      3,038      4,814      3,132      2,960
 DM      2       1995          6,428.0      2,365        141         19         23          7          8         14
                 1996         18,019.1      4,286        288         38         34         33         27         47
                 1997         29,262.1      5,040        469         69         62         38         36         77
                 1998         40,254.0      5,894        609         89         57         55         60         98
                 1999         51,778.4      6,798        790        122        102         79         63        122
                 2000         62,924.8      7,532        999        140        149         93         93        160
                 2001         74,310.6      8,075      1,167        168        172        137        113        147
                 2002         86,249.1      8,590      1,328        195        172        123        128        208
                 2003         99,405.6      8,906      1,370        212        184        141        136        180
                 2004        112,366.8      9,511      1,797        272        263        170        207        241
                 2005        123,715.7      9,531      2,045        292        258        181        273        274
                 2006        133,648.5      9,869      2,206        343        330        226        257        305
                 2007        144,034.3     10,070      2,329        353        359        218        341        253
                 2008        156,027.2     10,267      2,633        390        348        306        330        332
                 2009        167,244.8     10,380      2,879        396        420        378        365        346
         1       1995             36.9        260          0          0          0          0          0          0
                 1996             49.8        425          0          0          0          0          0          0
                 1997             52.8        429          0          0          0          0          0          0
                 1998             54.4        436          0          0          0          0          0          0
                 1999             53.5        441          0          0          0          0          0          0
                 2000             53.9        441          0          0          0          0          0          0
                 2001             54.4        436          0          0          0          0          0          0
                 2002             55.0        452          0          0          0          0          0          0
                 2003             53.8        441          1          0          0          0          0          0
                 2004             56.7        429          0          0          0          0          0          0
                 2005             54.2        442          0          0          0          0          0          0
                 2006             61.8        456          1          0          0          0          0          0
                 2007             58.1        440          0          0          0          0          0          0
                 2008             63.9        460          0          0          0          0          0          0
                 2009             64.3        468          0          0          0          0          0          0
```

```
 DM/Ins  2       1995            339.2      1,378          5          1          1          0          0          1
                 1996          1,471.0      5,383         12          1          0          1          1          2
                 1997          2,646.2      9,489         25          3          5          0          1          3
                 1998          3,862.6     12,525         43          6          7          4          3          9
                 1999          5,305.8     16,550         68          5          7          5          4         14
                 2000          6,971.2     20,369         84          8         13         11          3         15
                 2001          8,843.6     23,538        109         12         17          8         10         15
                 2002         10,971.5     27,267        128         14         20         10          7         17
                 2003         13,277.9     28,794        161         18         29         14         11         22
                 2004         16,169.3     32,185        242         27         34         22         20         25
                 2005         19,119.4     33,560        279         32         37         27         25         43
                 2006         22,145.6     36,424        316         39         39         24         29         41
                 2007         25,238.5     37,677        407         53         60         30         38         51
                 2008         28,027.3     40,159        423         47         60         43         32         65
                 2009         30,700.4     40,857        465         52         69         50         42         49
         1       1995            142.9        466          0          0          0          0          0          0
                 1996            511.1      1,350          0          0          0          0          0          0
                 1997            917.7      2,145          0          0          0          0          0          0
                 1998          1,331.8      2,755          0          0          0          0          0          0
                 1999          1,743.6      3,312          0          0          0          0          0          0
                 2000          2,150.4      3,736          1          0          0          0          0          0
                 2001          2,562.5      4,021          2          0          0          0          0          0
                 2002          2,958.7      4,268          2          0          0          1          0          0
                 2003          3,348.7      4,362          2          0          0          0          0          0
                 2004          3,749.5      4,519          0          0          0          0          0          0
                 2005          4,141.5      4,604          1          0          0          0          0          0
                 2006          4,581.7      4,806          3          0          1          0          0          2
                 2007          4,982.1      4,914          4          0          0          1          0          0
                 2008          5,437.1      5,104          4          0          0          1          0          1
                 2009          5,867.7      5,193          8          2          0          0          1          0

Dataset with duration variables (only doDM > 31.12.1994)                              13:55 Thursday, March 31, 2011  11

                                      State

                 All        Well        DM       DM/Ins

 Person-years 77,183,679 75,637,670  1,306,492    239,516
 All
 malignant
 neoplasms        369,984    346,138     21,052      2,794
 Other             48,785     45,606      2,804        375
 Oesophagus         4,931      4,586        307         38
 Stomach            6,964      6,460        445         59
 Ascending
 colon              9,551      8,762        724         65
 Transverse
 colon              4,361      3,991        326         44
 Descending
 colon             14,886     13,893        900         93
 Other colon        2,561      2,343        201         17
 Rectum            16,138     15,090        947        101
 Colorectal        47,497     44,079      3,098        320
 Liver              3,418      2,879        420        119
 Pancreas           9,917      8,466      1,122        329
 Lung              48,917     45,585      2,933        399
 Melanoma          16,479     15,881        530         68
 Breast            54,925     52,488      2,185        252
 Cervix             5,848      5,691        132         25
 Uterus             8,691      8,057        571         63
 Ovary              7,751      7,400        314         37
 Prostate          34,377     31,713      2,437        227
 Testis             4,301      4,257         37          7
 Kidney             7,017      6,410        512         95
 Bladder           21,204     19,687      1,373        144
 Brain              9,677      9,232        388         57
 Thyroid            2,188      2,104         66         18
 Hodgkin's
 lymphoma           1,784      1,713         61         10
 Non-Hodgkin
 lymphoma          10,653     10,036        551         66
 Multiple
 myeloma            4,630      4,335        269         26
 Leukaemia         10,030      9,473        497         60

Dataset without duration variables                                                    13:55 Thursday, March 31, 2011  12

The CONTENTS Procedure

Data Set Name        DATA.DMCAA                          Observations          32568
Member Type          DATA                                Variables             39
Engine               V9                                  Indexes               0
Created              31 Mar 2011 Thu 14:01:52 o'clock    Observation Length    312
Last Modified        31 Mar 2011 Thu 14:01:52 o'clock    Deleted Observations  0
Protection                                               Compressed            NO
Data Set Type                                            Sorted                NO
Label
Data Representation  WINDOWS_32
```

```
Encoding              wlatin1  Western (Windows)


                               Engine/Host Dependent Information

Data Set Page Size          16384
Number of Data Set Pages    627
First Data Page             1
Max Obs per Page            52
Obs in First Data Page      36
Number of Data Set Repairs  0
Filename                    C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data\dmcaa.sas7bdat
Release Created             9.0202M0
Host Created                XP_PRO


            Alphabetic List of Variables and Attributes

 #    Variable    Type    Len    Format    Label

 2    A           Num       8              Agr
35    Ax          Num       8              Age
 4    C           Num       8              Cgr
37    Cx          Num       8              Coh
 6    D0          Num       8              All malignant neoplasms
25    D21         Num       8              Oesophagus
22    D22         Num       8              Stomach
38    D24         Num       8              Colon
12    D26         Num       8              Liver
26    D28         Num       8              Pancreas
17    D33         Num       8              Lung
18    D51         Num       8              Melanoma
28    D70         Num       8              Breast
32    D82         Num       8              Cervix
31    D83         Num       8              Uterus
30    D84         Num       8              Ovary
13    D91         Num       8              Prostate
10    D92         Num       8              Testis
 7    D101        Num       8              Kidney
16    D103        Num       8              Bladder
 8    D113        Num       8              Brain
20    D121        Num       8              Thyroid
15    D131        Num       8              Hodgkin's lymphoma
14    D132        Num       8              Non-Hodgkin lymphoma
27    D133        Num       8              Multiple myeloma
11    D139        Num       8              Leukaemia
21    D241        Num       8              Ascending colon
19    D242        Num       8              Transverse colon
24    D243        Num       8              Descending colon
29    D249        Num       8              Other colon
23    D251        Num       8              Rectum
39    D259        Num       8              Colorectal
 9    D999        Num       8              Other
34    DMtype      Num       8              DM type
 3    P           Num       8              Pgr
36    Px          Num       8              Per
 5    Y           Num       8              Person-years
 1    sex         Num       8    SEX.      Sex
33    state       Char      6              State
Dataset without duration variables                                        13:55 Thursday, March 31, 2011  13


                                                    All
                                                 malignant
                         Person-years  No. cells  neoplasms  Colorectal     Lung     Breast   Prostate    Other

 All                     78,046,684.3     32,568    381,371      49,248    50,301    56,201     35,410    50,488
 State       DM type
 Well        0           75,637,670.4      6,000    346,138      44,079    45,585    52,488     31,713    45,606
 DM          0              425,407.0      5,215      6,937       1,130       796       780        674     1,045
             2            1,302,136.6      5,948     20,870       3,085     2,895     2,176      2,425     2,780
             1                  300.3      1,867          2           0         0         0          0         0
 DM/Ins      0              437,598.1      5,426      4,450         621       588       496        359       658
             2              198,621.7      5,666      2,947         331       436       258        238       396
             1               44,950.1      2,446         27           2         1         3          1         3
 State    DM type Pgr
 Well     0          1995  4,997,400.3        400     21,127       2,748     2,933     2,974      1,192     3,074
                     1996  5,017,439.1        400     21,264       2,742     2,847     3,140      1,322     3,102
                     1997  5,028,556.3        400     21,549       2,884     2,981     3,110      1,376     3,031
                     1998  5,036,218.0        400     22,042       2,896     2,872     3,244      1,508     3,176
                     1999  5,041,088.8        400     22,244       2,818     3,000     3,283      1,580     3,128
                     2000  5,045,750.8        400     22,197       2,828     3,015     3,337      1,640     3,004
                     2001  5,051,178.6        400     22,283       2,929     3,042     3,424      1,714     2,906
                     2002  5,052,995.1        400     22,800       2,908     3,129     3,639      1,906     2,975
                     2003  5,050,427.1        400     22,963       2,928     2,967     3,505      2,077     2,936
                     2004  5,047,109.5        400     23,339       2,998     3,110     3,411      2,381     3,054
                     2005  5,043,837.3        400     23,936       3,051     3,136     3,462      2,728     3,062
                     2006  5,043,879.0        400     24,590       3,213     3,137     3,527      2,847     3,100
                     2007  5,049,649.2        400     24,703       2,986     3,263     3,545      3,064     3,029
```

```
                 2008       5,061,199.4        400     25,235      3,107      3,115      4,073      3,246      3,069
                 2009       5,070,942.0        400     25,866      3,043      3,038      4,814      3,132      2,960
 DM      0       1995          59,424.4        396        899        132        104         94         85        142
                 1996          52,372.8        392        797        134         97        102         66        135
                 1997          46,530.7        381        752        130         91         91         62        106
                 1998          41,527.9        365        643         90         66         68         50        109
                 1999          36,566.0        357        642        117         74         68         71         77
                 2000          32,143.7        352        537         85         79         62         59         85
                 2001          28,275.1        347        510         82         51         58         52         80
                 2002          24,901.0        344        382         62         53         44         39         50
                 2003          21,750.9        340        351         54         44         31         32         59
                 2004          18,859.4        336        340         62         37         39         36         58
                 2005          16,439.8        332        256         41         20         22         33         34
                 2006          14,314.4        328        280         49         33         40         26         37
                 2007          12,468.0        322        204         36         14         24         24         26
                 2008          10,994.9        315        190         28         19         19         26         28
                 2009           8,838.2        308        154         28         14         18         13         19
         2       1995           6,353.0        390        138         19         23          5          8         14
                 1996          17,910.9        393        282         38         34         33         27         46
                 1997          29,156.3        395        465         69         62         38         36         76
                 1998          40,126.8        396        607         89         57         55         60         98
                 1999          51,627.9        398        785        122        100         79         63        120
                 2000          62,746.2        400        991        139        148         93         92        160
                 2001          74,107.1        399      1,156        167        170        135        112        146
                 2002          86,021.0        398      1,322        194        171        123        128        205
                 2003          99,126.1        398      1,358        212        180        141        136        179
                 2004         112,042.9        396      1,782        270        259        170        206        236
                 2005         123,383.1        395      2,032        291        255        180        272        273
                 2006         133,304.8        396      2,183        342        323        226        254        303
                 2007         143,663.2        398      2,304        350        354        216        340        250
                 2008         155,680.4        398      2,613        389        347        305        328        330
                 2009         166,886.8        398      2,852        394        412        377        363        344
         1       1995              10.3         82          0          0          0          0          0          0
                 1996              16.2        128          0          0          0          0          0          0
                 1997              17.8        126          0          0          0          0          0          0
                 1998              19.3        125          0          0          0          0          0          0
                 1999              18.9        132          0          0          0          0          0          0
                 2000              19.5        123          0          0          0          0          0          0
                 2001              20.6        125          0          0          0          0          0          0
                 2002              21.4        128          0          0          0          0          0          0
                 2003              21.4        125          1          0          0          0          0          0
                 2004              21.5        127          0          0          0          0          0          0
                 2005              20.2        128          0          0          0          0          0          0
                 2006              24.2        131          1          0          0          0          0          0
                 2007              22.5        125          0          0          0          0          0          0
                 2008              23.8        131          0          0          0          0          0          0
                 2009              22.8        131          0          0          0          0          0          0
 DM/Ins  0       1995          28,787.2        375        256         39         37         23          7         43
                 1996          29,825.2        383        272         44         36         31         15         35
                 1997          30,385.0        378        232         36         21         31         13         39
                 1998          30,580.6        377        295         34         43         29         26         49
                 1999          30,867.6        373        298         39         46         41         18         38
                 2000          31,034.5        371        316         36         42         38         29         45
                 2001          30,972.5        367        302         49         41         34         14         52
                 2002          30,689.6        365        290         45         39         34         27         48
                 2003          30,326.4        358        300         33         45         31         20         44
                 2004          30,046.4        355        343         42         52         38         29         49
                 2005          29,548.3        351        283         37         37         30         28         40
                 2006          28,866.3        347        338         63         41         27         31         43
                 2007          27,992.5        346        336         57         35         41         34         51
                 2008          26,629.0        342        323         38         38         26         44         47
                 2009          21,047.0        338        266         29         35         42         24         35
         2       1995             414.2        266          8          1          1          2          0          1
                 1996           1,579.2        365         18          1          0          1          1          3
                 1997           2,751.9        374         29          3          5          0          1          4
                 1998           3,989.8        380         45          6          7          4          3          9
                 1999           5,456.2        387         73          5          9          5          4         16
                 2000           7,149.9        386         92          9         14         11          4         15
                 2001           9,047.1        386        120         13         19         10         11         16


(Continued)
Dataset without duration variables                                                    13:55 Thursday, March 31, 2011  14


                                                     All
                                                  malignant
                         Person-years  No. cells  neoplasms  Colorectal    Lung      Breast    Prostate    Other

 State   DM type Pgr
 DM/Ins  2       2002          11,199.5        389        134         15         21         10          7         20
                 2003          13,557.4        392        173         18         33         14         11         23
                 2004          16,493.2        395        257         29         38         22         21         30
                 2005          19,452.1        391        292         33         40         28         26         44
                 2006          22,489.3        387        339         40         46         24         32         43
                 2007          25,609.6        386        432         56         65         32         39         54
                 2008          28,374.1        391        443         48         61         44         34         67
                 2009          31,058.4        391        492         54         77         51         44         51
         1       1995             169.6         86          0          0          0          0          0          0
```

```
                 1996            544.7        137          0          0          0          0          0          0
                 1997            952.7        148          0          0          0          0          0          0
                 1998          1,366.8        150          0          0          0          0          0          0
                 1999          1,778.1        154          0          0          0          0          0          0
                 2000          2,184.8        159          1          0          0          0          0          0
                 2001          2,596.3        163          2          0          0          0          0          0
                 2002          2,992.3        166          2          0          0          1          0          0
                 2003          3,381.1        170          2          0          0          0          0          0
                 2004          3,784.6        176          0          0          0          0          0          0
                 2005          4,175.6        179          1          0          0          0          0          0
                 2006          4,619.3        184          3          0          1          0          0          2
                 2007          5,017.7        187          4          0          0          1          0          0
                 2008          5,477.2        192          4          0          0          1          0          1
                 2009          5,909.2        195          8          2          0          0          1          0

Dataset without duration variables                                                      13:55 Thursday, March 31, 2011  15


                                      State

                 All        Well        DM       DM/Ins

 Person-years 78,046,684 75,637,670  1,727,844    681,170
 All
 malignant
 neoplasms       381,371    346,138     27,809      7,424
 Other            50,488     45,606      3,825      1,057
 Oesophagus        5,105      4,586        407        112
 Stomach           7,244      6,460        619        165
 Ascending
 colon             9,933      8,762        972        199
 Transverse
 colon             4,535      3,991        437        107
 Descending
 colon            15,452     13,893      1,260        299
 Other colon       2,665      2,343        265         57
 Rectum           16,663     15,090      1,281        292
 Colorectal       49,248     44,079      4,215        954
 Liver             3,755      2,879        631        245
 Pancreas         10,371      8,466      1,309        596
 Lung             50,301     45,585      3,691      1,025
 Melanoma         16,774     15,881        702        191
 Breast           56,201     52,488      2,956        757
 Cervix            5,939      5,691        181         67
 Uterus            9,065      8,057        792        216
 Ovary             7,923      7,400        421        102
 Prostate         35,410     31,713      3,099        598
 Testis            4,326      4,257         42         27
 Kidney            7,306      6,410        686        210
 Bladder          21,936     19,687      1,825        424
 Brain             9,871      9,232        481        158
 Thyroid           2,224      2,104         88         32
 Hodgkin's
 lymphoma          1,806      1,713         72         21
 Non-Hodgkin
 lymphoma         10,963     10,036        734        193
 Multiple
 myeloma           4,773      4,335        349         89
 Leukaemia        10,342      9,473        684        185
```

1.2 Acquiring mortality information: `DMmort`

```
1                                     "Program: DMmort.sas"         21:40 Monday, March 21, 2011

NOTE: Copyright (c) 2002-2008 by SAS Institute Inc., Cary, NC, USA.
NOTE: SAS (r) Proprietary Software 9.2 (TS2M0)
      Licensed to NNIT -BASIC PACKAGE AND ADDITIONAL PACKAGE, Site 50800704.
NOTE: This session is executing on the XP_PRO  platform.
NOTE: SAS initialization used:
      real time           2.42 seconds
      cpu time            0.49 seconds


NOTE: AUTOEXEC processing beginning; file is c:\stat\sas\autoexec.sas.

---------------------------------------------------------------
C:\Bendix\Steno\DM-register\NDR\projects\Cancer\sas\DMmort.sas
---------------------------------------------------------------
NOTE: Libref HER was successfully assigned as follows:
      Engine:        V9
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\sas
NOTE: Libref DATA was successfully assigned as follows:
      Engine:        V9
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data
```

```
NOTE: AUTOEXEC processing completed.

1          libname demodb "C:\Bendix\Demodb\data" ;
NOTE: Directory for library DEMODB contains files of mixed engine types.
NOTE: Libref DEMODB was successfully assigned as follows:
      Engine:        V9
      Physical Name: C:\Bendix\Demodb\data
1        !                                          * The total no deaths in the population ;
2          libname data   "..\data"               ;
NOTE: Libref DATA was successfully assigned as follows:
      Engine:        V9
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data
2        !                                          * the registers ;
3
4          *****************************************************************
5          NOTE: This program enumerates deaths among diabetes patients
6                in order to provide the data background for a mortality
7                analysis which is necessary for calculation of cumulative
8                risks.
9          ***************************************************************** ;
10
11         * The date from which we trust the inclusion date to be the first ;
12         %let  validdate = '01JAN1995'd ;
13         * Set the entry and exit dates for the entire follow-up endeavour ;
14         %let  truncdate = '01JAN1995'd ;
15         %let   censdate = '31DEC2009'd ;
16         * Set the breaks for the tabulation of deaths by duration ;
17         %let  durbreaks = %str(0 to 2 by 0.25, 2.5 to 5 by 0.5, 6, 7 to 19 by 2) ;
18
19         * Define the ranges for period-tabulation ;
20         data _null_ ;
21          call symput( 'Plo'   , year( &truncdate. ) - 1 ) ; * Last year before FU ;
22          call symput( 'Phi'   , year(  &censdate. ) + 1 ) ; * First year after FU ;
23          call symput( 'Pfirst', year( &truncdate. ) - 1900 ) ; * 1st tab break ;
24          call symput( 'Plast' , year(  &censdate. ) - 1900 + 1 ) ; * last tab break ;
25         run ;

NOTE: Numeric values have been converted to character values at the places given by: (Line):(Column).
      21:45   22:45   23:45   24:52
NOTE: DATA statement used (Total process time):
      real time           0.04 seconds
      cpu time            0.00 seconds


26
27         proc format ;
28         value sex
29              1="Males"
30              2="Females" ;
NOTE: Format SEX has been output.
31         run ;

NOTE: PROCEDURE FORMAT used (Total process time):
      real time           0.10 seconds
      cpu time            0.03 seconds


32
33         *----------------------------------------------------------------------;
34         * Preprocessing of the cancer register to first primary tumours ;
35
36         * First take the cancer registry, remove all non-first primary cancers ;
37         data cancer ;
38           set data.cancer ;
39           * Diagnoses not counted as cancer and non-Mel skin cancer excluded ;
40           if ( diag in (52,150) ) then delete ;
41         run ;

NOTE: There were 1748815 observations read from the data set DATA.CANCER.
NOTE: The data set WORK.CANCER has 1286419 observations and 31 variables.
NOTE: DATA statement used (Total process time):
      real time           14.50 seconds
      cpu time            1.23 seconds


42
43         * Sort by id and tumornumber ;
44         proc sort data = cancer ;
45           by id d_diagnosedato ;
46         run ;

NOTE: There were 1286419 observations read from the data set WORK.CANCER.
NOTE: The data set WORK.CANCER has 1286419 observations and 31 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           13.17 seconds
      cpu time            2.73 seconds
```

```
47
48         * Select only the first real tumor ;
49         data cancer ;
50           set cancer ;
51           by id ;
52           if first.id ;
53         run ;

NOTE: There were 1286419 observations read from the data set WORK.CANCER.
NOTE: The data set WORK.CANCER has 1195147 observations and 31 variables.
NOTE: DATA statement used (Total process time):
      real time           4.64 seconds
      cpu time            1.07 seconds


54
55         * Then merge with the diabetes register ;
56         data candi;
57           merge cancer
58                 data.diabetes ;
59           by id ;
60           keep sex diag diaggrp DMtype
61                doBT doDM doI doCA doX doDD ;
62           format sex sex.
63                  doBT doDM doI doCA doX doDD ddmmyy10. ;
64         * Demografic dates collected from CRG and NDR ;
65           doBT = min( D_foddto  , D_fdsdato ) ;
66           doDD = min( D_statdato, D_dodsdto ) ;
67           doX  = min( D_statdato, D_dodsdto, &censdate. ) ;
68         * Event-dates ;
69           doDM = D_inkldto ;
70           doI  = D_ins ;
71           doCA = D_diagnosedato ;
72         * Characteristics for diabetes patients --- missing if no DM ;
73         * If DM-duration can be trusted (and DMtype defined) then 2 ;
74           DMtype = ( doDM ge &validdate. ) * 2 + doDM - doDM ;
75         * Change to a value 1 for those considered to be T1D ;
76           if ( DMtype > 0  and
77                (doDM-doBT) < 35*365.25  and
78                 doI > .z and
79                (doI-doDM) < 90 ) then DMtype = 1 ;
80         run ;

NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      449181 at 66:10    1119643 at 74:40
NOTE: There were 1195147 observations read from the data set WORK.CANCER.
NOTE: There were 437593 observations read from the data set DATA.DIABETES.
NOTE: The data set WORK.CANDI has 1557236 observations and 10 variables.
NOTE: DATA statement used (Total process time):
      real time           8.82 seconds
      cpu time            1.46 seconds


81
82         **********************************************************************
83         NOTE: The dataset candi now has a record for each person who has
84               either a first primary cancer diagnosis or a diabetes diagnosis
85
86               We will then need to select the deaths by the state in which it
87               occurs, that is Cancer, DM or DM/ins. The sum of these
88               must be subtracted from the total poulation deaths to get the
89               deaths in the non-cancer, non-DM population. Only the deaths
90               from the states DM and DM/ins will be subject to analysis
91               and included in the dataset along with the cancer incidence
92               data, deaths in the cancer state will not be counted, regardless
93               of wheter DM has occurred previously or not
94         **********************************************************************;
95
96         data dead ;
97           set candi  ( where = ( doDD ge &validdate. and
98                                  doDD le &censdate.  and
99                                  doDD ge doDM        and
100                                 doDD ge doCA ) ) ;
101          length state $ 10 ;
102          state = "Well" ; * Hopefully no one will be left in this state ;
103          if ( doDM gt .z   and
104               doDM lt doDD and
105               doCA le .z )
106             then if ( doI gt .z )
107                  then state = "DM/Ins" ;
108                  else state = "DM" ;
109          if ( doCA gt .z )
110             then state = "Cancer" ;
111             * Note that the state Cancer here is ANY of the three cancer states,
112               including those subsequent to diabetes diagnosis. The deaths
113               occurring here are not going to be analysed in the round ;
114          * Compute timescales and birth cohort ;
115          A = floor( ( doDD - doBT ) / 365.25 ) ;
```

```
116            P = year( doDD ) ;
117            C = year( doBT ) ;
118            * Duration in prespecified intervals ;
119            do br = &durbreaks. ;
120               if  (doDD-doDM)/365.25 > br  then  DMdur = br ;
121               if  (doDD-doI )/365.25 > br  then Insdur = br ;
122            end ;
123            * Restrict to the relevant age range
124              (population deaths are coded 99 for 99+ ages) ;
125            if A < 99 ;
126          run ;

NOTE: Missing values were generated as a result of performing an operation on missing values.
      Each place is given by: (Number of times) at (Line):(Column).
      5985198 at 120:15   5985198 at 120:21   8250238 at 121:15   8250238 at 121:21
NOTE: There were 396406 observations read from the data set WORK.CANDI.
      WHERE (doDD>='01JAN1995'D and doDD<='31DEC2009'D) and (doDD>=doDM) and (doDD>=doCA);
NOTE: The data set WORK.DEAD has 395024 observations and 17 variables.
NOTE: DATA statement used (Total process time):
      real time           8.10 seconds
      cpu time            2.31 seconds


127
128          title "All deaths in the union of the Cancer register and the Diabetes register" ;
129          proc tabulate  data = dead  noseps  missing  formchar = "           " ;
130            class A P DMdur Insdur state DMtype ;
131            table all P DMdur Insdur,
132                  all              * f=comma8.
133               state * DMtype * f=comma7.
134                  / rts=8 ;
135            table all A="Age",
136                  P * f=comma6.
137                  / rts = 5 ;
138            keylabel n = ' ' ;
139          run ;

NOTE: There were 395024 observations read from the data set WORK.DEAD.
NOTE: The PROCEDURE TABULATE printed pages 1-3.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           0.98 seconds
      cpu time            0.67 seconds


140
141          * Collapse deaths over the duration variables ;
142          proc summary  data = dead  nway ;
143            class sex A P ;
144            output out = tdead ( keep = sex A P _freq_
145                                 rename = ( _freq_ = DD ) ) ;
146          run ;

NOTE: There were 395024 observations read from the data set WORK.DEAD.
NOTE: The data set WORK.TDEAD has 2774 observations and 4 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           0.23 seconds
      cpu time            0.25 seconds


147
148          * Get the population mortality data (i.e. deaths), restrict to the relevant period ;
149          data mort ;
150            set demodb.mdk1974ff ( rename = ( agr = A
151                                              per = P
152                                                D = DAll ) ) ;
153            if ( &Plo. < P < &Phi. and
154                 -0.1 < A < 99 ) ;
155          run ;

NOTE: There were 7200 observations read from the data set DEMODB.MDK1974FF.
NOTE: The data set WORK.MORT has 2970 observations and 6 variables.
NOTE: DATA statement used (Total process time):
      real time           0.03 seconds
      cpu time            0.00 seconds


156
157          proc sort  data = mort ;
158            by sex A P ;
159          run ;

NOTE: There were 2970 observations read from the data set WORK.MORT.
NOTE: The data set WORK.MORT has 2970 observations and 6 variables.
NOTE: PROCEDURE SORT used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds


160
```

```
161        title "Deaths in the total Danish population" ;
162        proc tabulate  data = mort  noseps  missing  formchar="           " ;
163          var Dall ;
164          class sex A P ;
165          table all A="Age",
166                P * Dall=" " * f=comma6.
167              / rts = 5 ;
168          keylabel sum = ' ' ;
169        run ;

NOTE: There were 2970 observations read from the data set WORK.MORT.
NOTE: The PROCEDURE TABULATE printed pages 4-5.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds


170
171        * Merge the population deaths with the deaths among DM and cancer patients,
172        in order to subtract the latter from the former to get the deaths from state Well ;
173
174        data mortwell ;
175          merge mort tdead ;
176          by sex A P ;
177          keep state sex A P DD ;
178          length state $ 10 ;
179          if DD le .z then DD = 0 ;
180          state = "Well" ;
181          DD = DAll - DD ;
182        run ;

NOTE: There were 2970 observations read from the data set WORK.MORT.
NOTE: There were 2774 observations read from the data set WORK.TDEAD.
NOTE: The data set WORK.MORTWELL has 2970 observations and 5 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds


183
184        title "Dead in state Well" ;
185        proc tabulate  data = mortwell  noseps  missing  formchar="           " ;
186          var DD ;
187          class sex A P ;
188          table all A="Age",
189                all * DD=" " * f=comma7.
190                  P * DD=" " * f=comma6.
191                / rts = 5 ;
192          keylabel sum = ' ' ;
193        run ;

NOTE: There were 2970 observations read from the data set WORK.MORTWELL.
NOTE: The PROCEDURE TABULATE printed pages 6-7.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds


194
195        title "Deaths among all non-cancer DM-patients" ;
196        proc summary  data = dead  nway  missing ;
197          where substr(state,1,2) eq "DM" ;
198          class DMtype sex A P DMdur Insdur state ;
199          output out = tdeadd ( keep = DMtype state sex A P DMdur Insdur _freq_
200                                rename = ( _freq_ = DD ) ) ;
201        run ;

NOTE: There were 93422 observations read from the data set WORK.DEAD.
      WHERE SUBSTR(state, 1, 2)='DM';
NOTE: The data set WORK.TDEADD has 42590 observations and 8 variables.
NOTE: PROCEDURE SUMMARY used (Total process time):
      real time           0.34 seconds
      cpu time            0.39 seconds


202
203        proc tabulate  data = tdeadd  noseps  formchar="           " missing ;
204          class DMtype state sex A P DMdur Insdur ;
205          var DD ;
206          table all DMdur Insdur,
207                state * DMtype * DD=" " * f=comma7.
208                / rts=8 ;
209          keylabel sum = ' ' ;
210        run ;

NOTE: There were 42590 observations read from the data set WORK.TDEADD.
NOTE: The PROCEDURE TABULATE printed page 8.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           0.07 seconds
```

```
      cpu time            0.12 seconds


211
212        ********************************************************************** ;
213        * Stack data and clean out the two inaccurate negative death counts ;
214        data data.DMmortD ;
215          set mortwell
216              tdeadd ;
217          DD = max( DD, 0 ) ;
218        run ;

NOTE: There were 2970 observations read from the data set WORK.MORTWELL.
NOTE: There were 42590 observations read from the data set WORK.TDEADD.
NOTE: The data set DATA.DMMORTD has 45560 observations and 8 variables.
NOTE: DATA statement used (Total process time):
      real time           0.15 seconds
      cpu time            0.01 seconds


219
220        proc tabulate  data = data.DMmortD  missing  noseps  formchar="           " ;
221          class DMtype state sex A P DMdur Insdur ;
222          var DD ;
223          table all P DMdur Insdur,
224                ( all sex state*DMtype ) * DD=" " * f=comma7.
225                / rts=8 ;
226          keylabel sum = ' ' ;
227        run ;

NOTE: There were 45560 observations read from the data set DATA.DMMORTD.
NOTE: The PROCEDURE TABULATE printed page 9.
NOTE: PROCEDURE TABULATE used (Total process time):
      real time           0.07 seconds
      cpu time            0.12 seconds


228
229        proc contents  data = data.DMmortD ;
230        run ;

NOTE: PROCEDURE CONTENTS used (Total process time):
      real time           0.54 seconds
      cpu time            0.00 seconds

NOTE: The PROCEDURE CONTENTS printed page 10.

231
232        * Finally export the relevant data for analysis in XPT format ;
233        libname xptD xport '../data/DMmortD.xpt';
NOTE: Libref XPTD was successfully assigned as follows:
      Engine:        XPORT
      Physical Name: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data\DMmortD.xpt
234        proc copy in=data out=xptD memtype=data;  select DMmortD ; run;

NOTE: Copying DATA.DMMORTD to XPTD.DMMORTD (memtype=DATA).
NOTE: There were 45560 observations read from the data set DATA.DMMORTD.
NOTE: The data set XPTD.DMMORTD has 45560 observations and 8 variables.
NOTE: PROCEDURE COPY used (Total process time):
      real time           0.20 seconds
      cpu time            0.03 seconds


NOTE: SAS Institute Inc., SAS Campus Drive, Cary, NC USA 27513-2414
NOTE: The SAS System used:
      real time           55.46 seconds
      cpu time            11.24 seconds

All deaths in the union of the Cancer register and the Diabetes register                21:40 Monday, March 21, 2011   1


                                                      state

                             Cancer                    DM                DM/Ins           Well

                             DMtype                  DMtype              DMtype         DMtype

          All       .       0       1       2       0       2       0       1       2       2

 All     395,024 259,392  15,132      12  26,953  25,513  41,681  18,754     104   7,370     113
 P
 1995     25,444  18,062   1,619       1     206   3,753     432   1,337       1      26       7
 1996     24,791  17,604   1,385       .     468   3,120     845   1,303       1      58       7
 1997     25,097  17,750   1,334       1     660   2,753   1,180   1,337       .      73       9
 1998     24,816  17,349   1,231       .     830   2,352   1,594   1,313       3     137       7
 1999     25,648  17,568   1,240       1   1,108   2,231   1,968   1,317       2     200      13
 2000     25,884  17,599   1,103       .   1,343   1,903   2,297   1,345       6     277      11
 2001     26,039  17,532   1,009       2   1,568   1,649   2,643   1,290       2     337       7
 2002     26,564  17,454     941       1   1,827   1,508   3,003   1,378       7     436       9
```

```
 2003     26,847  17,306     972       .   2,062   1,253   3,341   1,330       9     565       9
 2004     26,484  16,920     855       1   2,238   1,102   3,522   1,237       7     596       6
 2005     26,653  16,676     794       .   2,471     977   3,807   1,159      13     749       7
 2006     27,552  17,223     740       1   2,724     909   3,942   1,160       9     839       5
 2007     27,620  17,007     677       .   2,966     732   4,143   1,135      10     942       8
 2008     27,659  16,898     621       3   3,119     641   4,283   1,034      13   1,042       5
 2009     27,926  16,444     611       1   3,363     630   4,681   1,079      21   1,093       3
 DMdur
 .       259,532 259,392       .       .      27       .       .       .       .       .     113
 0         7,103       .      11       .   2,955      23   3,957       1       4     152       .
 0.25      4,022       .      33       1   1,773      76   1,994      10       2     133       .
 0.5       3,468       .      40       .   1,397     102   1,743       9       4     173       .
 0.75      3,222       .      79       2   1,160     149   1,670      23       4     135       .
 1         3,090       .      99       .   1,033     230   1,544      33       1     150       .
 1.25      2,848       .     107       .     962     208   1,391      28       1     151       .
 1.5       2,792       .     109       1     860     297   1,345      43       4     133       .
 1.75      2,803       .     132       1     823     288   1,377      35       3     144       .
 2         5,401       .     272       1   1,541     627   2,506     122       3     329       .
 2.5       5,203       .     285       .   1,404     710   2,357     153       1     293       .
 3         5,300       .     354       1   1,272     803   2,350     214       2     304       .
 3.5       5,233       .     412       1   1,193     912   2,152     255       3     305       .
 4         5,408       .     495       1   1,127   1,138   1,937     370       5     335       .
 4.5       5,897       .     609       .   1,058   1,423   1,927     528       5     347       .
 5        11,574       .   1,341       .   1,941   2,899   3,360   1,350      10     673       .
 6         9,961       .   1,214       1   1,535   2,475   2,698   1,414       6     618       .
 7        16,636       .   2,361       .   2,431   4,075   3,745   2,805      18   1,201       .
 9        12,664       .   2,080       2   1,482   3,135   2,235   2,764      16     950       .
 11        9,408       .   1,784       .     747   2,451   1,085   2,704      11     626       .
 13        6,432       .   1,499       .     232   1,786     308   2,388       1     218       .
 15        4,122       .   1,049       .       .   1,134       .   1,939       .       .       .
 17        2,357       .     608       .       .     511       .   1,238       .       .       .
 19          548       .     159       .       .      61       .     328       .       .       .
 Insdur
 .       357,418 259,392   8,937       .  21,766  25,513  41,681       9       .       7     113
 0         3,186       .     395       .   1,264       .       .     716       4     807       .
 0.25      1,725       .     214       1     619       .       .     448       2     441       .
 0.5       1,484       .     200       .     430       .       .     461       5     388       .
 0.75      1,459       .     232       2     328       .       .     551       4     342       .
 1         1,317       .     180       .     239       .       .     587       1     310       .
 1.25      1,175       .     187       .     165       .       .     528       1     294       .
 1.5       1,200       .     177       1     166       .       .     576       4     276       .
 1.75      1,147       .     170       1     158       .       .     541       2     275       .
 2         2,151       .     335       1     260       .       .     993       3     559       .
 2.5       1,962       .     295       .     246       .       .     973       2     446       .
 3         1,791       .     290       1     174       .       .     924       1     401       .
 3.5       1,678       .     263       1     151       .       .     876       3     384       .
 4         1,601       .     265       1     145       .       .     848       6     336       .
 4.5       1,467       .     233       .     146       .       .     776       5     307       .
 5         2,554       .     411       1     180       .       .   1,442       9     511       .
 6         2,165       .     433       .     156       .       .   1,194       6     376       .
 7         3,607       .     630       .     215       .       .   2,238      19     505       .
 9         2,488       .     489       2      97       .       .   1,620      15     265       .
 11        1,807       .     404       .      34       .       .   1,239      11     119       .
 13        1,290       .     318       .      14       .       .     936       1      21       .
 15          352       .      74       .       .       .       .     278       .       .       .

All deaths in the union of the Cancer register and the Diabetes register               21:40 Monday, March 21, 2011   2


                                                        P

        1995   1996   1997   1998   1999   2000   2001   2002   2003   2004   2005   2006   2007   2008   2009

 All  25,444 24,791 25,097 24,816 25,648 25,884 26,039 26,564 26,847 26,484 26,653 27,552 27,620 27,659 27,926
 Age
 0         5      2      5      2      2      1      2      .      4      2      1      4      5      2      2
 1         2      4      1      3      2      2      2      4      3      4      3      1      .      2      2
 2         1      1      3      4      3      .      8      3      6      .      2      1      4      1      2
 3         5      3      3      3      3      2      2      2      1      4      .      1      2      1      2
 4         3      1      3      4      3      2      3      3      3      5      3      .      2      .      3
 5         5      2      3      4      2      4      3      2      3      1      2      4      1      1      .
 6         1      6      2      .      2      1      3      1      1      2      3      1      2      .      4
 7         2      1      1      2      2      1     11      2      .      2      2      2      3      3      3
 8         1      4      3      3      1      1      1      1      1      1      2      2      .      3      3
 9         2      2      4      3      3      1      6      4      2      6      2      .      .      .      .
 10        4      3      3      2      .      3      1      3      2      .      .      1      2      2      1
 11        4      2      4      3      4      1      2      2      2      2      .      2      1      3      3
 12        2      3      .      2      3      3      3      2      2      5      2      2      .      1      3
 13        2      2      5      1      2      5      7      2      1      2      1      1      2      3      2
 14        5      1      2      2      1      1      5      2      2      2      3      .      2      4      1
 15        4      4      3      1      1      .      .      3      4      4      3      3      5      .      2
 16        .      1      4      5      2      7      .      3      .      6      1      5      3      4      4
 17        7      1      2      2      1      6      1      1      5      1      4      6      2      2      1
 18        5      4      1      5      6      4      3      5      1      2      6      4      7      5      6
 19        2      3      8      .      6      5      3      3      4      2      4      2      1      4      4
 20        6      6      3      5      2      8      2      3      1      4      3      2      1      1      3
 21        6      2      4      4      4      5      3      4      4     10      3      3      1      5      5
 22        9      3      9      2      4      .      1      9      7      2      2      4      6      4      5
 23        4      .      7      3      5      6      4      7      5      2      7      4      3      7     11
```

```
 24        7       4       7       8       4       4       3       7       9       6       7      10       2       5       4
 25        8       9       3       6       7       6       5      10       2       9       7       6       8       3       6
 26        7       5       8      11       9       7       3       5       5       3       7      13       5       7      11
 27       18       8       5       5       8      13       9      11       9       6       6       7       8      11       9
 28        6       9      12       5      12       9       9      11       7       7      11       9       7       7      11
 29       13      14      15      12       9      18       5      12      12       9      16      13      12       9       7
 30       13      18      19      14      14       9      10      10      15      10      14      10       7      15       7
 31       18      12      20      11      24      14      14      14      11      12      12      13      10      19      13
 32       17      24      19      23      25      17      16      19      14      19       9      16      14      12      13
 33       24      25      21      23      18      18      19      16      18      22      11      14      16      17      19
 34       19      29      23      19      27      15      18      22      16      17      16      11      18      19      21
 35       28      25      24      28      21      21      24      25      23      18      27      23      19      19      18
 36       24      33      25      18      14      24      26      36      39      22      12      17      13      25      25
 37       34      29      32      23      29      27      31      33      25      37      24      25      13      20      29
 38       40      19      28      31      45      33      35      33      28      31      37      32      19      22      27
 39       39      40      37      42      37      33      37      36      36      35      40      50      40      35      28
 40       26      52      55      54      37      54      39      41      34      45      48      48      27      38      29
 41       44      61      60      42      50      43      34      57      49      45      46      52      43      45      34
 42       59      65      62      61      47      39      58      59      67      34      43      63      58      55      56
 43       63      74      65      55      50      72      50      55      38      64      60      62      55      55      60
 44       74      73      89      77      63      68      69      72      65      69      63      79      75      67      52
 45       84      86      83      89      73      78      97      78      96      80      90      65      87      59      73
 46      100      89      90      95      90      96      94     104      87      65      79      73      79      82      73
 47      109     125     107     108     112     108      91     100      89      94      82      86      92      98      89
 48      161     135     115     105     111     124     134     122     131     111     100     104     110      93     108
 49      153     144     173     129     119     137     115     127     138     129     113     117     131     127     124
 50      197     180     184     149     178     149     145     151     158     138     136     135     131     136     115
 51      208     205     203     201     199     173     161     159     137     160     151     144     184     155     138
 52      202     199     212     209     198     194     192     200     173     194     186     208     191     171     191
 53      200     237     256     253     262     232     231     234     213     202     199     187     207     177     193
 54      201     226     211     234     281     264     253     237     217     235     211     200     217     208     210
 55      251     221     254     250     311     311     307     257     258     240     250     227     221     240     260
 56      240     225     276     261     303     302     302     351     331     292     248     281     317     262     282
 57      242     266     265     253     288     331     382     360     355     328     308     301     292     239     248
 58      272     293     284     265     275     329     341     377     423     382     364     337     359     322     298
 59      331     300     312     323     342     330     374     371     361     424     439     427     369     326     334
 60      354     338     362     346     318     343     289     353     424     474     454     455     439     428     367
 61      369     353     373     358     361     365     357     375     396     432     464     472     503     489     452
 62      387     391     384     390     387     405     406     391     395     402     484     563     547     523     508
 63      410     414     453     426     434     443     416     421     426     467     427     489     518     554     555
 64      500     464     458     458     464     452     433     461     429     452     433     464     533     563     619
 65      500     518     452     455     454     458     483     453     466     492     507     472     545     617     611
 66      493     482     515     513     494     519     507     530     464     482     530     544     526     573     640
 67      582     580     590     549     575     574     543     549     514     513     564     577     528     548     582
 68      608     536     567     605     600     545     577     569     608     547     554     599     565     606     582
 69      687     666     637     637     563     631     648     619     620     579     596     637     594     565     631
 70      682     689     635     646     652     639     639     631     628     653     605     651     661     638     667
 71      769     714     694     696     681     687     664     684     662     656     647     652     684     713     620
 72      732     759     794     691     707     748     686     718     726     677     671     703     727     722     730
 73      758     744     839     772     734     764     744     758     822     753     714     755     724     715     690
 74      863     839     719     802     823     735     778     777     785     730     785     749     710     747     778
 75      910     835     851     865     834     845     866     769     804     770     807     809     824     789     806
 76      876     856     912     885     888     881     855     899     870     835     789     796     840     811     813
 77      780     844     899     888     918     847     894     848     854     843     894     877     820     869     857
 78      840     859     804     923     957     907     909     865     903     898     882     938     841     862     954
 79      813     800     797     750     966     971     900     899     899     915     886     901     902     883     874
 80      896     805     817     834     826     918     966     901     902     914     900     964     837     904     933
 81      924     837     810     774     830     830     906     945     910     891     915     893     935     931     889
 82      794     839     826     775     816     833     809     935     948     909     864     921     976     902     908
 83      858     766     749     771     785     791     801     812     982     891     912     913     914     905     911
 84      789     753     815     766     768     733     798     808     804     892     910     876     907     907     928
 85      744     695     737     701     737     696     767     772     779     748     867     927     920     851     883
 86      679     708     603     665     719     715     728     711     737     775     752     885     871     853     854
 87      607     569     634     603     647     694     649     700     712     679     670     683     825     821     855
 88      552     526     572     559     591     587     613     663     639     591     617     671     668     732     719
 89      449     441     449     461     527     517     538     656     622     561     564     642     615     663     721

(Continued)
All deaths in the union of the Cancer register and the Diabetes register                            21:40 Monday, March 21, 2011   3

                                                                P

       1995    1996    1997    1998    1999    2000    2001    2002    2003    2004    2005    2006    2007    2008    2009

 Age
 90      411     359     353     385     438     500     478     516     545     485     490     531     551     537     569
 91      298     312     338     329     365     409     427     399     431     498     476     476     464     469     515
 92      248     266     273     267     309     310     326     378     398     403     395     427     414     413     405
 93      216     200     200     201     233     264     253     265     313     282     312     327     346     378     359
 94      173     137     161     182     179     208     199     219     230     251     246     254     263     301     265
 95      103     114     127     126     117     128     154     153     172     206     209     189     200     246     214
 96       84      68      80      90      90     100     116     117     121     121     168     164     162     165     173
 97       52      59      49      71      65      62      56      93      85      96      83     105     124     125     117
 98       35      36      32      44      40      59      52      69      69      56      79      81      86      83      85

Deaths in the total Danish population                                                               21:40 Monday, March 21, 2011   4
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                                                     Period

      1995   1996   1997   1998   1999   2000   2001   2002   2003   2004   2005   2006   2007   2008   2009

All 62,730 60,655 59,552 58,106 58,774 57,575 57,923 58,141 57,081 55,322 54,437 54,917 55,038 54,015 54,255
Age
0      353    376    351    309    282    358    320    284    286    283    280    250    256    262    193
1       36     43     33     42     21     28     28     32     21     27     17     17     23     19     20
2       17     15     19     21     20      8     18     15     23     13      7      8     14     13     12
3       16     15     12     13     10     12     16     16      9     10     14      9      5      9      6
4       16     14     12     15     11      7      9      5     14     11     12      5     10      3      6
5        9      9     10     11      8     12      7      5      5      6      5      8      3      6      3
6        8     11      9      5     12      5      9      7      9      5      4      4     11      0      8
7       13      7      6      7     10      2     15      4      7      8      5     10      6      9      7
8       10     10      6      6      5      7      9      8      6      5      9      7      6      9      4
9        7      7      5     13      6      7     11      8      7     10      7      5      2      3      2
10      11      8     12      5      3     10     10      6     10      5      4      8      5      6      3
11       5     11     10     11      8      7      8      5     10     10      4      8      7      7      6
12       7      9      4      8     11      8      9      9      9     12      7      4      2      5      7
13       8      9     10      9     12      9     10      6      6     13      6     10      5     15      6
14      15     17     12      7     14     10     14     12     13     12      9     11     19      8      7
15      14     17     14     11     12     14     15     18     13     13     12     14     14      4      9
16      16     18     20     27      8     22     18     21     12     21     20     17     24     18     18
17      26     23     20     17     26     34     19     24     22     11     23     29     25     15     22
18      47     40     43     42     38     32     27     31     23     36     35     26     32     35     32
19      55     36     46     23     35     34     28     34     26     24     26     25     21     36     21
20      42     54     31     41     41     37     27     32     24     31     28     28     24     27     19
21      48     41     38     33     36     44     33     23     22     33     23     34     34     29     21
22      50     43     36     18     33     35     31     35     35     21     18     31     27     30     33
23      46     42     39     28     41     33     32     37     31     33     23     23     26     36     34
24      50     40     57     38     44     48     27     40     44     43     27     29     24     42     20
25      64     34     46     44     57     35     33     42     37     37     36     25     28     17     36
26      54     41     43     42     51     44     30     39     32     23     37     39     26     30     34
27      83     49     53     51     41     55     53     43     42     34     36     22     28     26     35
28      57     55     50     51     55     39     50     39     33     38     38     31     42     36     31
29      80     76     53     52     57     52     45     44     47     39     51     32     45     32     34
30      74     67     70     47     65     55     39     46     49     46     41     38     27     40     41
31      65     67     82     64     65     44     56     58     57     48     39     46     50     48     40
32      87     91     91     89     73     58     43     60     51     54     52     48     48     40     37
33     103     88     74     81     71     70     69     61     59     69     49     44     46     61     45
34      87     99     74     80     77     66     80     77     57     61     52     58     57     53     58
35     100     91     98     94     83     70    100     83     86     61     61     59     63     59     55
36      98    119     83     86     69    101     82     87     93     82     59     71     63     84     68
37     122    102     85     89     95     82    108     94     82    105     69     68     61     65     63
38     114    110    116     99    114     91    106    105     93    113     88     86     71     58     79
39     152    128    141    142    104    116    123    144    102    108     91    108     99     94     87
40     157    153    163    147    118    147    108    123    111    122    120    117     98     99     82
41     162    172    167    138    131    134    119    132    127    130    116    133    124    120    104
42     185    195    155    169    145    131    152    153    144    127    105    152    154    136    147
43     188    194    197    170    149    159    161    137    140    157    132    132    153    137    150
44     197    201    219    214    206    168    167    187    173    171    159    172    169    155    123
45     212    210    206    210    195    164    215    185    211    205    182    164    179    151    162
46     258    229    214    221    224    234    214    224    206    175    197    181    203    176    161
47     270    278    263    231    249    244    228    205    206    221    188    196    199    214    197
48     327    301    247    261    269    272    295    249    276    250    235    238    227    214    216
49     354    342    365    278    299    293    248    271    315    275    276    246    276    265    228
50     394    389    375    333    315    306    334    329    325    277    273    292    291    278    235
51     386    410    384    382    367    358    306    316    301    332    324    294    329    301    272
52     403    401    436    423    392    361    367    353    349    358    351    413    377    328    346
53     372    452    436    455    467    398    416    409    388    368    397    364    392    353    365
54     386    435    445    448    502    484    468    467    409    439    383    409    422    382    380
55     448    452    477    446    516    548    546    474    463    450    442    398    407    418    484
56     439    424    490    504    515    515    557    579    550    507    437    483    511    449    470
57     517    495    477    456    517    546    621    598    613    550    489    514    492    430    434
58     535    548    499    483    523    579    596    639    697    615    584    573    572    537    506
59     605    575    524    570    566    587    608    620    615    666    694    700    601    547    546
60     683    635    636    640    589    557    537    614    653    739    717    730    700    684    612
61     695    662    628    638    624    623    616    619    651    690    728    792    831    725    719
62     739    732    700    694    687    686    630    658    670    664    750    867    835    838    785
63     792    779    785    774    738    708    703    688    721    722    706    747    832    862    890
64     907    826    775    850    778    774    740    748    716    740    678    776    810    861    966
65     949    982    845    845    815    807    796    748    792    776    739    736    847    918    939
66     970    932    939    955    883    902    856    878    757    791    801    866    820    891    917
67   1,115  1,111  1,092  1,018  1,020    948    917    945    884    842    886    830    786    855    902
68   1,175  1,079  1,056  1,068  1,061    977    996    967    979    902    895    904    891    938    869
69   1,364  1,253  1,220  1,168  1,075  1,110  1,106  1,026  1,033    967    956    964    948    910    952
70   1,402  1,289  1,266  1,199  1,230  1,142  1,116  1,089  1,044  1,030    966  1,037  1,018    974  1,009
71   1,487  1,426  1,327  1,289  1,214  1,273  1,202  1,207  1,132  1,113  1,045  1,069  1,098  1,093    970
72   1,571  1,509  1,496  1,368  1,313  1,333  1,260  1,221  1,240  1,174  1,093  1,108  1,146  1,145  1,102
73   1,673  1,565  1,613  1,483  1,469  1,380  1,391  1,383  1,347  1,270  1,214  1,239  1,172  1,133  1,138
74   1,839  1,681  1,552  1,607  1,558  1,430  1,417  1,413  1,387  1,278  1,321  1,265  1,183  1,173  1,247
75   1,923  1,833  1,714  1,748  1,610  1,619  1,576  1,492  1,444  1,374  1,379  1,383  1,351  1,274  1,314
76   1,783  1,925  1,911  1,801  1,747  1,664  1,619  1,680  1,553  1,484  1,386  1,388  1,390  1,344  1,300
77   1,844  1,825  1,881  1,832  1,850  1,750  1,759  1,729  1,631  1,560  1,538  1,533  1,402  1,486  1,438
78   1,855  1,926  1,774  1,933  1,943  1,901  1,882  1,753  1,784  1,658  1,586  1,604  1,558  1,479  1,589
79   2,023  1,865  1,836  1,753  2,020  1,972  1,921  1,888  1,770  1,747  1,685  1,680  1,597  1,562  1,568
80   2,076  1,924  1,909  1,894  1,867  2,015  2,043  1,909  1,862  1,833  1,769  1,730  1,648  1,651  1,674
81   2,237  2,046  1,882  1,848  1,925  1,804  2,002  2,070  1,941  1,862  1,841  1,793  1,825  1,724  1,670
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82   2,117   2,169   2,017   1,937   1,944   1,902   1,875   2,113   2,060   1,921   1,814   1,846   1,908   1,748   1,795
83   2,201   2,077   2,000   1,935   1,969   1,841   1,943   1,910   2,168   1,991   1,948   1,869   1,897   1,825   1,854
84   2,117   2,052   2,217   1,930   1,970   1,852   1,897   1,900   1,821   2,003   2,004   1,866   1,891   1,811   1,889
85   2,093   1,995   2,013   1,967   2,018   1,851   1,873   1,862   1,904   1,719   1,978   1,981   1,981   1,818   1,846
86   2,058   1,943   1,876   1,896   1,946   1,901   1,862   1,865   1,767   1,758   1,748   1,988   1,957   1,847   1,883
87   1,916   1,844   1,871   1,748   1,835   1,953   1,858   1,892   1,806   1,725   1,676   1,614   1,968   1,859   1,889
88   1,774   1,664   1,813   1,740   1,770   1,696   1,771   1,850   1,697   1,631   1,622   1,639   1,685   1,736   1,841
89   1,513   1,520   1,527   1,498   1,674   1,605   1,691   1,759   1,721   1,564   1,544   1,634   1,599   1,590   1,727


(Continued)
Deaths in the total Danish population                                                21:40 Monday, March 21, 2011   5

                                                          Period

      1995    1996    1997    1998    1999    2000    2001    2002    2003    2004    2005    2006    2007    2008    2009

Age
90   1,388   1,392   1,319   1,371   1,503   1,467   1,551   1,615   1,644   1,465   1,460   1,400   1,447   1,489   1,490
91   1,236   1,230   1,237   1,229   1,264   1,319   1,381   1,316   1,405   1,398   1,346   1,357   1,330   1,347   1,349
92   1,087     991   1,027   1,043   1,110   1,071   1,203   1,304   1,259   1,247   1,212   1,252   1,224   1,208   1,158
93     864     832     844     837     885     940     967     980   1,025     978   1,056   1,010   1,046   1,055   1,067
94     750     725     688     720     758     733     798     863     831     857     854     897     855     963     914
95     539     525     567     536     611     574     633     625     636     676     727     679     734     757     725
96     399     401     430     408     441     463     469     504     481     532     592     562     560     586     605
97     302     291     318     292     337     341     324     382     364     369     383     430     400     444     442
98     214     211     198     204     234     262     249     287     275     263     286     286     313     333     341

Dead in state Well                                                                   21:40 Monday, March 21, 2011   6

                                                                Period

        All   1995    1996    1997    1998    1999    2000    2001    2002    2003    2004    2005    2006    2007    2008    2009

All 463,497 37,286 35,864 34,455 33,290 33,126 31,691 31,884 31,577 30,234 28,838 27,784 27,365 27,418 26,356 26,329
Age
0     4,404     348     374     346     307     280     357     318     284     282     281     279     246     251     260     191
1       372      34      39      32      39      19      26      26      28      18      23      14      16      23      17      18
2       184      16      14      16      17      17       8      10      12      17      13       5       7      10      12      10
3       138      11      12       9      10       7      10      14      14       8       6      14       8       3       8       4
4       112      13      13       9      11       8       5       6       2      11       6       9       5       8       3       3
5        70       4       7       7       7       6       8       4       3       2       5       3       4       2       5       3
6        78       7       5       7       5      10       4       6       6       8       3       1       3       9       0       4
7        79      11       6       5       5       8       1       4       2       7       6       3       8       3       6       4
8        80       9       6       3       3       4       6       8       7       5       4       7       5       6       6       1
9        65       5       5       1      10       3       6       5       4       5       4       5       5       2       3       2
10       79       7       5       9       3       3       7       9       3       8       5       4       7       3       4       2
11       82       1       9       6       8       4       6       6       3       8       8       4       6       6       4       3
12       78       5       6       4       6       8       5       6       7       7       7       5       2       2       4       4
13       96       6       7       5       8      10       4       3       4       5      11       5       9       3      12       4
14      147      10      16      10       5      13       9       9      10      11      10       6      11      17       4       6
15      157      10      13      11      10      11      14      15      15       9       9       9      11       9       4       7
16      235      16      17      16      22       6      15      18      18      12      15      19      12      21      14      14
17      294      19      22      18      15      25      28      18      23      17      10      19      23      23      13      21
18      455      42      36      42      37      32      28      24      26      22      34      29      22      25      30      26
19      419      53      33      38      23      29      29      25      31      22      22      22      23      20      32      17
20      436      36      48      28      36      39      29      25      29      23      27      25      26      23      26      16
21      429      42      39      34      29      32      39      30      19      18      23      20      31      33      24      16
22      409      41      40      27      16      29      35      30      26      28      19      16      27      21      26      28
23      429      42      42      32      25      36      27      28      30      26      31      16      19      23      29      23
24      486      43      36      50      30      40      44      24      33      35      37      20      19      22      37      16
25      476      56      25      43      38      50      29      28      32      35      28      29      19      20      14      30
26      459      47      36      35      31      42      37      27      34      27      20      30      26      21      23      23
27      518      65      41      48      46      33      42      44      32      33      28      30      15      20      15      26
28      513      51      46      38      46      43      30      41      28      26      31      27      22      35      29      20
29      563      67      62      38      40      48      34      40      32      35      30      35      19      33      23      27
30      560      61      49      51      33      51      46      29      36      34      36      27      28      20      25      34
31      612      47      55      62      53      41      30      42      44      46      36      27      33      40      29      27
32      665      70      67      72      66      48      41      27      41      37      35      43      32      34      28      24
33      709      79      63      53      58      53      52      50      45      41      47      38      30      30      44      26
34      746      68      70      51      61      50      51      62      55      41      44      36      47      39      34      37
35      820      72      66      74      66      62      49      76      58      63      43      34      36      44      40      37
36      892      74      86      58      68      55      77      56      51      54      60      47      54      50      59      43
37      879      88      73      53      66      66      55      77      61      57      68      45      43      48      45      34
38      983      74      91      88      68      69      58      71      72      65      82      51      54      52      36      52
39    1,174     113      88     104     100      67      83      86     108      66      73      51      58      59      59      59
40    1,238     131     101     108      93      81      93      69      82      77      77      72      69      71      61      53
41    1,304     118     111     107      96      81      91      85      75      78      85      70      81      81      75      70
42    1,424     126     130      93     108      98      92      94      94      77      93      62      89      96      81      91
43    1,478     125     120     132     115      99      87     111      82     102      93      72      70      98      82      90
44    1,626     123     128     130     137     143     100      98     115     108     102      96      93      94      88      71
45    1,633     128     124     123     121     122      86     118     107     115     125      92      99      92      92      89
46    1,821     158     140     124     126     134     138     120     120     119     110     118     108     124      94      88
47    1,899     161     153     156     123     137     136     137     105     117     127     106     110     107     116     108
48    2,113     166     166     132     156     158     148     161     127     145     139     135     134     117     121     108
49    2,355     201     198     192     149     180     156     133     144     177     146     163     129     145     138     104
50    2,464     197     209     191     184     137     157     189     178     167     139     137     157     160     142     120
```

```
 51    2,484     178     205     181     181     168     185     145     157     164     172     173     150     145     146     134
 52    2,738     201     202     224     214     194     167     175     153     176     164     165     205     186     157     155
 53    2,749     172     215     180     202     205     166     185     175     175     166     198     177     185     176     172
 54    3,054     185     209     234     214     221     220     215     230     192     204     172     209     205     174     170
 55    3,111     197     231     223     196     205     237     239     217     205     210     192     171     186     178     224
 56    3,157     199     199     214     243     212     213     255     228     219     215     189     202     194     187     188
 57    3,291     275     229     212     203     229     215     239     238     258     222     181     213     200     191     186
 58    3,565     263     255     215     218     248     250     255     262     274     233     220     236     213     215     208
 59    3,661     274     275     212     247     224     257     234     249     254     242     255     273     232     221     212
 60    3,982     329     297     274     294     271     214     248     261     229     265     263     275     261     256     245
 61    4,122     326     309     255     280     263     258     259     244     255     258     264     320     328     236     267
 62    4,372     352     341     316     304     300     281     224     267     275     262     266     304     288     315     277
 63    4,594     382     365     332     348     304     265     287     267     295     255     279     258     314     308     335
 64    4,762     407     362     317     392     314     322     307     287     287     288     245     312     277     298     347
 65    5,051     449     464     393     390     361     349     313     295     326     284     232     264     302     301     328
 66    5,346     477     450     424     442     389     383     349     348     293     309     271     322     294     318     277
 67    5,783     533     531     502     469     445     374     374     396     370     329     322     253     258     307     320
 68    6,089     567     543     489     463     461     432     419     398     371     355     341     305     326     332     287
 69    6,742     677     587     583     531     512     479     458     407     413     388     360     327     354     345     321
 70    7,095     720     600     631     553     578     503     477     458     416     377     361     386     357     336     342
 71    7,722     718     712     633     593     533     586     538     523     470     457     398     417     414     380     350
 72    8,288     839     750     702     677     606     585     574     503     514     497     422     405     419     423     372
 73    9,184     915     821     774     711     735     616     647     625     525     517     500     484     448     418     448
 74    9,731     976     842     833     805     735     695     639     636     602     548     536     516     473     426     469
 75   10,650   1,013     998     863     883     776     774     710     723     640     604     572     574     527     485     508
 76   11,169     907   1,069     999     916     859     783     764     781     683     649     597     592     550     533     487
 77   12,126   1,064     981     982     944     932     903     865     881     777     717     644     656     582     617     581
 78   12,883   1,015   1,067     970   1,010     986     994     973     888     881     760     704     666     717     617     635
 79   13,731   1,210   1,065   1,039   1,003   1,054   1,001   1,021     989     871     832     799     779     695     679     694
 80   14,487   1,180   1,119   1,092   1,060   1,041   1,097   1,077   1,008     960     919     869     766     811     747     741
 81   15,250   1,313   1,209   1,072   1,074   1,095     974   1,096   1,125   1,031     971     926     900     890     793     781
 82   16,111   1,323   1,330   1,191   1,162   1,128   1,069   1,066   1,178   1,112   1,012     950     925     932     846     887
 83   16,667   1,343   1,311   1,251   1,164   1,184   1,050   1,142   1,098   1,186   1,100   1,036     956     983     920     943
 84   16,766   1,328   1,299   1,402   1,164   1,202   1,119   1,099   1,092   1,017   1,111   1,094     990     984     904     961
 85   17,075   1,349   1,300   1,276   1,266   1,281   1,155   1,106   1,090   1,125     971   1,111   1,054   1,061     967     963
 86   17,040   1,379   1,235   1,273   1,231   1,227   1,186   1,134   1,154   1,030     983     996   1,103   1,086     994   1,029
 87   17,106   1,309   1,275   1,237   1,145   1,188   1,259   1,209   1,192   1,094   1,046   1,006     931   1,143   1,038   1,034
 88   16,629   1,222   1,138   1,241   1,181   1,179   1,109   1,158   1,187   1,058   1,040   1,005     968   1,017   1,004   1,122
 89   15,740   1,064   1,079   1,078   1,037   1,147   1,088   1,153   1,103   1,099   1,003     980     992     984     927   1,006

(Continued)
Dead in state Well                                                                               21:40 Monday, March 21, 2011   7

                                                                                  Period

         All    1995    1996    1997    1998    1999    2000    2001    2002    2003    2004    2005    2006    2007    2008    2009

Age
 90   14,853     977   1,033     966     986   1,065     967   1,073   1,099   1,099     980     970     869     896     952     921
 91   13,538     938     918     899     900     899     910     954     917     974     900     870     881     866     878     834
 92   12,164     839     725     754     776     801     761     877     926     861     844     817     825     810     795     753
 93   10,237     648     632     644     636     652     676     714     715     712     696     744     683     700     677     708
 94    8,938     577     588     527     538     579     525     599     644     601     606     608     643     592     662     649
 95    7,086     436     411     440     410     494     446     479     472     464     470     518     490     534     511     511
 96    5,614     315     333     350     318     351     363     353     387     360     411     424     398     398     421     432
 97    4,177     250     232     269     221     272     279     268     289     279     273     300     325     276     319     325
 98    3,050     179     175     166     160     194     203     197     218     206     207     207     205     227     250     256

Deaths among all non-cancer DM-patients                                                          21:40 Monday, March 21, 2011   8

                                   state

                   DM                       DM/Ins

                 DMtype                     DMtype

                0       2       0       1       2

 All       25,513  41,681  18,754     104   7,370
 DMdur
 0             23   3,957       1       4     152
 0.25          76   1,994      10       2     133
 0.5          102   1,743       9       4     173
 0.75         149   1,670      23       4     135
 1            230   1,544      33       1     150
 1.25         208   1,391      28       1     151
 1.5          297   1,345      43       4     133
 1.75         288   1,377      35       3     144
 2            627   2,506     122       3     329
 2.5          710   2,357     153       1     293
 3            803   2,350     214       2     304
 3.5          912   2,152     255       3     305
 4          1,138   1,937     370       5     335
 4.5        1,423   1,927     528       5     347
 5          2,899   3,360   1,350      10     673
 6          2,475   2,698   1,414       6     618
```

```
7        4,075   3,745   2,805      18   1,201
9        3,135   2,235   2,764      16     950
11       2,451   1,085   2,704      11     626
13       1,786     308   2,388       1     218
15       1,134       .   1,939       .       .
17         511       .   1,238       .       .
19          61       .     328       .       .
Insdur
.       25,513  41,681       9       .       7
0            .       .     716       4     807
0.25         .       .     448       2     441
0.5          .       .     461       5     388
0.75         .       .     551       4     342
1            .       .     587       1     310
1.25         .       .     528       1     294
1.5          .       .     576       4     276
1.75         .       .     541       2     275
2            .       .     993       3     559
2.5          .       .     973       2     446
3            .       .     924       1     401
3.5          .       .     876       3     384
4            .       .     848       6     336
4.5          .       .     776       5     307
5            .       .   1,442       9     511
6            .       .   1,194       6     376
7            .       .   2,238      19     505
9            .       .   1,620      15     265
11           .       .   1,239      11     119
13           .       .     936       1      21
15           .       .     278       .       .
```

```
Deaths among all non-cancer DM-patients                                                     21:40 Monday, March 21, 2011   9

                                                       state

                                      DM                DM/Ins          Well

                         Sex        DMtype              DMtype          DMtype

            All   Males Females     0       2       0       1       2       .

All     556,920 274,133 282,787  25,513  41,681  18,754     104   7,370 463,498
Period
1995     42,835  21,359  21,476   3,753     432   1,337       1      26  37,286
1996     41,191  20,668  20,523   3,120     845   1,303       1      58  35,864
1997     39,798  19,777  20,021   2,753   1,180   1,337       .      73  34,455
1998     38,689  19,355  19,334   2,352   1,594   1,313       3     137  33,290
1999     38,844  19,004  19,840   2,231   1,968   1,317       2     200  33,126
2000     37,519  18,333  19,186   1,903   2,297   1,345       6     277  31,691
2001     37,805  18,406  19,399   1,649   2,643   1,290       2     337  31,884
2002     37,910  18,374  19,536   1,508   3,003   1,378       7     436  31,578
2003     36,732  17,993  18,739   1,253   3,341   1,330       9     565  30,234
2004     35,302  17,332  17,970   1,102   3,522   1,237       7     596  28,838
2005     34,489  16,906  17,583     977   3,807   1,159      13     749  27,784
2006     34,224  16,697  17,527     909   3,942   1,160       9     839  27,365
2007     34,380  16,846  17,534     732   4,143   1,135      10     942  27,418
2008     33,369  16,504  16,865     641   4,283   1,034      13   1,042  26,356
2009     33,833  16,579  17,254     630   4,681   1,079      21   1,093  26,329
DMdur
.       463,498 225,684 237,814       .       .       .       .       . 463,498
0         4,137   2,202   1,935      23   3,957       1       4     152       .
0.25      2,215   1,167   1,048      76   1,994      10       2     133       .
0.5       2,031   1,132     899     102   1,743       9       4     173       .
0.75      1,981   1,036     945     149   1,670      23       4     135       .
1         1,958   1,022     936     230   1,544      33       1     150       .
1.25      1,779     983     796     208   1,391      28       1     151       .
1.5       1,822     966     856     297   1,345      43       4     133       .
1.75      1,847     996     851     288   1,377      35       3     144       .
2         3,587   1,971   1,616     627   2,506     122       3     329       .
2.5       3,514   1,887   1,627     710   2,357     153       1     293       .
3         3,673   1,995   1,678     803   2,350     214       2     304       .
3.5       3,627   1,913   1,714     912   2,152     255       3     305       .
4         3,785   2,032   1,753   1,138   1,937     370       5     335       .
4.5       4,230   2,220   2,010   1,423   1,927     528       5     347       .
5         8,292   4,235   4,057   2,899   3,360   1,350      10     673       .
6         7,211   3,674   3,537   2,475   2,698   1,414       6     618       .
7        11,844   6,016   5,828   4,075   3,745   2,805      18   1,201       .
9         9,100   4,604   4,496   3,135   2,235   2,764      16     950       .
11        6,877   3,508   3,369   2,451   1,085   2,704      11     626       .
13        4,701   2,341   2,360   1,786     308   2,388       1     218       .
15        3,073   1,507   1,566   1,134       .   1,939       .       .       .
17        1,749     841     908     511       .   1,238       .       .       .
19          389     201     188      61       .     328       .       .       .
Insdur
.       530,708 259,922 270,786  25,513  41,681       9       .       7 463,498
0         1,527     808     719       .       .     716       4     807       .
0.25        891     475     416       .       .     448       2     441       .
0.5         854     462     392       .       .     461       5     388       .
```

```
 0.75       897     475     422       .       .     551       4     342       .
 1          898     492     406       .       .     587       1     310       .
 1.25       823     445     378       .       .     528       1     294       .
 1.5        856     462     394       .       .     576       4     276       .
 1.75       818     428     390       .       .     541       2     275       .
 2        1,555     802     753       .       .     993       3     559       .
 2.5      1,421     765     656       .       .     973       2     446       .
 3        1,326     750     576       .       .     924       1     401       .
 3.5      1,263     676     587       .       .     876       3     384       .
 4        1,190     666     524       .       .     848       6     336       .
 4.5      1,088     587     501       .       .     776       5     307       .
 5        1,962   1,086     876       .       .   1,442       9     511       .
 6        1,576     845     731       .       .   1,194       6     376       .
 7        2,762   1,495   1,267       .       .   2,238      19     505       .
 9        1,900   1,039     861       .       .   1,620      15     265       .
 11       1,369     737     632       .       .   1,239      11     119       .
 13         958     550     408       .       .     936       1      21       .
 15         278     166     112       .       .     278       .       .       .

Deaths among all non-cancer DM-patients                                                 21:40 Monday, March 21, 2011  10

The CONTENTS Procedure

Data Set Name        DATA.DMMORTD                             Observations          45560
Member Type          DATA                                     Variables             8
Engine               V9                                       Indexes               0
Created              21 March 2011 Monday 21:41:06 o'clock   Observation Length    72
Last Modified        21 March 2011 Monday 21:41:06 o'clock   Deleted Observations  0
Protection                                                    Compressed            NO
Data Set Type                                                 Sorted                NO
Label
Data Representation  WINDOWS_32
Encoding             wlatin1  Western (Windows)


                                Engine/Host Dependent Information

Data Set Page Size          8192
Number of Data Set Pages    404
First Data Page             1
Max Obs per Page            113
Obs in First Data Page      88
Number of Data Set Repairs  0
Filename                    C:\Bendix\Steno\DM-register\NDR\projects\Cancer\data\dmmortd.sas7bdat
Release Created             9.0202M0
Host Created                XP_PRO


       Alphabetic List of Variables and Attributes

#    Variable    Type    Len    Format    Label

1    A           Num       8              Age (99 ~ 99+)
4    DD          Num       8
7    DMdur       Num       8
6    DMtype      Num       8
8    Insdur      Num       8
3    P           Num       8              Period
2    sex         Num       8    SEX.      Sex
5    state       Char     10
```

Chapter 2

Statistical analysis with R

The statistical analyses is split across a number of separate programs in order to facilitate debugging and maintenance of the programs.

2.1 Read all datasets and convert to `.Rdata`

```
 R 2.12.1
 ---------------------------------------------
 Program:  readDM.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 31. marts 2011, 17:29:09
 ---------------------------------------------
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> library( foreign )
>
> # First, get the names of the diagnosis groups
> dxnam <- read.table( "../data/diagnames.txt", header=T, as.is=T )
>
> # Read the data sets from SAS and store in R format for analysis
>
> # The dataset classified by state, sex, A, P and C only; all patients
> dmca <- read.xport( "../data/dmcaA.xpt" )
> names(dmca) <- tolower(names(dmca))
> names(dmca)[grep("dmtype",names(dmca))] <- "DMtype"
> names(dmca)
 [1] "sex"    "a"      "p"      "c"      "y"      "d0"     "d101"   "d113"  
 [9] "d999"   "d92"    "d139"   "d26"    "d91"    "d132"   "d131"   "d103"  
[17] "d33"    "d51"    "d242"   "d121"   "d241"   "d22"    "d251"   "d243"  
[25] "d21"    "d28"    "d133"   "d70"    "d249"   "d84"    "d83"    "d82"   
[33] "state"  "DMtype" "ax"     "px"     "cx"     "d24"    "d259"  
> dmca <- transform( dmca, state = Relevel(dmca$state,3),
+                          State = Relevel(dmca$state,list(3,1:2)),
+                            sex = factor(sex,labels=c("M","F")) )
> addmargins( with( dmca, tapply(y ,list(p,state),sum,na.rm=T) ) )
         Well         DM    DM/Ins      Sum
1995  4997400   65787.74  29371.06  5092559
1996  5017439   70299.86  31949.12  5119688
1997  5028556   75704.82  34089.55  5138351
1998  5036218   81673.93  35937.20  5153829
1999  5041089   88212.86  38101.93  5167404
2000  5045751   94909.44  40369.14  5181029
2001  5051179  102402.67  42615.91  5196197
2002  5052995  110943.45  44881.40  5208820
2003  5050427  120898.38  47264.85  5218590
2004  5047109  130923.80  50324.23  5228358
2005  5043837  139843.07  53175.93  5236856
2006  5043879  147643.33  55974.86  5247497
2007  5049649  156153.72  58619.75  5264423
2008  5061199  166699.02  60480.40  5288379
2009  5070942  175747.84  58014.59  5304704
Sum  75637670 1727843.93 681169.91 78046684
> addmargins( with( dmca, tapply(d0,list(p,state),sum,na.rm=T) ) )
       Well    DM DM/Ins    Sum
1995  21127  1037    264  22428
```

```
1996  21264  1079    290  22633
1997  21549  1217    261  23027
1998  22042  1250    340  23632
1999  22244  1427    371  24042
2000  22197  1528    409  24134
2001  22283  1666    424  24373
2002  22800  1704    426  24930
2003  22963  1710    475  25148
2004  23339  2122    600  26061
2005  23936  2288    576  26800
2006  24590  2464    680  27734
2007  24703  2508    772  27983
2008  25235  2803    770  28808
2009  25866  3006    766  29638
Sum  346138 27809   7424 381371
> addmargins( with( dmca, table(p,state) ) )
      state
p       Well    DM DM/Ins   Sum
  1995   400   868    727  1995
  1996   400   913    885  2198
  1997   400   902    900  2202
  1998   400   886    907  2193
  1999   400   887    914  2201
  2000   400   875    916  2191
  2001   400   871    916  2187
  2002   400   870    920  2190
  2003   400   863    920  2183
  2004   400   859    926  2185
  2005   400   855    921  2176
  2006   400   855    918  2173
  2007   400   845    919  2164
  2008   400   844    925  2169
  2009   400   837    924  2161
  Sum   6000 13030  13538 32568
> # Reorder the columns sensibly
> d.col <- grep("d",names(dmca))
> d.num <- as.numeric(gsub( "d", "", names(dmca)[d.col] ))
> d.col <- d.col[!is.na(d.num)]
> code  <- d.num[!is.na(d.num)]
> d.num <- code/(1+9*(500>code & code>200))
> ov <- order(d.num)
> c.col <- match( c("state","State","DMtype","sex",
+                   "a","p","c","ax","px","cx","y"),
+                 names(dmca) )
> dmca <- dmca[,c(c.col,d.col[ov])]
> str( dmca )
'data.frame':	32568 obs. of  40 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ State : Factor w/ 2 levels "Well","DM+DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ DMtype: num  0 0 0 0 0 0 0 0 0 0 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1995 1996 1996 1997 ...
 $ c     : num  1994 1995 1995 1996 1996 ...
 $ ax    : num  0.667 0.333 0.667 0.333 0.667 ...
 $ px    : num  1995 1996 1996 1997 1997 ...
 $ cx    : num  1995 1995 1996 1996 1997 ...
 $ y     : num  17870 18025 18061 17426 17448 ...
 $ d0    : num  2 4 2 2 3 1 4 4 2 4 ...
 $ d21   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d22   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d24   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d241  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d242  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d243  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d249  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d251  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d259  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d26   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d28   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d33   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d51   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d70   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d82   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d83   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d84   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d91   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d92   : num  0 0 1 0 0 0 0 0 0 0 ...
 $ d101  : num  1 1 0 1 1 0 0 0 1 0 ...
 $ d103  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d113  : num  1 1 1 1 0 0 0 0 0 3 ...
 $ d121  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d131  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d132  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d133  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d139  : num  0 0 0 0 2 0 0 0 0 0 ...
 $ d999  : num  0 2 0 0 0 1 4 4 1 1 ...
>
> # Now get the diagnosis-names for these columns and their column numbers
```

```
> # to have a reference object for the anlyses
> d.col <- length(c.col)+(1:length(d.col))
> d.nam <- dxnam$name[match(code[ov],dxnam$code)]
> ( dxnam <- data.frame( col = names(dmca)[d.col],
+                        d.col = d.col,
+                         code = code[ov],
+                        d.num = d.num[ov],
+                        d.nam  ) )
   col d.col code d.num                             d.nam
1    d0    12    0   0.0           All malignant neoplasms
2   d21    13   21  21.0                        Oesophagus
3   d22    14   22  22.0                           Stomach
4   d24    15   24  24.0       Colon incl. rectosigmoideum
5  d241    16  241  24.1                   Ascending colon
6  d242    17  242  24.2                  Transverse colon
7  d243    18  243  24.3      Descending and sigmoid colon
8  d249    19  249  24.9 Other colon (unspec. or multiple)
9  d251    20  251  25.1               Rectum (excl. anus)
10 d259    21  259  25.9    Colorectal cancer (excl. anus)
11  d26    22   26  26.0                             Liver
12  d28    23   28  28.0                          Pancreas
13  d33    24   33  33.0          Lung, bronchus and pleura
14  d51    25   51  51.0                  Melanoma of skin
15  d70    26   70  70.0                            Breast
16  d82    27   82  82.0                      Cervix uteri
17  d83    28   83  83.0                      Corpus uteri
18  d84    29   84  84.0        Ovary, fallopian tube etc.
19  d91    30   91  91.0                          Prostate
20  d92    31   92  92.0                            Testis
21 d101    32  101 101.0                            Kidney
22 d103    33  103 103.0                   Urinary bladder
23 d113    34  113 113.0                             Brain
24 d121    35  121 121.0                           Thyroid
25 d131    36  131 131.0                Hodgkin's lymphoma
26 d132    37  132 132.0              Non-Hodgkin lymphoma
27 d133    38  133 133.0                  Multiple myeloma
28 d139    39  139 139.0                         Leukaemia
29 d999    40  999 999.0                             Other
>
> # Save both objects
> save( dmca, dxnam, file = "../data/dmcaA.Rdata" )
>
> # Only patients diagnosed after 1.1.1995,
> # classified by sex, A, P, C and the two durations
> dmca <- read.xport( "../data/dmcaD.xpt" )
> names(dmca) <- tolower(names(dmca))
> names(dmca)[grep("dmtype",names(dmca))] <- "DMtype"
> names(dmca)[grep( "dmdur",names(dmca))] <-  "DMDur"
> names(dmca)[grep("insdur",names(dmca))] <- "InsDur"
> system.time( dmca <- transform( dmca, state = relevel( dmca$state, 3 ),
+                                         sex = factor(sex,labels=c("M","F")) ) )
   user  system elapsed
   3.44    0.36    3.80
> addmargins( with( dmca, tapply(y ,list(p,state),sum,na.rm=T) ) )
         Well          DM      DM/Ins      Sum
1995  4997400    6464.926    482.1881  5004347
1996  5017439   18068.922   1982.1235  5037490
1997  5028556   29314.834   3563.8722  5061435
1998  5036218   40308.328   5194.3360  5081721
1999  5041089   51831.841   7049.3769  5099970
2000  5045751   62978.707   9121.6431  5117851
2001  5051179   74364.965  11406.0354  5136950
2002  5052995   86304.047  13930.1957  5153229
2003  5050427   99459.383  16626.6338  5166513
2004  5047109  112423.413  19918.7508  5179452
2005  5043837  123769.920  23260.9720  5190868
2006  5043879  133710.327  26727.2484  5204317
2007  5049649  144092.451  30220.5727  5223962
2008  5061199  156091.194  33464.3244  5250755
2009  5070942  167309.119  36568.0685  5274819
Sum  75637670 1306492.379 239516.3416 77183679
> addmargins( with( dmca, tapply(d0,list(p,state),sum,na.rm=T) ) )
       Well    DM DM/Ins    Sum
1995  21127   141      5  21273
1996  21264   288     12  21564
1997  21549   469     25  22043
1998  22042   609     43  22694
1999  22244   790     68  23102
2000  22197   999     85  23281
2001  22283  1167    111  23561
2002  22800  1328    130  24258
2003  22963  1371    163  24497
2004  23339  1797    242  25378
2005  23936  2045    280  26261
2006  24590  2207    319  27116
2007  24703  2329    411  27443
2008  25235  2633    427  28295
2009  25866  2879    473  29218
Sum  346138 21052   2794 369984
```

```
> addmargins( with( dmca, table(p,state) ) )
      state
p        Well     DM DM/Ins    Sum
  1995    400   2625   1844   4869
  1996    400   4711   6733  11844
  1997    400   5469  11634  17503
  1998    400   6330  15280  22010
  1999    400   7239  19862  27501
  2000    400   7973  24105  32478
  2001    400   8511  27559  36470
  2002    400   9042  31535  40977
  2003    400   9347  33156  42903
  2004    400   9940  36704  47044
  2005    400   9973  38164  48537
  2006    400  10325  41230  51955
  2007    400  10510  42591  53501
  2008    400  10727  45263  56390
  2009    400  10848  46050  57298
  Sum    6000 123570 421710 551280
>
> # Reorder the columns sensibly
> d.col <- grep("d",names(dmca))
> d.num <- as.numeric(gsub( "d", "", names(dmca)[d.col] ))
> d.col <- d.col[!is.na(d.num)]
> code  <- d.num[!is.na(d.num)]
> d.num <- code/(1+9*(500>code & code>200))
> ov <- order(d.num)
> # Columns with the relevant covariates
> c.col <- match( c("state","DMtype","sex","a","p","c","ax","px","cx",
+                   "DMDur","InsDur","y"),
+                 names(dmca) )
> dmca <- dmca[,c(c.col,d.col[ov])]
> str( dmca )
'data.frame': 551280 obs. of  41 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ DMtype: num  0 0 0 0 0 0 0 0 0 0 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1995 1996 1996 1997 ...
 $ c     : num  1994 1995 1995 1996 1996 ...
 $ ax    : num  0.667 0.333 0.667 0.333 0.667 ...
 $ px    : num  1995 1996 1996 1997 1997 ...
 $ cx    : num  1995 1995 1996 1996 1997 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ y     : num  17870 18025 18061 17426 17448 ...
 $ d0    : num  2 4 2 2 3 1 4 4 2 4 ...
 $ d21   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d22   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d24   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d241  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d242  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d243  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d249  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d251  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d259  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d26   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d28   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d33   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d51   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d70   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d82   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d83   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d84   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d91   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d92   : num  0 0 1 0 0 0 0 0 0 0 ...
 $ d101  : num  1 1 0 1 1 0 0 0 1 0 ...
 $ d103  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d113  : num  1 1 1 1 0 0 0 0 0 3 ...
 $ d121  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d131  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d132  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d133  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d139  : num  0 0 0 0 2 0 0 0 0 0 ...
 $ d999  : num  0 2 0 0 0 1 4 4 1 1 ...
>
> # Now get the diagnosis-names for these columns and their column numbers
> # to have a reference object for the anlyses
>
> dxnam$d.col <- length(c.col)+(1:length(d.col))
> dxnam
    col d.col code d.num                             d.nam
1    d0    13    0   0.0           All malignant neoplasms
2   d21    14   21  21.0                        Oesophagus
3   d22    15   22  22.0                           Stomach
4   d24    16   24  24.0       Colon incl. rectosigmoideum
5  d241    17  241  24.1                   Ascending colon
6  d242    18  242  24.2                  Transverse colon
7  d243    19  243  24.3      Descending and sigmoid colon
```

```
8  d249    20  249  24.9 Other colon (unspec. or multiple)
9  d251    21  251  25.1               Rectum (excl. anus)
10 d259    22  259  25.9    Colorectal cancer (excl. anus)
11  d26    23   26  26.0                             Liver
12  d28    24   28  28.0                          Pancreas
13  d33    25   33  33.0         Lung, bronchus and pleura
14  d51    26   51  51.0                Melanoma of skin
15  d70    27   70  70.0                            Breast
16  d82    28   82  82.0                      Cervix uteri
17  d83    29   83  83.0                      Corpus uteri
18  d84    30   84  84.0        Ovary, fallopian tube etc.
19  d91    31   91  91.0                          Prostate
20  d92    32   92  92.0                            Testis
21 d101    33  101 101.0                            Kidney
22 d103    34  103 103.0                   Urinary bladder
23 d113    35  113 113.0                             Brain
24 d121    36  121 121.0                           Thyroid
25 d131    37  131 131.0                Hodgkin's lymphoma
26 d132    38  132 132.0               Non-Hodgkin lymphoma
27 d133    39  133 133.0                  Multiple myeloma
28 d139    40  139 139.0                         Leukaemia
29 d999    41  999 999.0                             Other
>
> # Fix the two duration variables
> # First the left endponits
> ileft <- sort( unique( dmca$DMDur ) )
> # Then half of the lengths, the last repeated twice
> ilength <- diff(ileft)
> nd    <- length(ilength)
> ilength <- ilength[c(1:nd,nd)]
> dmca$DMDur  <- dmca$DMDur  + (as.integer(dmca$state)>1)*ilength[match(dmca$DMDur ,ileft)]/2
> dmca$InsDur <- dmca$InsDur + (as.integer(dmca$state)>2)*ilength[match(dmca$InsDur,ileft)]/2
> # ... and control it
> with( dmca, cbind(table( DMDur,state),
+                   table(InsDur,state)) )
Error in cbind(table(DMDur, state), table(InsDur, state)) :
  number of rows of matrices must match (see arg 2)
Calls: with -> with.default -> eval -> eval -> cbind
Execution halted

 R 2.12.1
 ---------------------------------------------
 Program:  readmort.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 31. marts 2011, 17:30:00
 ---------------------------------------------
> library(Epi)

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> library(foreign)
>
> # Get the data classified by duration
> ddd <- read.xport("../data/DMmortD.xpt" )
> names(ddd) <- tolower( names(ddd) )
> ddd$dmtype <- addNA( ddd$dmtype )
> summary(ddd)
       a             sex              p               dd            state
 Min.   : 0.0   Min.   :1.000   Min.   :1995   Min.   :  0.00   DM    :21925
 1st Qu.:63.0   1st Qu.:1.000   1st Qu.:1999   1st Qu.:  1.00   DM/Ins:20665
 Median :75.0   Median :1.000   Median :2003   Median :  1.00   Well  : 2970
 Mean   :71.8   Mean   :1.462   Mean   :2003   Mean   : 12.22
 3rd Qu.:84.0   3rd Qu.:2.000   3rd Qu.:2006   3rd Qu.:  3.00
 Max.   :98.0   Max.   :2.000   Max.   :2009   Max.   :862.00

 dmtype         dmdur              insdur
 0 :19740   Min.   :   0.000   Min.   :    0.000
 1 :  101   1st Qu.:   2.000   1st Qu.:    1.250
 2 :22749   Median :   5.000   Median :    3.000
 NA: 2970   Mean   :   6.027   Mean   :    3.999
            3rd Qu.:   9.000   3rd Qu.:    6.000
            Max.   :  19.000   Max.   :   15.000
            NA's   :2970.000   NA's   :24911.000
> ddd <- subset( ddd, as.integer(dmtype)>1 )
> summary(ddd)
       a              sex              p               dd            state
 Min.   : 0.00   Min.   :1.000   Min.   :1995   Min.   :  0.00   DM    :15759
 1st Qu.:61.00   1st Qu.:1.000   1st Qu.:2001   1st Qu.:  1.00   DM/Ins: 7091
 Median :74.00   Median :1.000   Median :2004   Median :  1.00   Well  : 2970
 Mean   :70.63   Mean   :1.458   Mean   :2004   Mean   : 19.85
 3rd Qu.:84.00   3rd Qu.:2.000   3rd Qu.:2007   3rd Qu.:  3.00
 Max.   :98.00   Max.   :2.000   Max.   :2009   Max.   :862.00

 dmtype         dmdur              insdur
 0 :    0   Min.   :   0.000   Min.   :    0.000
```

```
 1 :  101   1st Qu.:   1.250   1st Qu.:    0.750
 2 :22749   Median :   3.000   Median :    2.000
 NA: 2970   Mean   :   3.674   Mean   :    2.921
            3rd Qu.:   6.000   3rd Qu.:    4.500
            Max.   :  13.000   Max.   :   13.000
            NA's   :2970.000   NA's   :18736.000
> with( ddd, table(state,dmtype) )
        dmtype
state        0     1     2  <NA>
  DM         0     0 15759     0
  DM/Ins     0   101  6990     0
  Well       0     0     0  2970
> ddd$dmdur[is.na(ddd$dmdur)] <- 0
> ddd$insdur[is.na(ddd$insdur)] <- 0
> ddd <- with( ddd,
+              aggregate( dd, list(state=state,
+                                    sex=sex,
+                                      a=a,
+                                      p=p,
+                                  DMDur= dmdur,
+                                 InsDur=insdur), sum, na.rm=T ) )
> names(ddd)[match("x",names(ddd))] <- "dd"
> ddd <- transform( ddd,
+                 state = relevel(state,3),
+                   sex = factor(sex,labels=c("M","F")) )
> str( ddd )
'data.frame':	25818 obs. of  7 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 2 1 2 1 2 1 2 1 2 ...
 $ a     : num  0 0 1 1 2 2 3 3 4 4 ...
 $ p     : num  1995 1995 1995 1995 1995 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ dd    : num  196 152 19 15 9 7 7 4 12 1 ...
> head( ddd )
  state sex a    p DMDur InsDur  dd
1  Well   M 0 1995     0      0 196
2  Well   F 0 1995     0      0 152
3  Well   M 1 1995     0      0  19
4  Well   F 1 1995     0      0  15
5  Well   M 2 1995     0      0   9
6  Well   F 2 1995     0      0   7
> summary( ddd )
    state       sex            a               p            DMDur       
 Well  : 2970   M:14002   Min.   : 0.00   Min.   :1995   Min.   : 0.000  
 DM    :15759   F:11816   1st Qu.:61.00   1st Qu.:2001   1st Qu.: 0.500  
 DM/Ins: 7089             Median :74.00   Median :2004   Median : 2.500  
                          Mean   :70.63   Mean   :2004   Mean   : 3.251  
                          3rd Qu.:84.00   3rd Qu.:2007   3rd Qu.: 5.000  
                          Max.   :98.00   Max.   :2009   Max.   :13.000  
     InsDur              dd        
 Min.   : 0.0000   Min.   :  0.00  
 1st Qu.: 0.0000   1st Qu.:  1.00  
 Median : 0.0000   Median :  1.00  
 Mean   : 0.8006   Mean   : 19.86  
 3rd Qu.: 0.0000   3rd Qu.:  3.00  
 Max.   :13.0000   Max.   :862.00  
> rbind(
+ addmargins(with(ddd,tapply(dd,list(        state           ,sex),sum))),
+ addmargins(with(ddd,tapply(dd,list(Relevel(state,list(1,2:3)),sex),sum)))[2,,drop=F])[c(1:3,5,4),]
               M      F    Sum
Well      225684 237814 463498
DM         21846  19835  41681
DM/Ins      4319   3155   7474
DM+DM/Ins  26165  22990  49155
Sum       251849 260804 512653
> 
> # Fix the two duration variables
> # First the left endponits
> ileft <- sort( unique( ddd$DMDur ) )
> # Then half of the lengths, the last repeated twice
> ilength <- diff(ileft)
> nd    <- length(ilength)
> ilength <- ilength[c(1:nd,nd)]
> ddd$DMDur  <- ddd$DMDur  + (as.integer(ddd$state)>1)*ilength[match(ddd$DMDur ,ileft)]/2
> ddd$InsDur <- ddd$InsDur + (as.integer(ddd$state)>2)*ilength[match(ddd$InsDur,ileft)]/2
> # ... and control it
> with( ddd, cbind(table( DMDur,state),
+                  table(InsDur,state)) )
      Well   DM DM/Ins Well    DM DM/Ins
0     2970    0      0 2970 15759      0
0.125    0 1305    145    0     0    787
0.375    0  987    131    0     0    434
0.625    0  909    174    0     0    385
0.875    0  897    137    0     0    337
1.125    0  847    146    0     0    307
1.375    0  815    150    0     0    291
1.625    0  775    135    0     0    271
1.875    0  789    144    0     0    269
```

```
2.25     0  984    324    0     0    543
2.75     0  938    287    0     0    423
3.25     0  925    301    0     0    388
3.75     0  855    305    0     0    371
4.25     0  774    336    0     0    336
4.75     0  777    343    0     0    302
5.5      0  854    645    0     0    468
6.5      0  731    605    0     0    355
8        0  703   1118    0     0    453
10       0  497    884    0     0    239
12       0  286    581    0     0    111
14       0  111    198    0     0     19
>
>
> # Get the cancer incidence data, but only tabulate the
> # person-years by state, sex, duration etc.
> load( "../data/dmcaD.Rdata" )
> yy <- with( dmca,
+             aggregate( y, list(state=state,
+                                  sex=sex,
+                                    a=a,
+                                    p=p,
+                                DMDur=DMDur,
+                               InsDur=InsDur), sum, na.rm=T ) )
> names(yy)[match("x",names(yy))] <- "y"
> str( yy )
'data.frame': 284374 obs. of  7 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 2 1 2 1 2 1 2 1 2 ...
 $ a     : num  0 0 1 1 2 2 3 3 4 4 ...
 $ p     : num  1995 1995 1995 1995 1995 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ y     : num  35895 34122 35329 33666 35008 ...
> levels(ddd$state) <- levels(dmca$state)
> DMm <- merge( ddd, yy, all=T )
> with( DMm, table(is.na(y),!is.na(dd)) )

         FALSE   TRUE
  FALSE 260650  23724
  TRUE       0   2094
> # A lille bit of cleaning
> DMm$dd[is.na(DMm$dd)] <- 0
> DMm$y[is.na(DMm$y)] <- 0
> DMm <- subset( DMm, y>0 )
> str(DMm)
'data.frame': 284374 obs. of  8 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1996 1997 1998 1999 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ dd    : num  196 219 187 160 169 208 163 159 164 153 ...
 $ y     : num  35895 35486 34834 34442 34014 ...
> summary(DMm)
    state         sex               a                p             DMDur
 Well  :  3000   M:139777   Min.   : 0.00   Min.   :1995   Min.   : 0.000
 DM    : 42276   F:144597   1st Qu.:37.00   1st Qu.:2001   1st Qu.: 1.625
 DM/Ins:239098              Median :55.00   Median :2004   Median : 3.250
                            Mean   :53.45   Mean   :2004   Mean   : 4.114
                            3rd Qu.:72.00   3rd Qu.:2007   3rd Qu.: 5.500
                            Max.   :99.00   Max.   :2009   Max.   :14.000
     InsDur             dd                y
 Min.   : 0.000   Min.   :  0.000   Min.   :9.770e-15
 1st Qu.: 0.375   1st Qu.:  0.000   1st Qu.:2.158e-01
 Median : 1.125   Median :  0.000   Median :5.515e-01
 Mean   : 1.678   Mean   :  1.786   Mean   :2.713e+02
 3rd Qu.: 2.250   3rd Qu.:  0.000   3rd Qu.:1.680e+00
 Max.   :14.000   Max.   :862.000   Max.   :4.482e+04
>
> with( DMm,
+       cbind(
+       rbind( addmargins( tapply( dd, list(         state             , sex ), sum ) ),
+              addmargins( tapply( dd, list( Relevel(state,list(1,2:3)), sex ), sum ) )[2,,drop=F] )[c(1:3,5,4),],
+       round(
+       rbind( addmargins( tapply(  y, list(         state             , sex ), sum ) ),
+              addmargins( tapply(  y, list( Relevel(state,list(1,2:3)), sex ), sum ) )[2,,drop=F] )[c(1:3,5,4),]/1000, 1 )
               M      F    Sum       M       F     Sum
Well      225684 237814 463498 37646.2 37991.5 75637.7
DM         19737  17987  37724   652.4   627.1  1279.5
DM/Ins      3872   2782   6654   137.0   102.5   239.5
DM+DM/Ins  23609  20769  44378   789.4   729.6  1519.0
Sum       249293 258583 507876 38435.6 38721.1 77156.7
>
> # Save the mortality data
> save( DMm, file="../data/DMmD.Rdata" )
>
>
```

```
 --------------------------------------------
 Program: readmort.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 31. marts 2011, 17:30:54
 Elapsed: 00:00:53
 --------------------------------------------
> proc.time()
   user  system elapsed
  52.04    0.85   54.36
```

2.2 Create basic table and histogram for the paper

```
 R 2.12.1
 --------------------------------------------
 Program:  table1.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 31. marts 2011, 17:30:55
 --------------------------------------------
> # A few numbers for the description of the diabetes register
>
> # Read in the diabetes register
> dr <- read.ssd( "../data", "diabetes" )

C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r>call "C:\Program Files\SAS\SASFoundation\9.2\sas.exe" -sysin C:\DOCUME~1\
> str( dr )
'data.frame': 437593 obs. of  14 variables:
 $ D_FODDTO: num  -21914 14610 14610 -21549 15341 ...
 $ C_SEX   : Factor w/ 2 levels "K","M": 1 1 1 1 2 2 2 2 1 1 ...
 $ D_INKLDT: num  10981 16700 17757 12227 16713 ...
 $ C_INKLAA: Factor w/ 6 levels "blod2i5","blod5i1",..: 3 5 5 3 5 5 5 5 5 3 ...
 $ D_DODSDT: num  11499 NA NA 12460 NA ...
 $ D_LPR   : num  11436 16700 17757 NA 16713 ...
 $ D_FODT  : num  10981 NA NA 12227 NA ...
 $ D_BLOD2I: num  NA NA NA NA NA NA NA NA NA NA ...
 $ D_BLOD5I: num  NA NA NA NA NA ...
 $ D_OAD   : num  NA NA NA NA NA ...
 $ D_INS   : num  NA 16719 17784 NA 16758 ...
 $ V_PID   : Factor w/ 434329 levels "\f","\f\001ÿÿ\0033Õ¡",..: 111980 213805 101004 303857 379238 203896 26265 323344 1579
 $ ID      : num  1256431 1256457 1256458 1256474 1256543 ...
 $ SEX     : num  2 2 2 2 1 1 1 1 2 2 ...
> for( i in c(1,3,5:11) ) dr[,i] <- dr[,i]/365.25+1960
> dr <- dr[,1:11]
> names( dr ) <- c("foddto","sex","inkldto","inkl","dodsdto","lpr","fodt","blod2i5","blod5i1","oad","ins")
> str( dr )
'data.frame': 437593 obs. of  11 variables:
 $ foddto : num  1900 2000 2000 1901 2002 ...
 $ sex    : Factor w/ 2 levels "K","M": 1 1 1 1 2 2 2 2 1 1 ...
 $ inkldto: num  1990 2006 2009 1993 2006 ...
 $ inkl   : Factor w/ 6 levels "blod2i5","blod5i1",..: 3 5 5 3 5 5 5 5 5 3 ...
 $ dodsdto: num  1991 NA NA 1994 NA ...
 $ lpr    : num  1991 2006 2009 NA 2006 ...
 $ fodt   : num  1990 NA NA 1993 NA ...
 $ blod2i5: num  NA NA NA NA NA NA NA NA NA NA ...
 $ blod5i1: num  NA NA NA NA NA ...
 $ oad    : num  NA NA NA NA NA ...
 $ ins    : num  NA 2006 2009 NA 2006 ...
>
> # How namy records at end of 2009
> tt <- with( dr, table(ind=inkldto<2010,exclude=NULL) )
> addmargins( tt )
ind
  TRUE   <NA>    Sum
437593      0 437593
> tt[2]
<NA>
   0
>
> # Prevalent diabetes at 1995
> tt <- with( dr, table("ind<95"=inkldto<1995,"dod<95"=dodsdto<1995,exclude=NULL) )
> addmargins(tt)
       dod<95
ind<95   FALSE   TRUE   <NA>    Sum
  FALSE  76586     25 235353 311964
  TRUE   59599  27017  39013 125629
  <NA>       0      0      0      0
  Sum   136185  27042 274366 437593
> addmargins(tt[,-2])
       dod<95
ind<95   FALSE   <NA>    Sum
  FALSE  76586 235353 311939
  TRUE   59599  39013  98612
  <NA>       0      0      0
  Sum   136185 274366 410551
>
```

```
> # Prevalent diabetes at 2010
> tt <- with( dr, table("ind<2010"=inkldto<2010,"dod<2010"=dodsdto<2010,exclude=NULL) )
> addmargins(tt)
        dod<2010
ind<2010   TRUE   <NA>    Sum
    TRUE 163227 274366 437593
    <NA>      0      0      0
    Sum  163227 274366 437593
>
> # Incident cases 1995-2009 inkl
> tt <- with( dr, table("ind>94"=inkldto>1994,"ind>10"=inkldto>2010,exclude=NULL) )
> addmargins(tt)
       ind>10
ind>94   FALSE   <NA>    Sum
  FALSE 102930      0 102930
  TRUE  334663      0 334663
  <NA>       0      0      0
  Sum   437593      0 437593
> tt[2,1]
[1] 334663
>
> # Conrtruct table 1
> load( file = "../data/dmcaD.Rdata" )
> dnam <- as.character( dxnam$d.nam )
> vnam <- as.character( dxnam$col )
> # Create the table
> dims <- list( diag = c( "PYRS", dnam, "Deaths" ),
+               outer(c("M","F"),c("Well","DM","DM+Ins"),paste) )
> ttca <-
+ ttcr <- array( NA, dim=sapply(dims,length), dimnames=dims )
> dims <- list( diag = c( "PYRS", dnam, "Deaths" ),
+               outer(c("M","F"),c("Ins=DM","DM=Pop"),paste) )
> ttst <- array( NA, dim=sapply(dims,length), dimnames=dims )
>
> # First cases
> for( i in 1:length(vnam) )
+ ttca[dnam[i],] <- tapply( dmca[,vnam[i]], list( dmca$sex, dmca$state ), sum )
> # Then the person-years
> ttca[   "PYRS",] <- tapply( dmca[,"y"    ], list( dmca$sex, dmca$state ), sum )
> # And finally the deaths
> load( file="../data/DMmD.Rdata" )
> str(DMm)
'data.frame': 284374 obs. of  8 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1996 1997 1998 1999 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ dd    : num  196 219 187 160 169 208 163 159 164 153 ...
 $ y     : num  35895 35486 34834 34442 34014 ...
> ttca["Deaths",] <- as.vector( with( DMm, tapply( dd, list( sex, state ), sum ) ) )
>
> ( cases <-
+ rbind(
+ formatC( ttca[1,,drop=F]/1000,  digits=1, big.mark=",", width=7, format="f" ),
+ formatC(  ttca[-1,], digits=0, big.mark=",", width=7, format="f" ) ) )
                                  M Well     F Well     M DM      F DM
PYRS                              "37,646.2" "37,991.5" "  652.4" "  627.1"
All malignant neoplasms           "167,394"  "178,744"  " 11,378" "  8,654"
Oesophagus                        "  3,282"  "  1,304"  "    235" "     64"
Stomach                           "  4,171"  "  2,289"  "    287" "    132"
Colon incl. rectosigmoideum       " 13,853"  " 15,136"  "  1,118" "    938"
Ascending colon                   "  3,636"  "  5,126"  "    311" "    385"
Transverse colon                  "  1,819"  "  2,172"  "    168" "    145"
Descending and sigmoid colon      "  7,292"  "  6,601"  "    539" "    322"
Other colon (unspec. or multiple) "  1,106"  "  1,237"  "    100" "     86"
Rectum (excl. anus)               "  8,876"  "  6,214"  "    607" "    309"
Colorectal cancer (excl. anus)    " 22,729"  " 21,350"  "  1,725" "  1,247"
Liver                             "  1,776"  "  1,103"  "    325" "     77"
Pancreas                          "  4,041"  "  4,425"  "    525" "    446"
Lung, bronchus and pleura         " 25,302"  " 20,283"  "  1,673" "  1,068"
Melanoma of skin                  "  7,008"  "  8,873"  "    311" "    208"
Breast                            "    298"  " 52,190"  "     13" "  2,118"
Cervix uteri                      "      0"  "  5,691"  "      0" "    127"
Corpus uteri                      "      0"  "  8,057"  "      0" "    538"
Ovary, fallopian tube etc.        "      0"  "  7,400"  "      0" "    297"
Prostate                          " 31,713"  "      0"  "  2,355" "      0"
Testis                            "  4,257"  "      0"  "     36" "      0"
Kidney                            "  3,976"  "  2,434"  "    306" "    181"
Urinary bladder                   " 14,781"  "  4,906"  "  1,071" "    250"
Brain                             "  4,922"  "  4,310"  "    205" "    156"
Thyroid                           "    593"  "  1,511"  "     24" "     39"
Hodgkin's lymphoma                "    990"  "    723"  "     35" "     22"
Non-Hodgkin lymphoma              "  5,434"  "  4,602"  "    313" "    219"
Multiple myeloma                  "  2,452"  "  1,883"  "    157" "    100"
Leukaemia                         "  5,423"  "  4,050"  "    280" "    197"
Other                             " 24,246"  " 21,360"  "  1,502" "  1,168"
Deaths                            "225,684"  "237,814"  " 19,737" " 17,987"
```

```
                                  M DM+Ins  F DM+Ins
PYRS                              "  137.0" "  102.5"
All malignant neoplasms           "  1,609" "  1,185"
Oesophagus                        "     30" "      8"
Stomach                           "     41" "     18"
Colon incl. rectosigmoideum       "    135" "     84"
Ascending colon                   "     36" "     29"
Transverse colon                  "     27" "     17"
Descending and sigmoid colon      "     64" "     29"
Other colon (unspec. or multiple) "      8" "      9"
Rectum (excl. anus)               "     71" "     30"
Colorectal cancer (excl. anus)    "    206" "    114"
Liver                             "    100" "     19"
Pancreas                          "    182" "    147"
Lung, bronchus and pleura         "    248" "    151"
Melanoma of skin                  "     37" "     31"
Breast                            "      4" "    248"
Cervix uteri                      "      0" "     25"
Corpus uteri                      "      0" "     63"
Ovary, fallopian tube etc.        "      0" "     37"
Prostate                          "    227" "      0"
Testis                            "      7" "      0"
Kidney                            "     55" "     40"
Urinary bladder                   "    115" "     29"
Brain                             "     30" "     27"
Thyroid                           "      6" "     12"
Hodgkin's lymphoma                "      8" "      2"
Non-Hodgkin lymphoma              "     37" "     29"
Multiple myeloma                  "     18" "      8"
Leukaemia                         "     37" "     23"
Other                             "    221" "    154"
Deaths                            "  3,872" "  2,782"
>
> load( file="../data/prcan.Rdata" )
> str( p.can )
 num [1:29, 1:2, 1:2, 1:3, 1:3, 1:2] 0.13048 0.00272 0.00323 0.0108 0.00265 ...
 - attr(*, "dimnames")=List of 6
  ..$ diag  : chr [1:29] "All malignant neoplasms" "Oesophagus" "Stomach" "Colon incl. rectosigmoideum" ...
  ..$ sex   : chr [1:2] "M" "F"
  ..$ model : chr [1:2] "Main" "Interact"
  ..$ state : chr [1:3] "Well" "DM" "DM/ins"
  ..$ age.in: chr [1:3] "60" "65" "70"
  ..$ dur.in: chr [1:2] "0" "2"
> ttcr[-c(1,30),] <- ftable( p.can[,,"Main",,"65","0"], col.vars=3:2 )
> ( risks <-
+ formatC(  ttcr*100, digits=1, width=4, format="f" ) )

diag                                M Well F Well M DM   F DM   M DM+Ins
  PYRS                              "  NA" "  NA" "  NA" "  NA" "  NA"
  All malignant neoplasms           "17.3" "13.6" "17.9" "14.3" "17.8"
  Oesophagus                        " 0.3" " 0.1" " 0.4" " 0.1" " 0.4"
  Stomach                           " 0.4" " 0.2" " 0.4" " 0.2" " 0.5"
  Colon incl. rectosigmoideum       " 1.5" " 1.3" " 1.8" " 1.4" " 1.6"
  Ascending colon                   " 0.4" " 0.4" " 0.5" " 0.5" " 0.4"
  Transverse colon                  " 0.2" " 0.2" " 0.3" " 0.2" " 0.3"
  Descending and sigmoid colon      " 0.8" " 0.6" " 0.9" " 0.5" " 0.8"
  Other colon (unspec. or multiple) " 0.1" " 0.1" " 0.2" " 0.1" " 0.1"
  Rectum (excl. anus)               " 1.0" " 0.5" " 1.0" " 0.5" " 0.8"
  Colorectal cancer (excl. anus)    " 2.5" " 1.8" " 2.8" " 1.9" " 2.3"
  Liver                             " 0.2" " 0.1" " 0.6" " 0.1" " 1.1"
  Pancreas                          " 0.4" " 0.4" " 0.7" " 0.6" " 3.1"
  Lung, bronchus and pleura         " 3.2" " 2.3" " 3.1" " 2.3" " 3.6"
  Melanoma of skin                  " 0.5" " 0.4" " 0.4" " 0.3" " 0.3"
  Breast                            " 0.0" " 3.4" " 0.0" " 3.3" " 0.0"
  Cervix uteri                      "  NA" " 0.2" "  NA" " 0.2" "  NA"
  Corpus uteri                      "  NA" " 0.7" "  NA" " 1.1" "  NA"
  Ovary, fallopian tube etc.        "  NA" " 0.6" "  NA" " 0.6" "  NA"
  Prostate                          " 4.0" "  NA" " 3.4" "  NA" " 2.2"
  Testis                            " 0.0" "  NA" " 0.0" "  NA" " 0.0"
  Kidney                            " 0.4" " 0.2" " 0.5" " 0.3" " 0.6"
  Urinary bladder                   " 1.7" " 0.5" " 1.8" " 0.4" " 1.5"
  Brain                             " 0.3" " 0.2" " 0.3" " 0.2" " 0.3"
  Thyroid                           " 0.0" " 0.0" " 0.0" " 0.0" " 0.0"
  Hodgkin's lymphoma                " 0.0" " 0.0" " 0.1" " 0.0" " 0.1"
  Non-Hodgkin lymphoma              " 0.4" " 0.4" " 0.5" " 0.4" " 0.3"
  Multiple myeloma                  " 0.3" " 0.2" " 0.3" " 0.2" " 0.2"
  Leukaemia                         " 0.5" " 0.3" " 0.4" " 0.3" " 0.4"
  Other                             "  NA" "  NA" "  NA" "  NA" "  NA"
  Deaths                            "13.7" " 9.1" "24.2" "16.4" "38.3"

diag                                F DM+Ins
  PYRS                              "  NA"
  All malignant neoplasms           "16.1"
  Oesophagus                        " 0.1"
  Stomach                           " 0.3"
  Colon incl. rectosigmoideum       " 1.1"
  Ascending colon                   " 0.4"
  Transverse colon                  " 0.2"
  Descending and sigmoid colon      " 0.4"
```

```
  Other colon (unspec. or multiple) " 0.1"
  Rectum (excl. anus)               " 0.4"
  Colorectal cancer (excl. anus)    " 1.5"
  Liver                             " 0.3"
  Pancreas                          " 3.1"
  Lung, bronchus and pleura         " 2.8"
  Melanoma of skin                  " 0.3"
  Breast                            " 2.9"
  Cervix uteri                      " 0.2"
  Corpus uteri                      " 1.0"
  Ovary, fallopian tube etc.        " 0.6"
  Prostate                          "  NA"
  Testis                            "  NA"
  Kidney                            " 0.6"
  Urinary bladder                   " 0.6"
  Brain                             " 0.3"
  Thyroid                           " 0.1"
  Hodgkin's lymphoma                " 0.0"
  Non-Hodgkin lymphoma              " 0.4"
  Multiple myeloma                  " 0.1"
  Leukaemia                         " 0.3"
  Other                             "  NA"
  Deaths                            "27.9"
>
> # Tests for effects
> load( file="../data/ana3dx.Rdata" )
> ttst[-c(1,30,31),] <- ftable( tst[,,1:2], col.vars=3:2 )
> ( tests <-
+ formatC( ttst, digits=3, width=5, format="f" ) )

diag                                M Ins=DM F Ins=DM M DM=Pop F DM=Pop
  PYRS                              "   NA"  "   NA"  "   NA"  "   NA"
  All malignant neoplasms           "0.000"  "0.000"  "0.000"  "0.000"
  Oesophagus                        "0.113"  "0.599"  "0.005"  "0.435"
  Stomach                           "0.605"  "0.047"  "0.005"  "0.015"
  Colon incl. rectosigmoideum       "0.607"  "0.515"  "0.000"  "0.000"
  Ascending colon                   "0.776"  "0.766"  "0.000"  "0.000"
  Transverse colon                  "0.222"  "0.571"  "0.000"  "0.054"
  Descending and sigmoid colon      "0.516"  "0.547"  "0.000"  "0.738"
  Other colon (unspec. or multiple) "0.725"  "0.895"  "0.000"  "0.032"
  Rectum (excl. anus)               "0.312"  "0.512"  "0.058"  "0.996"
  Colorectal cancer (excl. anus)    "0.394"  "0.242"  "0.000"  "0.000"
  Liver                             "0.000"  "0.000"  "0.000"  "0.000"
  Pancreas                          "0.000"  "0.000"  "0.000"  "0.000"
  Lung, bronchus and pleura         "0.003"  "0.007"  "0.000"  "0.000"
  Melanoma of skin                  "0.340"  "0.893"  "0.824"  "0.003"
  Breast                            "0.491"  "0.944"  "0.055"  "0.388"
  Cervix uteri                      "   NA"  "0.512"  "   NA"  "0.261"
  Corpus uteri                      "   NA"  "0.720"  "   NA"  "0.000"
  Ovary, fallopian tube etc.        "   NA"  "0.598"  "   NA"  "0.823"
  Prostate                          "0.013"  "   NA"  "0.000"  "   NA"
  Testis                            "0.361"  "   NA"  "0.446"  "   NA"
  Kidney                            "0.002"  "0.000"  "0.000"  "0.000"
  Urinary bladder                   "0.632"  "0.334"  "0.000"  "0.186"
  Brain                             "0.352"  "0.039"  "0.000"  "0.001"
  Thyroid                           "0.495"  "0.012"  "0.596"  "0.073"
  Hodgkin's lymphoma                "0.530"  "0.918"  "0.000"  "0.006"
  Non-Hodgkin lymphoma              "0.587"  "0.165"  "0.003"  "0.282"
  Multiple myeloma                  "0.959"  "0.680"  "0.490"  "0.423"
  Leukaemia                         "0.444"  "0.656"  "0.061"  "0.171"
  Other                             "   NA"  "   NA"  "   NA"  "   NA"
  Deaths                            "   NA"  "   NA"  "   NA"  "   NA"
>
> table1 <-
+ cbind( cases, risks, tests )
>
> options( width=200 )
> ( rownames(table1) <- gsub( " \\(excl. anus\\)", "", rownames(table1) ) )
 [1] "PYRS"                              "All malignant neoplasms"           "Oesophagus"                        "Stomach"
 [6] "Ascending colon"                   "Transverse colon"                  "Descending and sigmoid colon"      "Other col
[11] "Colorectal cancer"                 "Liver"                             "Pancreas"                          "Lung, bro
[16] "Breast"                            "Cervix uteri"                      "Corpus uteri"                      "Ovary, fa
[21] "Testis"                            "Kidney"                            "Urinary bladder"                   "Brain"
[26] "Hodgkin's lymphoma"                "Non-Hodgkin lymphoma"              "Multiple myeloma"                  "Leukaemia
[31] "Deaths"
> wh <- c(1:4,11,6:8,10,12:31)
> table1[wh,]
                             M Well     F Well     M DM      F DM      M DM+Ins  F DM+Ins  M Well F Well M DM   F DM   M DM
PYRS                         "37,646.2" "37,991.5" "  652.4" "  627.1" "  137.0" "  102.5" "  NA" "  NA" "  NA" "  NA" " N
All malignant neoplasms      "167,394"  "178,744"  " 11,378" "  8,654" "  1,609" "  1,185" "17.3" "13.6" "17.9" "14.3" "17.
Oesophagus                   "  3,282"  "  1,304"  "    235" "     64" "     30" "      8" " 0.3" " 0.1" " 0.4" " 0.1" " 0.
Stomach                      "  4,171"  "  2,289"  "    287" "    132" "     41" "     18" " 0.4" " 0.2" " 0.4" " 0.2" " 0.
Colorectal cancer            " 22,729"  " 21,350"  "  1,725" "  1,247" "    206" "    114" " 2.5" " 1.8" " 2.8" " 1.9" " 2.
Ascending colon              "  3,636"  "  5,126"  "    311" "    385" "     36" "     29" " 0.4" " 0.4" " 0.5" " 0.5" " 0.
Transverse colon             "  1,819"  "  2,172"  "    168" "    145" "     27" "     17" " 0.2" " 0.2" " 0.3" " 0.2" " 0.
Descending and sigmoid colon "  7,292"  "  6,601"  "    539" "    322" "     64" "     29" " 0.8" " 0.6" " 0.9" " 0.5" " 0.
Rectum                       "  8,876"  "  6,214"  "    607" "    309" "     71" "     30" " 1.0" " 0.5" " 1.0" " 0.5" " 0.
Liver                        "  1,776"  "  1,103"  "    325" "     77" "    100" "     19" " 0.2" " 0.1" " 0.6" " 0.1" " 1.
Pancreas                     "  4,041"  "  4,425"  "    525" "    446" "    182" "    147" " 0.4" " 0.4" " 0.7" " 0.6" " 3.
```

```
Lung, bronchus and pleura    " 25,302"  " 20,283"  "  1,673" "  1,068" "    248" "    151" " 3.2" " 2.3" " 3.1" " 2.3" " 3.
Melanoma of skin             "  7,008"  "  8,873"  "    311" "    208" "     37" "     31" " 0.5" " 0.4" " 0.4" " 0.3" " 0.
Breast                       "    298"  " 52,190"  "     13" "  2,118" "      4" "    248" " 0.0" " 3.4" " 0.0" " 3.3" " 0.
Cervix uteri                 "      0"  "  5,691"  "      0" "    127" "      0" "     25" "  NA" " 0.2" "  NA" " 0.2" "  N
Corpus uteri                 "      0"  "  8,057"  "      0" "    538" "      0" "     63" "  NA" " 0.7" "  NA" " 1.1" "  N
Ovary, fallopian tube etc.   "      0"  "  7,400"  "      0" "    297" "      0" "     37" "  NA" " 0.6" "  NA" " 0.6" "  N
Prostate                     " 31,713"  "      0"  "  2,355" "      0" "    227" "      0" " 4.0" "  NA" " 3.4" "  NA" " 2.
Testis                       "  4,257"  "      0"  "     36" "      0" "      7" "      0" " 0.0" "  NA" " 0.0" "  NA" " 0.
Kidney                       "  3,976"  "  2,434"  "    306" "    181" "     55" "     40" " 0.4" " 0.2" " 0.5" " 0.3" " 0.
Urinary bladder              " 14,781"  "  4,906"  "  1,071" "    250" "    115" "     29" " 1.7" " 0.5" " 1.8" " 0.4" " 1.
Brain                        "  4,922"  "  4,310"  "    205" "    156" "     30" "     27" " 0.3" " 0.2" " 0.3" " 0.2" " 0.
Thyroid                      "    593"  "  1,511"  "     24" "     39" "      6" "     12" " 0.0" " 0.0" " 0.0" " 0.0" " 0.
Hodgkin's lymphoma           "    990"  "    723"  "     35" "     22" "      8" "      2" " 0.0" " 0.0" " 0.1" " 0.0" " 0.
Non-Hodgkin lymphoma         "  5,434"  "  4,602"  "    313" "    219" "     37" "     29" " 0.4" " 0.4" " 0.5" " 0.4" " 0.
Multiple myeloma             "  2,452"  "  1,883"  "    157" "    100" "     18" "      8" " 0.3" " 0.2" " 0.3" " 0.2" " 0.
Leukaemia                    "  5,423"  "  4,050"  "    280" "    197" "     37" "     23" " 0.5" " 0.3" " 0.4" " 0.3" " 0.
Other                        " 24,246"  " 21,360"  "  1,502" "  1,168" "    221" "    154" "  NA" "  NA" "  NA" "  NA" "  N
Deaths                       "225,684"  "237,814"  " 19,737" " 17,987" "  3,872" "  2,782" "13.7" " 9.1" "24.2" "16.4" "38.
>
> library( Hmisc )
Loading required package: survival
Loading required package: splines

Attaching package: 'Hmisc'

The following object(s) are masked from 'package:survival':

    untangle.specials

The following object(s) are masked from 'package:base':

    format.pval, round.POSIXt, trunc.POSIXt, units

> zz <- latex( table1[wh,], file="../table1.tex", booktabs=TRUE )
>

 ---------------------------------------------
 Program: table1.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 31. marts 2011, 17:31:55
 Elapsed: 00:01:00
 ---------------------------------------------
> proc.time()
   user  system elapsed
  48.28    2.26   61.54

 R 2.12.1
 ---------------------------------------------
 Program:  dur-hist.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 31. marts 2011, 17:31:56
 ---------------------------------------------
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> # A handy function for starting plot devices
> source( "c:/stat/r/bxc/library.sources/useful/r/plt.r" )
>
> ######################################################################
> # Show the differences between the diagnosis dated for those who have
> # both by reading the join of the diabetes register and the CR
> candi <- read.xport( "../data/candi.xpt" )
> names(candi) <- tolower(names(candi))
> for( i in 4:9 ) candi[,i] <- candi[,i]/365.25 + 1960
> head(candi)
  diag diaggrp sex     dobt dodm doi     doca      dox     dodd dmtype
1   70      70   2 1900.003   NA  NA 1970.497 1979.433 1979.433     NA
2  242      20   2 1900.003   NA  NA 1983.162 1992.580 1992.580     NA
3   22      20   1 1900.003   NA  NA 1970.582 1972.939 1972.939     NA
4  249      20   1 1900.003   NA  NA 1964.498 1976.110 1976.110     NA
5   91      90   1 1900.003   NA  NA 1978.001 1980.747 1980.747     NA
6   51      50   2 1900.003   NA  NA 1961.834 1980.257 1980.257     NA
> summary(candi)
      diag             diaggrp               sex             dobt
 Min.   :    21.0   Min.   :    10.00   Min.   :1.000   Min.   :1846
 1st Qu.:    51.0   1st Qu.:    20.00   1st Qu.:1.000   1st Qu.:1907
 Median :    91.0   Median :    70.00   Median :2.000   Median :1923
 Mean   :   239.1   Mean   :    62.95   Mean   :1.507   Mean   :1923
 3rd Qu.:   242.0   3rd Qu.:    90.00   3rd Qu.:2.000   3rd Qu.:1940
 Max.   :   999.0   Max.   :   140.00   Max.   :2.000   Max.   :2010
 NA's   :362089.0   NA's   :362089.00
      dodm                   doi          doca             dox
 Min.   :   1942   Min.   :    1994   Min.   :  1943   Min.   :1921
 1st Qu.:   1994   1st Qu.:    1995   1st Qu.:  1969   1st Qu.:1979
```

```
 Median :   2001   Median :   2001   Median :  1985   Median :1998
 Mean   :   2000   Mean   :   2001   Mean   :  1983   Mean   :1992
 3rd Qu.:   2006   3rd Qu.:   2006   3rd Qu.:  1999   3rd Qu.:2010
 Max.   :   2010   Max.   :   2010   Max.   :  2010   Max.   :2010
 NA's   :1119643   NA's   :1447828   NA's   :362089
      dodd            dmtype
 Min.   :  1921   Min.   :0.000e+00
 1st Qu.:  1972   1st Qu.:0.000e+00
 Median :  1989   Median :2.000e+00
 Mean   :  1985   Mean   :1.411e+00
 3rd Qu.:  2000   3rd Qu.:2.000e+00
 Max.   :  2011   Max.   :2.000e+00
 NA's   :449181   NA's   :1.120e+06
>
> plt( "diag-diff", height=10, width=10 )
> par( mfrow=c(2,2), mgp=c(3,1,0)/1.6, mar=c(3,3,0,0) )
> ymax <- 1400
>
> # Cancer - Diabetes
> with( subset( candi, abs(doca-dodm)<2 & dodm>1995 ),
+       hist( doca-dodm, breaks=seq(-2,2,1/12),
+       col=gray(0.4), border=gray(0.49), las=1,
+       xlim=c(-2,2), xlab="",#Date of Cancer - date of DM (years)",
+       ylim=c(0,ymax), ylab="", main="" ) )
> abline( v=0, col="red" )
> mtext( "Cancer after DM", at= 0.5, adj=0, line=-2, cex=0.7 )
> mtext( "Cancer before DM", at=-0.5, adj=1, line=-2, cex=0.7 )
>
> # Cancer - Insulin
> with( subset( candi, abs(doca-doi)<2 & doi>1995 ),
+       hist( doca-doi, breaks=seq(-2,2,1/12),
+       col=gray(0.4), border=gray(0.49), las=1,
+       xlim=c(-2,2), xlab="",#Date of Cancer - date of Insulin (years)",
+       yaxt="n", ylim=c(0,ymax), ylab="", main="" ) )
> abline( v=0, col="red" )
> mtext( "Cancer after Insulin", at= 0.5, adj=0, line=-2, cex=0.7 )
> mtext( "Cancer before Insulin", at=-0.5, adj=1, line=-2, cex=0.7 )
>
> if(TRUE){
+ # Transform the dates of diagnosis of cancer by adding a uniform over
+ # a month
+ candr <- transform( candi, doca = doca+runif(length(doca),0,1/12)*(doca<2005) )
+
+ # Cancer - Diabetes
+ with( subset( candr, abs(doca-dodm)<2 & dodm>1995 ),
+       hist( doca-dodm, breaks=seq(-2,2,1/12),
+       col=gray(0.4), border=gray(0.49), las=1,
+       xlim=c(-2,2), xlab="Date of Cancer - date of DM (years)",
+       ylim=c(0,ymax), ylab="", main="" ) )
+ abline( v=0, col="red" )
+ #mtext( "DM before Cancer", at= 0.5, adj=0, line=-2, cex=0.7 )
+ #mtext( "Cancer before DM", at=-0.5, adj=1, line=-2, cex=0.7 )
+
+ # Cancer - Insulin
+ with( subset( candr, abs(doca-doi)<2 & doi>1995 ),
+       hist( doca-doi, breaks=seq(-2,2,1/12),
+       col=gray(0.4), border=gray(0.49), las=1,
+       xlim=c(-2,2), xlab="Date of Cancer - date of Insulin (years)",
+       yaxt="n", ylim=c(0,ymax), ylab="", main="" ) )
+ abline( v=0, col="red" )
+ #mtext( "Insulin before Cancer", at= 0.5, adj=0, line=-2, cex=0.7 )
+ #mtext( "Cancer before Insulin", at=-0.5, adj=1, line=-2, cex=0.7 )
+
+ # Transform the dates of diagnosis of cancer by adding a uniform
+ candr <- transform( candr, doca = doca+runif(length(doca),-1/12,1/12),
+                            dodm = dodm+runif(length(dodm),-1/12,1/12),
+                            doi  = doi +runif(length(doi ),-1/12,1/12) )
+ }
>
> if(FALSE){
+ # Cancer - Diabetes
+ with( subset( candr, abs(doca-dodm)<2 & dodm>1995 ),
+       hist( doca-dodm, breaks=seq(-2,2,1/12),
+       col=gray(0.4), border=gray(0.49), las=1,
+       xlim=c(-2,2), xlab="Date of Cancer - date of DM (years)",
+       ylim=c(0,ymax), ylab="", main="" ) )
+ abline( v=0, col="red" )
+ #mtext( "DM before Cancer", at= 0.5, adj=0, line=-2, cex=0.7 )
+ #mtext( "Cancer before DM", at=-0.5, adj=1, line=-2, cex=0.7 )
+
+ # Cancer - Insulin
+ with( subset( candr, abs(doca-doi)<2 & doi>1995 ),
+       hist( doca-doi, breaks=seq(-2,2,1/12),
+       col=gray(0.4), border=gray(0.49), las=1,
+       xlim=c(-2,2), xlab="Date of Cancer - date of Insulin (years)",
+       yaxt="n", ylim=c(0,ymax), ylab="", main="" ) )
+ abline( v=0, col="red" )
+ #mtext( "Insulin before Cancer", at= 0.5, adj=0, line=-2, cex=0.7 )
+ #mtext( "Cancer before Insulin", at=-0.5, adj=1, line=-2, cex=0.7 )
```

```
+ }
>
> dev.off()
null device
          1
>
> ################################################################################
> # Get the data file ;
> load( file = "../data/dmcaD.Rdata" )
> str( dmca )
'data.frame': 508062 obs. of  41 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ DMtype: num  0 0 0 0 0 0 0 0 0 0 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1995 1996 1996 1997 ...
 $ c     : num  1994 1995 1995 1996 1996 ...
 $ ax    : num  0.667 0.333 0.667 0.333 0.667 ...
 $ px    : num  1995 1996 1996 1997 1997 ...
 $ cx    : num  1995 1995 1996 1996 1997 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ y     : num  17870 18025 18061 17426 17448 ...
 $ d0    : num  2 4 2 2 3 1 4 4 2 4 ...
 $ d21   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d22   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d24   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d241  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d242  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d243  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d249  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d251  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d259  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d26   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d28   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d33   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d51   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d70   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d82   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d83   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d84   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d91   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d92   : num  0 0 1 0 0 0 0 0 0 0 ...
 $ d101  : num  1 1 0 1 1 0 0 0 1 0 ...
 $ d103  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d113  : num  1 1 1 1 0 0 0 0 0 3 ...
 $ d121  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d131  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d132  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d133  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d139  : num  0 0 0 0 2 0 0 0 0 0 ...
 $ d999  : num  0 2 0 0 0 1 4 4 1 1 ...
>
> # Where are the cancers in terms of duration
> dd <- with( dmca, cbind(tapply(d0,list( DMDur,state),sum),
+                         tapply(d0,list(InsDur,state),sum)) )
> dd[is.na(dd)] <- 0
> addmargins( dd, 1 )
           Well    DM DM/Ins   Well    DM DM/Ins
0        346138     0      0 346138 20032      0
0.166665      0  1044     38      0     0    198
0.375         0  1084     65      0     0    205
0.625         0   969     59      0     0    162
0.875         0   866     48      0     0    146
1.125         0   799     59      0     0    119
1.375         0   770     46      0     0    123
1.625         0   765     46      0     0    117
1.875         0   706     49      0     0    126
2.25          0  1309    110      0     0    198
2.75          0  1301    117      0     0    182
3.25          0  1107    127      0     0    156
3.75          0  1045    123      0     0    139
4.25          0  1037    108      0     0    122
4.75          0   931    117      0     0    108
5.5           0  1610    238      0     0    165
6.5           0  1278    232      0     0    166
8             0  1775    468      0     0    196
10            0  1046    388      0     0     96
12            0   467    269      0     0     50
14            0   123     87      0     0     20
Sum      346138 20032   2794 346138 20032   2794
> # Cumulative numbers from the bottom
> apply( dd[nrow(dd):1,], 2, cumsum )[nrow(dd):1,]
           Well    DM DM/Ins   Well    DM DM/Ins
0        346138 20032   2794 346138 20032   2794
0.166665      0 20032   2794      0     0   2794
0.375         0 18988   2756      0     0   2596
0.625         0 17904   2691      0     0   2391
0.875         0 16935   2632      0     0   2229
```

```
1.125         0 16069   2584      0     0   2083
1.375         0 15270   2525      0     0   1964
1.625         0 14500   2479      0     0   1841
1.875         0 13735   2433      0     0   1724
2.25          0 13029   2384      0     0   1598
2.75          0 11720   2274      0     0   1400
3.25          0 10419   2157      0     0   1218
3.75          0  9312   2030      0     0   1062
4.25          0  8267   1907      0     0    923
4.75          0  7230   1799      0     0    801
5.5           0  6299   1682      0     0    693
6.5           0  4689   1444      0     0    528
8             0  3411   1212      0     0    362
10            0  1636    744      0     0    166
12            0   590    356      0     0     70
14            0   123     87      0     0     20
>
> # Where are the PYRS in terms of duration
> yy <- with( dmca, cbind(tapply(y,list( DMDur,state),sum),
+                         tapply(y,list(InsDur,state),sum)) )/1000
> yy[is.na(yy)] <- 0
> round(addmargins( yy, 1 ),1)
            Well     DM DM/Ins    Well     DM DM/Ins
0        75637.7    0.0    0.0 75637.7 1279.5    0.0
0.166665     0.0   43.6    1.8     0.0    0.0    7.9
0.375        0.0   62.4    4.5     0.0    0.0   11.5
0.625        0.0   60.0    4.9     0.0    0.0   11.1
0.875        0.0   57.6    5.1     0.0    0.0   10.6
1.125        0.0   55.4    5.2     0.0    0.0   10.2
1.375        0.0   53.4    5.2     0.0    0.0    9.8
1.625        0.0   51.3    5.3     0.0    0.0    9.5
1.875        0.0   49.3    5.3     0.0    0.0    9.1
2.25         0.0   92.8   10.8     0.0    0.0   17.2
2.75         0.0   85.6   10.9     0.0    0.0   15.8
3.25         0.0   78.7   11.0     0.0    0.0   14.4
3.75         0.0   72.4   11.1     0.0    0.0   13.2
4.25         0.0   66.2   11.1     0.0    0.0   11.9
4.75         0.0   60.4   11.0     0.0    0.0   10.9
5.5          0.0  103.3   21.8     0.0    0.0   18.6
6.5          0.0   81.8   21.1     0.0    0.0   14.9
8            0.0  110.6   38.3     0.0    0.0   21.4
10           0.0   60.3   29.9     0.0    0.0   12.9
12           0.0   27.5   18.7     0.0    0.0    6.8
14           0.0    7.0    6.5     0.0    0.0    2.0
Sum      75637.7 1279.5  239.5 75637.7 1279.5  239.5
> # Cumulative numbers from the bottom
> round(apply( yy[nrow(yy):1,], 2, cumsum )[nrow(yy):1,],1)
            Well     DM DM/Ins    Well     DM DM/Ins
0        75637.7 1279.5  239.5 75637.7 1279.5  239.5
0.166665     0.0 1279.5  239.5     0.0    0.0  239.5
0.375        0.0 1235.9  237.7     0.0    0.0  231.6
0.625        0.0 1173.5  233.3     0.0    0.0  220.1
0.875        0.0 1113.6  228.3     0.0    0.0  209.1
1.125        0.0 1055.9  223.3     0.0    0.0  198.5
1.375        0.0 1000.5  218.1     0.0    0.0  188.3
1.625        0.0  947.1  212.8     0.0    0.0  178.4
1.875        0.0  895.8  207.5     0.0    0.0  169.0
2.25         0.0  846.5  202.2     0.0    0.0  159.9
2.75         0.0  753.8  191.4     0.0    0.0  142.7
3.25         0.0  668.2  180.5     0.0    0.0  127.0
3.75         0.0  589.4  169.5     0.0    0.0  112.6
4.25         0.0  517.1  158.4     0.0    0.0   99.4
4.75         0.0  450.9  147.4     0.0    0.0   87.4
5.5          0.0  390.5  136.3     0.0    0.0   76.5
6.5          0.0  287.2  114.5     0.0    0.0   57.9
8            0.0  205.4   93.3     0.0    0.0   43.1
10           0.0   94.8   55.0     0.0    0.0   21.7
12           0.0   34.5   25.1     0.0    0.0    8.8
14           0.0    7.0    6.5     0.0    0.0    2.0
>
> ################################################################################
> # Distribution of cases by duration
> ################################################################################
> ph <- 6  # Height in inches of upper barplots
> fr <- 1/6 # Fraction of this for the lower barplots
> mai <- c(2.5,2.6,1,0.5)/4 # Single plot margins in inches
> mh <- mai[1]+mai[3] # Vertical margin space
> th <- ph*(1+fr)+2*mh # Total height of the entire graph
>
> plt( "dur-hist", height=th, width=th )
> layout( matrix(1:4,2,2), height=rep(c(ph+mh,ph*fr+mh),2))
> par( mai=mai, mgp=c(3,1,0.4)/1.5, las=1 )
> barplot(height=t(dd[,3:2]/ilength), width=ilength,
+         space=0, xaxt="n", yaxs="i", col=gray(c(3,7)/10),
+         xlim=c(0,15), ylim=c(0,6800),
+         xlab="Diabetes duration" )
> axis(side=1,at=seq(0,15,3),labels=seq(0,15,3))
> axis(side=1,at=seq(0,15,1),labels=rep("",16))
> mtext( side=3, line=0, "Cancer cases per year", adj=0.1 )
```

```
>
> barplot(t(dd[,6]/ilength), width=ilength,
+         space=0,xaxt="n",yaxt="n",
+         yaxs="i",col=gray(3/10),
+         xlim=c(0,15),ylim=c(0,6800*fr),xlab="Insulin duration" )
> axis(side=1,at=seq(0,15,3),labels=seq(0,15,3))
> axis(side=1,at=seq(0,15,1),labels=rep("",16))
> axis(side=2,at=0:2*500)
> # axis(side=2,at=0:15*100,labels=rep("",16) )
>
> barplot(t(yy[,3:2]/ilength), width=ilength,
+         space=0,xaxt="n",yaxs="i",col=gray(c(3,7)/10),
+         xlim=c(0,15), ylim=c(0,300),xlab="Diabetes duration" )
> axis(side=1,at=seq(0,15,3),labels=seq(0,15,3))
> axis(side=1,at=seq(0,15,1),labels=rep("",16))
> mtext( side=3, line=0, "Average no. at risk (1000s)", adj=0.1 )
>
> barplot(t(yy[,6]/ilength), width=ilength,
+         space=0, xaxt="n", yaxt="n",
+         yaxs="i",col=gray(3/10),
+         xlim=c(0,15),ylim=c(0,300*fr),xlab="Insulin duration")
> axis(side=1,at=seq(0,15,3),labels=seq(0,15,3))
> axis(side=1,at=seq(0,15,1),labels=rep("",16))
> axis(side=2,at=0:2*20)
> # axis(side=2,at=0:6*10,labels=rep("",7) )
> dev.off()
null device
          1
>

 --------------------------------------------
 Program: dur-hist.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 31. marts 2011, 17:32:41
 Elapsed: 00:00:44
 --------------------------------------------
> proc.time()
   user  system elapsed
  32.42    6.06   45.87
```

2.3 Analysis disregarding duration

These programs use the suffix “`a`” for those including prevalent cases and suffix “`i`” for those only including incident cases.

```
 R 2.12.1
 --------------------------------------------
 Program:  ana1a.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 31. marts 2011, 17:32:42
 --------------------------------------------
> # Same analysis as in ana1i.r, except persons diagnosed with diabetes
> # prior to 1995 are included here
>
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> library( splines )
> # A wrapper for ns() where boundary knots are taken as the
> # smallest of the knots= argument
> source( "C:/Bendix/Steno/DM-register/NDR/R/Ns.r" )
> Ns
function (x, df = NULL, knots = NULL, intercept = FALSE, Boundary.knots = NULL)
{
    if (is.null(Boundary.knots)) {
        if (!is.null(knots)) {
            knots <- sort(unique(knots))
            ok <- c(1, length(knots))
            Boundary.knots <- knots[ok]
            knots <- knots[-ok]
        }
    }
    ns(x, df = df, knots = knots, intercept = intercept, Boundary.knots = Boundary.knots)
}
>
> # Get the data file:
> load( file = "../data/dmcaA.Rdata" )
> stat.table( list(state,DMtype), list( sum(y/1000), sum(d0), count() ),
+            data=dmca, margins=T )
```

```
 ----------------------------------------------
         ----------------DMtype----------------
 state            0       1        2     Total
 ----------------------------------------------
 Well      75637.67      NA       NA  75637.67
          346138.00      NA       NA 346138.00
               6000       0        0      6000

 DM          425.41    0.30  1302.14   1727.84
            6937.00    2.00 20870.00  27809.00
               5215    1867     5948     13030

 DM/Ins      437.60   44.95   198.62    681.17
            4450.00   27.00  2947.00   7424.00
               5426    2446     5666     13538


 Total     76500.68   45.25  1500.76  78046.68
          357525.00   29.00 23817.00 381371.00
              16641    4313    11614     32568
 ----------------------------------------------
> stat.table( list(state,DMtype), list( sum(y), sum(d0), count() ), data=dmca )
 -----------------------------------------
         -------------DMtype--------------
 state              0        1          2
 -----------------------------------------
 Well     75637670.45       NA         NA
            346138.00       NA         NA
                 6000        0          0

 DM         425406.99   300.32 1302136.62
              6937.00     2.00   20870.00
                 5215     1867       5948

 DM/Ins     437598.13 44950.07  198621.70
              4450.00    27.00    2947.00
                 5426     2446       5666
 -----------------------------------------
> str( dmca )
'data.frame':   32568 obs. of  40 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ State : Factor w/ 2 levels "Well","DM+DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ DMtype: num  0 0 0 0 0 0 0 0 0 0 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1995 1996 1996 1997 ...
 $ c     : num  1994 1995 1995 1996 1996 ...
 $ ax    : num  0.667 0.333 0.667 0.333 0.667 ...
 $ px    : num  1995 1996 1996 1997 1997 ...
 $ cx    : num  1995 1995 1996 1996 1997 ...
 $ y     : num  17870 18025 18061 17426 17448 ...
 $ d0    : num  2 4 2 2 3 1 4 4 2 4 ...
 $ d21   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d22   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d24   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d241  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d242  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d243  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d249  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d251  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d259  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d26   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d28   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d33   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d51   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d70   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d82   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d83   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d84   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d91   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d92   : num  0 0 1 0 0 0 0 0 0 0 ...
 $ d101  : num  1 1 0 1 1 0 0 0 1 0 ...
 $ d103  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d113  : num  1 1 1 1 0 0 0 0 0 3 ...
 $ d121  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d131  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d132  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d133  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d139  : num  0 0 0 0 2 0 0 0 0 0 ...
 $ d999  : num  0 2 0 0 0 1 4 4 1 1 ...
> d.col <- dxnam$d.col
> c.col <- 1:(d.col[1]-1)
>
> # Construct an array to hold the results
> dnam <- list( diag = dxnam$d.nam,
+                 sex = c("M","F"),
+                type = c("DM/noIns","DM/Ins","Ins vs. noIns", "DM"),
+                 est = c("Est","lo","hi") )
> res <- array( NA, dim=sapply(dnam,length), dimnames=dnam )
```

```
> # Construct an array to hold the no. cancer cases analysed
> dnam <- list( diag = c(as.character(dxnam$d.nam),"PYRS","Deaths"),
+                sex = c("M","F"),
+               type = c("Well","DM/noIns","DM/Ins","DM") )
> nca <- array( NA, dim=sapply(dnam,length), dimnames=dnam )
>
> Nres <- dim( res )[1]
>
> # Knots for the natural splines
> a.kn <- seq(  10, 100,,9)
> p.kn <- seq(1995,2009,,5)
> c.kn <- seq(1900,2005,,9)
> # Contrast matrix to extract each of the RRs and  also ther ratio
> CM <- rbind( c( 1, 0),
+              c( 0, 1),
+              c(-1, 1) )
> rownames(CM) <- c("DM/noIns","DM/Ins","Ins vs. noIns")
>
> # Analysis for all sites
> for( i in 1:Nres )
+ {
+ data <- dmca[,c(c.col,d.col[i])]
+ names(data)[ncol(data)] <- "D"
+ m1 <- glm( D ~ Ns(ax,knots=a.kn) +
+                Ns(px,knots=p.kn) +
+                Ns(cx,knots=c.kn) +
+                state + offset( log(y) ),
+                family = poisson,
+                data = subset(data,sex=="M") )
+ f1 <- glm( D ~ Ns(ax,knots=a.kn) +
+                Ns(px,knots=p.kn) +
+                Ns(cx,knots=c.kn) +
+                state + offset( log(y) ),
+                family = poisson,
+                data = subset(data,sex=="F") )
+ # Collapse the DM and DM/ins levels and repeat all
+ m2 <- update( m1, ~ . - state + State )
+ f2 <- update( f1, ~ . - state + State )
+ # The RR estimates
+ res[i,"M",1:3,] <- ci.lin( m1, subset="state", ctr.mat=CM, E=T )[,5:7]
+ res[i,"F",1:3,] <- ci.lin( f1, subset="state", ctr.mat=CM, E=T )[,5:7]
+ res[i,"M",  4,] <- ci.lin( m2, subset="State", E=T )[,5:7]
+ res[i,"F",  4,] <- ci.lin( f2, subset="State", E=T )[,5:7]
+ # The total number of cases
+ nca[i,,1:3] <- with(data,tapply( D, list(sex,state), sum, na.rm=T ))
+ }
There were 50 or more warnings (use warnings() to see the first 50)
> # The rows of person years
> nca["PYRS" ,,1:3] <- with(dmca,tapply( y/1000, list(sex,state), sum, na.rm=T ))
> # Get the right number of cases for the analysis of DM as one state
> nca[,,4] <- nca[,,2] + nca[,,3]
> # Get rid of the male/females in the wrong places
> no.M <- c( grep("uteri",dimnames(res)[["diag"]]),
+            grep("Ovary",dimnames(res)[["diag"]]) )
> no.F <- c( grep("Prost",dimnames(res)[["diag"]]),
+            grep("Testi",dimnames(res)[["diag"]]) )
> res[no.M,"M",,] <- NA
> res[no.F,"F",,] <- NA
> round( ftable( res, row.vars=1:2 ), 2 )
                                      type DM/noIns           DM/Ins           Ins vs. noIns             DM
                                      est       Est   lo   hi    Est   lo   hi           Est   lo   hi  Est   lo   hi
diag                              sex
All malignant neoplasms           M            1.16 1.15 1.18   1.15 1.12 1.19          0.99 0.96 1.03 1.16 1.15 1.18
                                  F            1.15 1.13 1.17   1.19 1.15 1.24          1.04 1.00 1.08 1.16 1.14 1.18
Oesophagus                        M            1.25 1.11 1.40   1.31 1.07 1.61          1.05 0.83 1.33 1.26 1.14 1.40
                                  F            0.90 0.72 1.12   0.89 0.57 1.39          0.99 0.61 1.61 0.90 0.74 1.10
Stomach                           M            1.26 1.13 1.39   1.26 1.04 1.52          1.00 0.81 1.24 1.26 1.15 1.38
                                  F            1.28 1.11 1.49   1.45 1.11 1.90          1.13 0.84 1.52 1.32 1.16 1.50
Colon incl. rectosigmoideum       M            1.31 1.24 1.38   1.18 1.06 1.31          0.90 0.80 1.01 1.28 1.22 1.35
                                  F            1.17 1.11 1.24   1.12 1.00 1.26          0.96 0.84 1.09 1.17 1.11 1.23
Ascending colon                   M            1.40 1.26 1.54   1.29 1.06 1.57          0.92 0.75 1.14 1.37 1.25 1.51
                                  F            1.30 1.19 1.42   1.03 0.84 1.26          0.79 0.64 0.99 1.25 1.15 1.36
Transverse colon                  M            1.45 1.26 1.66   1.38 1.06 1.80          0.96 0.71 1.28 1.44 1.27 1.63
                                  F            1.16 1.00 1.34   1.27 0.96 1.68          1.10 0.80 1.49 1.18 1.03 1.34
Descending and sigmoid colon      M            1.20 1.11 1.30   1.07 0.92 1.24          0.89 0.75 1.05 1.17 1.10 1.26
                                  F            1.06 0.96 1.16   1.13 0.95 1.35          1.07 0.88 1.30 1.07 0.99 1.16
Other colon (unspec. or multiple) M            1.50 1.26 1.79   1.23 0.85 1.77          0.82 0.55 1.22 1.44 1.23 1.70
                                  F            1.25 1.03 1.50   1.22 0.83 1.78          0.98 0.64 1.48 1.24 1.04 1.47
Rectum (excl. anus)               M            1.10 1.02 1.18   1.01 0.88 1.16          0.92 0.78 1.07 1.08 1.01 1.15
                                  F            1.02 0.92 1.12   0.86 0.70 1.06          0.85 0.68 1.06 0.99 0.90 1.08
Colorectal cancer (excl. anus)    M            1.23 1.18 1.28   1.11 1.02 1.21          0.91 0.83 0.99 1.20 1.16 1.25
                                  F            1.13 1.08 1.19   1.05 0.95 1.16          0.93 0.83 1.04 1.12 1.07 1.17
Liver                             M            3.63 3.28 4.02   5.35 4.62 6.20          1.47 1.25 1.74 4.01 3.66 4.38
                                  F            1.78 1.48 2.14   2.56 1.90 3.45          1.44 1.03 2.02 1.93 1.64 2.27
Pancreas                          M            2.08 1.92 2.26   3.72 3.32 4.17          1.79 1.57 2.04 2.43 2.27 2.61
                                  F            1.90 1.75 2.07   3.47 3.07 3.93          1.83 1.58 2.11 2.20 2.05 2.37
Lung, bronchus and pleura         M            1.07 1.03 1.12   1.18 1.09 1.27          1.10 1.01 1.20 1.09 1.05 1.14
                                  F            1.03 0.97 1.08   1.04 0.93 1.15          1.01 0.90 1.14 1.03 0.98 1.08
Melanoma of skin                  M            0.97 0.87 1.07   0.79 0.65 0.96          0.82 0.66 1.02 0.93 0.85 1.01
```

```
                                  F            0.81 0.72 0.91   0.80 0.64 0.98          0.99 0.78 1.26 0.80 0.72 0.89
Breast                            M            0.87 0.56 1.36   1.12 0.53 2.38          1.28 0.55 3.02 0.92 0.63 1.37
                                  F            1.07 1.03 1.11   0.98 0.91 1.05          0.92 0.84 0.99 1.05 1.01 1.08
Cervix uteri                      M              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
                                  F            1.00 0.86 1.16   1.10 0.86 1.40          1.11 0.84 1.46 1.02 0.90 1.16
Corpus uteri                      M              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
                                  F            1.59 1.48 1.71   1.67 1.45 1.91          1.05 0.90 1.22 1.61 1.50 1.72
Ovary, fallopian tube etc.        M              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
                                  F            1.03 0.94 1.14   0.92 0.76 1.12          0.89 0.72 1.11 1.01 0.92 1.10
Prostate                          M            0.96 0.93 1.00   0.73 0.68 0.80          0.76 0.70 0.83 0.91 0.88 0.95
                                  F              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
Testis                            M            0.81 0.59 1.10   0.71 0.49 1.04          0.88 0.54 1.43 0.77 0.60 0.98
                                  F              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
Kidney                            M            1.49 1.34 1.64   1.58 1.33 1.88          1.06 0.88 1.30 1.51 1.38 1.65
                                  F            1.62 1.42 1.85   2.03 1.62 2.53          1.25 0.97 1.61 1.70 1.52 1.91
Urinary bladder                   M            1.15 1.09 1.21   1.05 0.94 1.17          0.91 0.81 1.03 1.13 1.08 1.19
                                  F            0.98 0.88 1.10   0.96 0.78 1.20          0.98 0.77 1.25 0.98 0.89 1.08
Brain                             M            1.08 0.96 1.23   1.04 0.84 1.29          0.96 0.75 1.23 1.07 0.96 1.20
                                  F            1.12 0.98 1.30   1.42 1.13 1.79          1.26 0.97 1.65 1.19 1.05 1.35
Thyroid                           M            1.21 0.84 1.73   1.21 0.66 2.19          1.00 0.50 1.99 1.21 0.88 1.65
                                  F            1.12 0.86 1.47   1.27 0.82 1.95          1.13 0.68 1.86 1.16 0.92 1.46
Hodgkin's lymphoma                M            1.58 1.15 2.16   1.32 0.79 2.20          0.84 0.46 1.50 1.50 1.14 1.97
                                  F            1.65 1.12 2.44   0.97 0.43 2.16          0.59 0.24 1.42 1.46 1.02 2.08
Non-Hodgkin lymphoma              M            1.15 1.04 1.28   0.93 0.76 1.14          0.81 0.65 1.01 1.10 1.01 1.21
                                  F            1.12 1.00 1.26   1.33 1.09 1.63          1.19 0.95 1.50 1.16 1.05 1.29
Multiple myeloma                  M            1.00 0.86 1.15   0.95 0.72 1.25          0.95 0.70 1.29 0.99 0.87 1.12
                                  F            1.03 0.87 1.23   1.13 0.81 1.56          1.09 0.76 1.57 1.05 0.90 1.23
Leukaemia                         M            1.05 0.95 1.17   1.15 0.96 1.38          1.10 0.89 1.34 1.07 0.98 1.18
                                  F            1.11 0.98 1.25   1.09 0.86 1.39          0.99 0.76 1.29 1.10 0.99 1.23
Other                             M            1.25 1.20 1.31   1.25 1.16 1.36          1.00 0.91 1.09 1.25 1.20 1.31
                                  F            1.27 1.21 1.33   1.39 1.27 1.53          1.10 0.99 1.22 1.29 1.24 1.35
> round( ftable( nca, col.vars=3:2 ), 0 )
                                  type   Well        DM/noIns        DM/Ins          DM
                                  sex       M      F        M      F      M      F       M     F
diag
All malignant neoplasms                167394 178744    15626  12183   4143   3281   19769 15464
Oesophagus                               3282   1304      322     85     92     20     414   105
Stomach                                  4171   2289      416    203    111     54     527   257
Colon incl. rectosigmoideum             13853  15136     1583   1351    364    298    1947  1649
Ascending colon                          3636   5126      442    530    104     95     546   625
Transverse colon                         1819   2172      234    203     57     50     291   253
Descending and sigmoid colon             7292   6601      764    496    173    126     937   622
Other colon (unspec. or multiple)        1106   1237      143    122     30     27     173   149
Rectum (excl. anus)                      8876   6214      832    449    201     91    1033   540
Colorectal cancer (excl. anus)          22729  21350     2415   1800    565    389    2980  2189
Liver                                    1776   1103      500    131    200     45     700   176
Pancreas                                 4041   4425      687    622    329    267    1016   889
Lung, bronchus and pleura               25302  20283     2294   1397    664    361    2958  1758
Melanoma of skin                         7008   8873      410    292    104     87     514   379
Breast                                    298  52190       21   2935      7    750      28  3685
Cervix uteri                                0   5691        0    181      0     67       0   248
Corpus uteri                                0   8057        0    792      0    216       0  1008
Ovary, fallopian tube etc.                  0   7400        0    421      0    102       0   523
Prostate                                31713      0     3099      0    598      0    3697     0
Testis                                   4257      0       42      0     27      0      69     0
Kidney                                   3976   2434      430    256    130     80     560   336
Urinary bladder                         14781   4906     1475    350    342     82    1817   432
Brain                                    4922   4310      273    208     83     75     356   283
Thyroid                                   593   1511       32     56     11     21      43    77
Hodgkin's lymphoma                        990    723       44     28     15      6      59    34
Non-Hodgkin lymphoma                     5434   4602      422    312     98     95     520   407
Multiple myeloma                         2452   1883      208    141     52     37     260   178
Leukaemia                                5423   4050      407    277    119     66     526   343
Other                                   24246  21360     2129   1696    596    461    2725  2157
PYRS                                    37646  37991      871    857    372    309    1243  1166
Deaths                                     NA     NA       NA     NA     NA     NA      NA    NA
>
> save( res, nca, file="../data/ana1a.Rdata" )
>

 ---------------------------------------------
 Program: ana1a.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 31. marts 2011, 17:35:53
 Elapsed: 00:03:10
 ---------------------------------------------
> proc.time()
   user  system elapsed
 185.07    5.23  191.51

 R 2.12.1
 ---------------------------------------------
 Program:  ana1i.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 31. marts 2011, 17:35:54
 ---------------------------------------------
> # Same analysis as in ana1a.r, except persons diagnosed with diabetes
> # prior to 1995 are excluded
>
```

```
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> library( splines )
> # A wrapper for ns() where boundary knots are taken as the
> # smallest of the knots= argument
> source( "C:/Bendix/Steno/DM-register/NDR/R/Ns.r" )
> Ns
function (x, df = NULL, knots = NULL, intercept = FALSE, Boundary.knots = NULL)
{
    if (is.null(Boundary.knots)) {
        if (!is.null(knots)) {
            knots <- sort(unique(knots))
            ok <- c(1, length(knots))
            Boundary.knots <- knots[ok]
            knots <- knots[-ok]
        }
    }
    ns(x, df = df, knots = knots, intercept = intercept, Boundary.knots = Boundary.knots)
}
>
> # Get the data file:
> load( file = "../data/dmcaA.Rdata" )
> stat.table( list(state,DMtype), list( sum(y/1000), sum(d0), count() ),
+             data=dmca, margins=T )
 ----------------------------------------------
         ----------------DMtype----------------
 state           0       1        2     Total
 ----------------------------------------------
 Well      75637.67      NA       NA  75637.67
          346138.00      NA       NA 346138.00
               6000       0        0      6000

 DM          425.41    0.30  1302.14   1727.84
            6937.00    2.00 20870.00  27809.00
               5215    1867     5948     13030

 DM/Ins      437.60   44.95   198.62    681.17
            4450.00   27.00  2947.00   7424.00
               5426    2446     5666     13538


 Total     76500.68   45.25  1500.76  78046.68
          357525.00   29.00 23817.00 381371.00
              16641    4313    11614     32568
 ----------------------------------------------
> dmca <- subset( dmca, state %in% "Well" | DMtype > 0 )
> stat.table( list(state,DMtype), list( sum(y), sum(d0), count() ), data=dmca )
 -----------------------------------------
         -------------DMtype--------------
 state             0        1         2
 -----------------------------------------
 Well     75637670.45       NA        NA
            346138.00       NA        NA
                 6000        0         0

 DM                NA   300.32 1302136.62
                   NA     2.00   20870.00
                    0     1867       5948

 DM/Ins            NA 44950.07  198621.70
                   NA    27.00    2947.00
                    0     2446       5666
 -----------------------------------------
> str( dmca )
'data.frame': 21927 obs. of  40 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ State : Factor w/ 2 levels "Well","DM+DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ DMtype: num  0 0 0 0 0 0 0 0 0 0 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1995 1996 1996 1997 ...
 $ c     : num  1994 1995 1995 1996 1996 ...
 $ ax    : num  0.667 0.333 0.667 0.333 0.667 ...
 $ px    : num  1995 1996 1996 1997 1997 ...
 $ cx    : num  1995 1995 1996 1996 1997 ...
 $ y     : num  17870 18025 18061 17426 17448 ...
 $ d0    : num  2 4 2 2 3 1 4 4 2 4 ...
 $ d21   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d22   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d24   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d241  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d242  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d243  : num  0 0 0 0 0 0 0 0 0 0 ...
```

```
 $ d249  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d251  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d259  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d26   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d28   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d33   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d51   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d70   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d82   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d83   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d84   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d91   : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d92   : num  0 0 1 0 0 0 0 0 0 0 ...
 $ d101  : num  1 1 0 1 1 0 0 0 1 0 ...
 $ d103  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d113  : num  1 1 1 1 0 0 0 0 0 3 ...
 $ d121  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d131  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d132  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d133  : num  0 0 0 0 0 0 0 0 0 0 ...
 $ d139  : num  0 0 0 0 2 0 0 0 0 0 ...
 $ d999  : num  0 2 0 0 0 1 4 4 1 1 ...
> d.col <- dxnam$d.col
> c.col <- 1:(d.col[1]-1)
>
> # Construct an array to hold the results
> dnam <- list( diag = dxnam$d.nam,
+                sex = c("M","F"),
+               type = c("DM/noIns","DM/Ins","Ins vs. noIns", "DM"),
+                est = c("Est","lo","hi") )
> res <- array( NA, dim=sapply(dnam,length), dimnames=dnam )
> # Construct an array to hold the no. cancer cases analysed
> dnam <- list( diag = c(as.character(dxnam$d.nam),"PYRS","Deaths"),
+                sex = c("M","F"),
+               type = c("Well","DM/noIns","DM/Ins","DM") )
> nca <- array( NA, dim=sapply(dnam,length), dimnames=dnam )
>
> Nres <- dim( res )[1]
>
> # Knots for the natural splines
> a.kn <- seq(  10, 100,,9)
> p.kn <- seq(1995,2009,,5)
> c.kn <- seq(1900,2005,,9)
> # Contrast matrix to extract each of the RRs and  also ther ratio
> CM <- rbind( c( 1, 0),
+              c( 0, 1),
+              c(-1, 1) )
> rownames(CM) <- c("DM/noIns","DM/Ins","Ins vs. noIns")
>
> # Analysis for all sites
> for( i in 1:Nres )
+ {
+ data <- dmca[,c(c.col,d.col[i])]
+ names(data)[ncol(data)] <- "D"
+ m1 <- glm( D ~ Ns(ax,knots=a.kn) +
+                Ns(px,knots=p.kn) +
+                Ns(cx,knots=c.kn) +
+                state + offset( log(y) ),
+                family = poisson,
+                data = subset(data,sex=="M") )
+ f1 <- glm( D ~ Ns(ax,knots=a.kn) +
+                Ns(px,knots=p.kn) +
+                Ns(cx,knots=c.kn) +
+                state + offset( log(y) ),
+                family = poisson,
+                data = subset(data,sex=="F") )
+ # Collapse the DM and DM/ins levels and repeat all
+ m2 <- update( m1, ~ . - state + State )
+ f2 <- update( f1, ~ . - state + State )
+ # The RR estimates
+ res[i,"M",1:3,] <- ci.lin( m1, subset="state", ctr.mat=CM, E=T )[,5:7]
+ res[i,"F",1:3,] <- ci.lin( f1, subset="state", ctr.mat=CM, E=T )[,5:7]
+ res[i,"M",  4,] <- ci.lin( m2, subset="State", E=T )[,5:7]
+ res[i,"F",  4,] <- ci.lin( f2, subset="State", E=T )[,5:7]
+ # The total number of cases
+ nca[i,,1:3] <- with(data,tapply( D, list(sex,state), sum, na.rm=T ))
+ }
There were 50 or more warnings (use warnings() to see the first 50)
> # The rows of person years
> nca["PYRS" ,,1:3] <- with(dmca,tapply( y/1000, list(sex,state), sum, na.rm=T ))
> # Get the right number of cases for the analysis of DM as one state
> nca[,,4] <- nca[,,2] + nca[,,3]
> # Get rid of the male/females in the wrong places
> no.M <- c( grep("uteri",dimnames(res)[["diag"]]),
+            grep("Ovary",dimnames(res)[["diag"]]) )
> no.F <- c( grep("Prost",dimnames(res)[["diag"]]),
+            grep("Testi",dimnames(res)[["diag"]]) )
> res[no.M,"M",,] <- NA
> res[no.F,"F",,] <- NA
```

```
> round( ftable( res, row.vars=1:2 ), 2 )
                                      type DM/noIns           DM/Ins           Ins vs. noIns             DM          
                                      est       Est   lo   hi    Est   lo   hi           Est   lo   hi  Est   lo   hi
diag                              sex                                                                               
All malignant neoplasms           M            1.19 1.17 1.21   1.35 1.29 1.42          1.14 1.08 1.20 1.21 1.19 1.23
                                  F            1.17 1.15 1.20   1.44 1.37 1.53          1.23 1.16 1.30 1.20 1.18 1.23
Oesophagus                        M            1.27 1.11 1.45   1.24 0.87 1.79          0.98 0.67 1.43 1.27 1.12 1.44
                                  F            0.96 0.75 1.24   1.15 0.57 2.30          1.19 0.57 2.49 0.98 0.77 1.24
Stomach                           M            1.25 1.11 1.41   1.53 1.15 2.05          1.23 0.90 1.68 1.28 1.15 1.43
                                  F            1.29 1.09 1.54   1.85 1.19 2.87          1.43 0.89 2.28 1.34 1.14 1.58
Colon incl. rectosigmoideum       M            1.32 1.24 1.40   1.32 1.11 1.56          1.00 0.84 1.19 1.32 1.24 1.40
                                  F            1.22 1.14 1.30   1.10 0.89 1.35          0.90 0.73 1.12 1.20 1.13 1.28
Ascending colon                   M            1.40 1.24 1.57   1.33 0.96 1.84          0.95 0.68 1.34 1.39 1.24 1.55
                                  F            1.38 1.25 1.54   1.02 0.71 1.47          0.74 0.51 1.08 1.35 1.22 1.50
Transverse colon                  M            1.46 1.24 1.71   1.88 1.29 2.76          1.29 0.86 1.94 1.50 1.29 1.74
                                  F            1.22 1.03 1.44   1.48 0.93 2.36          1.22 0.75 1.99 1.24 1.06 1.45
Descending and sigmoid colon      M            1.20 1.10 1.31   1.21 0.95 1.55          1.01 0.78 1.30 1.20 1.11 1.31
                                  F            1.05 0.94 1.18   0.95 0.66 1.35          0.90 0.62 1.30 1.04 0.94 1.16
Other colon (unspec. or multiple) M            1.60 1.31 1.95   0.98 0.49 1.96          0.61 0.30 1.25 1.53 1.26 1.86
                                  F            1.28 1.03 1.59   1.43 0.77 2.67          1.12 0.58 2.15 1.29 1.05 1.59
Rectum (excl. anus)               M            1.11 1.02 1.21   1.09 0.87 1.36          0.98 0.77 1.24 1.11 1.03 1.20
                                  F            1.00 0.90 1.13   0.91 0.64 1.31          0.91 0.62 1.32 1.00 0.89 1.11
Colorectal cancer (excl. anus)    M            1.24 1.18 1.30   1.22 1.07 1.40          0.99 0.86 1.14 1.24 1.18 1.30
                                  F            1.16 1.09 1.22   1.04 0.87 1.25          0.90 0.75 1.09 1.15 1.08 1.21
Liver                             M            3.37 2.99 3.80   8.12 6.63 9.93          2.41 1.93 3.00 3.90 3.50 4.35
                                  F            1.55 1.23 1.96   4.01 2.57 6.26          2.59 1.58 4.23 1.77 1.43 2.19
Pancreas                          M            2.36 2.16 2.58   6.89 5.98 7.94          2.92 2.49 3.42 2.86 2.64 3.10
                                  F            2.19 1.99 2.40   7.21 6.17 8.42          3.30 2.77 3.93 2.65 2.43 2.88
Lung, bronchus and pleura         M            1.14 1.08 1.19   1.45 1.29 1.64          1.28 1.13 1.45 1.17 1.12 1.23
                                  F            1.10 1.04 1.17   1.44 1.23 1.68          1.31 1.11 1.54 1.14 1.07 1.20
Melanoma of skin                  M            0.95 0.85 1.06   0.76 0.55 1.05          0.80 0.57 1.12 0.92 0.83 1.03
                                  F            0.77 0.68 0.89   0.85 0.60 1.21          1.10 0.76 1.60 0.78 0.69 0.89
Breast                            M            0.76 0.43 1.33   1.97 0.73 5.30          2.59 0.84 7.94 0.89 0.54 1.46
                                  F            1.05 1.00 1.10   1.01 0.89 1.14          0.96 0.84 1.09 1.04 1.00 1.09
Cervix uteri                      M              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
                                  F            1.03 0.86 1.23   1.41 0.95 2.09          1.37 0.89 2.09 1.08 0.92 1.27
Corpus uteri                      M              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
                                  F            1.57 1.44 1.71   1.65 1.30 2.10          1.05 0.82 1.36 1.58 1.45 1.71
Ovary, fallopian tube etc.        M              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
                                  F            1.07 0.96 1.20   1.15 0.83 1.58          1.07 0.76 1.50 1.08 0.97 1.20
Prostate                          M            0.97 0.93 1.01   0.76 0.67 0.86          0.79 0.69 0.90 0.94 0.91 0.98
                                  F              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
Testis                            M            0.88 0.63 1.22   0.50 0.24 1.05          0.57 0.25 1.28 0.78 0.58 1.06
                                  F              NA   NA   NA     NA   NA   NA            NA   NA   NA   NA   NA   NA
Kidney                            M            1.47 1.30 1.65   2.04 1.58 2.63          1.39 1.06 1.83 1.53 1.38 1.71
                                  F            1.66 1.43 1.93   3.38 2.48 4.62          2.04 1.45 2.86 1.83 1.59 2.10
Urinary bladder                   M            1.21 1.14 1.29   1.10 0.92 1.32          0.91 0.75 1.10 1.20 1.13 1.27
                                  F            1.02 0.90 1.16   1.15 0.80 1.65          1.13 0.77 1.64 1.03 0.91 1.16
Brain                             M            1.15 1.01 1.33   1.15 0.82 1.63          1.00 0.69 1.44 1.15 1.01 1.31
                                  F            1.20 1.02 1.41   1.77 1.23 2.54          1.47 1.00 2.18 1.26 1.09 1.47
Thyroid                           M            1.31 0.88 1.96   1.80 0.80 4.04          1.38 0.57 3.35 1.38 0.96 1.99
                                  F            1.08 0.78 1.48   2.20 1.25 3.89          2.05 1.07 3.90 1.22 0.92 1.62
Hodgkin's lymphoma                M            1.84 1.31 2.58   1.96 0.98 3.95          1.07 0.50 2.29 1.86 1.37 2.53
                                  F            1.81 1.18 2.79   0.95 0.24 3.81          0.52 0.12 2.22 1.69 1.12 2.55
Non-Hodgkin lymphoma              M            1.18 1.05 1.32   1.00 0.72 1.38          0.85 0.60 1.19 1.16 1.04 1.29
                                  F            1.14 1.00 1.30   1.35 0.94 1.93          1.18 0.81 1.73 1.16 1.02 1.32
Multiple myeloma                  M            1.07 0.91 1.25   0.99 0.63 1.55          0.92 0.57 1.49 1.06 0.91 1.23
                                  F            1.04 0.85 1.27   0.77 0.38 1.54          0.74 0.36 1.52 1.02 0.84 1.23
Leukaemia                         M            1.03 0.92 1.16   1.05 0.76 1.45          1.01 0.72 1.43 1.03 0.92 1.16
                                  F            1.16 1.01 1.34   1.25 0.83 1.89          1.08 0.70 1.66 1.17 1.02 1.34
Other                             M            1.26 1.20 1.33   1.44 1.26 1.64          1.14 0.99 1.31 1.28 1.22 1.35
                                  F            1.30 1.23 1.38   1.65 1.41 1.92          1.26 1.07 1.48 1.34 1.27 1.41
>
> # For completeness, insert the deaths in the last line
> load( file="../data/DMmD.Rdata" )
> nca["Deaths",,1:3] <- with( DMm, tapply( dd, list(sex,state), sum ) )
> nca["Deaths",,4] <- nca["Deaths",,2]+nca["Deaths",,3]
>
> round( ftable( nca, col.vars=3:2 ) )
                                  type   Well        DM/noIns        DM/Ins            DM       
                                  sex       M      F        M      F      M      F      M      F
diag                                                                                            
All malignant neoplasms               167394 178744    11837   9035   1716   1258  13553  10293
Oesophagus                              3282   1304      242     65     30      8    272     73
Stomach                                 4171   2289      299    139     46     20    345    159
Colon incl. rectosigmoideum            13853  15136     1163    981    138     88   1301   1069
Ascending colon                         3636   5126      324    399     37     29    361    428
Transverse colon                        1819   2172      174    151     27     18    201    169
Descending and sigmoid colon            7292   6601      554    342     66     31    620    373
Other colon (unspec. or multiple)       1106   1237      111     89      8     10    119     99
Rectum (excl. anus)                     8876   6214      625    316     77     30    702    346
Colorectal cancer (excl. anus)         22729  21350     1788   1297    215    118   2003   1415
Liver                                   1776   1103      338     78    103     20    441     98
Pancreas                                4041   4425      570    504    208    169    778    673
Lung, bronchus and pleura              25302  20283     1766   1129    274    163   2040   1292
Melanoma of skin                        7008   8873      314    214     38     32    352    246
Breast                                   298  52190       13   2163      4    257     17   2420
Cervix uteri                               0   5691        0    132      0     25      0    157
Corpus uteri                               0   8057        0    567      0     67      0    634
```

```
Ovary, fallopian tube etc.                  0   7400        0    313      0     38      0    351
Prostate                                31713      0     2425      0    239      0   2664      0
Testis                                   4257      0       37      0      7      0     44      0
Kidney                                   3976   2434      319    187     60     41    379    228
Urinary bladder                         14781   4906     1110    259    118     30   1228    289
Brain                                    4922   4310      219    163     33     30    252    193
Thyroid                                   593   1511       26     40      6     12     32     52
Hodgkin's lymphoma                        990    723       38     23      8      2     46     25
Non-Hodgkin lymphoma                     5434   4602      321    229     37     30    358    259
Multiple myeloma                         2452   1883      165    103     19      8    184    111
Leukaemia                                5423   4050      292    205     37     23    329    228
Other                                   24246  21360     1555   1225    234    165   1789   1390
PYRS                                    37646  37991      664    638    139    104    804    742
Deaths                                 225684 237814    19737  17987   3872   2782  23609  20769
> round( apply( nca, c(1,3), sum ) )
                                   type
diag                                  Well DM/noIns DM/Ins    DM
  All malignant neoplasms           346138    20872   2974 23846
  Oesophagus                          4586      307     38   345
  Stomach                             6460      438     66   504
  Colon incl. rectosigmoideum        28989     2144    226  2370
  Ascending colon                     8762      723     66   789
  Transverse colon                    3991      325     45   370
  Descending and sigmoid colon       13893      896     97   993
  Other colon (unspec. or multiple)   2343      200     18   218
  Rectum (excl. anus)                15090      941    107  1048
  Colorectal cancer (excl. anus)     44079     3085    333  3418
  Liver                               2879      416    123   539
  Pancreas                            8466     1074    377  1451
  Lung, bronchus and pleura          45585     2895    437  3332
  Melanoma of skin                   15881      528     70   598
  Breast                             52488     2176    261  2437
  Cervix uteri                        5691      132     25   157
  Corpus uteri                        8057      567     67   634
  Ovary, fallopian tube etc.          7400      313     38   351
  Prostate                           31713     2425    239  2664
  Testis                              4257       37      7    44
  Kidney                              6410      506    101   607
  Urinary bladder                    19687     1369    148  1517
  Brain                               9232      382     63   445
  Thyroid                             2104       66     18    84
  Hodgkin's lymphoma                  1713       61     10    71
  Non-Hodgkin lymphoma               10036      550     67   617
  Multiple myeloma                    4335      268     27   295
  Leukaemia                           9473      497     60   557
  Other                              45606     2780    399  3179
  PYRS                               75638     1302    244  1546
  Deaths                            463498    37724   6654 44378
>
> save( res, nca, file="../data/ana1i.Rdata" )
>

 ---------------------------------------------
 Program: ana1i.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 31. marts 2011, 17:38:07
 Elapsed: 00:02:13
 ---------------------------------------------
> proc.time()
   user  system elapsed
 128.90    3.79  134.10

 R 2.12.1
 ---------------------------------------------
 Program:  plot1a.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 31. marts 2011, 17:38:08
 ---------------------------------------------
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> source( "c:/stat/r/bxc/library.sources/useful/r/plt.r" )
> source( "c:/stat/r/bxc/library.sources/useful/r/cnr.r" )
> load( file="../data/ana1a.Rdata" )
> str( res )
 num [1:29, 1:2, 1:4, 1:3] 1.16 1.25 1.26 1.31 1.4 ...
 - attr(*, "dimnames")=List of 4
  ..$ diag: chr [1:29] "All malignant neoplasms" "Oesophagus" "Stomach" "Colon incl. rectosigmoideum" ...
  ..$ sex : chr [1:2] "M" "F"
  ..$ type: chr [1:4] "DM/noIns" "DM/Ins" "Ins vs. noIns" "DM"
  ..$ est : chr [1:3] "Est" "lo" "hi"
> dimnames(res)[[1]] <- gsub(" \\(excl\\. anus)","",dimnames(res)[[1]])
> res["Breast","M",,] <- NA
> Nres <- dim(res)[1]
```

```
>
> # Check that sites comprising all cancers are properly selected
> xsites <- c(1,4,10,29:31)
> dimnames(nca)[[1]][ xsites]
[1] "All malignant neoplasms"        "Colon incl. rectosigmoideum"
[3] "Colorectal cancer (excl. anus)" "Other"
[5] "PYRS"                           "Deaths"
> dimnames(nca)[[1]][-xsites]
 [1] "Oesophagus"                        "Stomach"
 [3] "Ascending colon"                   "Transverse colon"
 [5] "Descending and sigmoid colon"      "Other colon (unspec. or multiple)"
 [7] "Rectum (excl. anus)"               "Liver"
 [9] "Pancreas"                          "Lung, bronchus and pleura"
[11] "Melanoma of skin"                  "Breast"
[13] "Cervix uteri"                      "Corpus uteri"
[15] "Ovary, fallopian tube etc."        "Prostate"
[17] "Testis"                            "Kidney"
[19] "Urinary bladder"                   "Brain"
[21] "Thyroid"                           "Hodgkin's lymphoma"
[23] "Non-Hodgkin lymphoma"              "Multiple myeloma"
[25] "Leukaemia"
>        nca[      1,,] -
+ apply( nca[-xsites,,], 2:3, sum )
   type
sex  Well DM/noIns DM/Ins   DM
  M 24246     2129    596 2725
  F 21360     1696    461 2157
>        nca["Other",,]
   type
sex  Well DM/noIns DM/Ins   DM
  M 24246     2129    596 2725
  F 21360     1696    461 2157
>
> round( ftable( nca[ 30,,,drop=F], col.vars=3:2 ), 1 )
     type    Well         DM/noIns          DM/Ins              DM
     sex        M       F        M       F       M       F       M       F
diag
PYRS      37646.2 37991.5    870.7   857.2   372.5   308.7  1243.1  1165.9
>        ftable( nca[-30,,      ], col.vars=3:2 )
                                  type   Well        DM/noIns        DM/Ins            DM
                                  sex       M      F        M      F      M      F      M      F
diag
All malignant neoplasms                167394 178744    15626  12183   4143   3281  19769  15464
Oesophagus                               3282   1304      322     85     92     20    414    105
Stomach                                  4171   2289      416    203    111     54    527    257
Colon incl. rectosigmoideum             13853  15136     1583   1351    364    298   1947   1649
Ascending colon                          3636   5126      442    530    104     95    546    625
Transverse colon                         1819   2172      234    203     57     50    291    253
Descending and sigmoid colon             7292   6601      764    496    173    126    937    622
Other colon (unspec. or multiple)        1106   1237      143    122     30     27    173    149
Rectum (excl. anus)                      8876   6214      832    449    201     91   1033    540
Colorectal cancer (excl. anus)          22729  21350     2415   1800    565    389   2980   2189
Liver                                    1776   1103      500    131    200     45    700    176
Pancreas                                 4041   4425      687    622    329    267   1016    889
Lung, bronchus and pleura               25302  20283     2294   1397    664    361   2958   1758
Melanoma of skin                         7008   8873      410    292    104     87    514    379
Breast                                    298  52190       21   2935      7    750     28   3685
Cervix uteri                                0   5691        0    181      0     67      0    248
Corpus uteri                                0   8057        0    792      0    216      0   1008
Ovary, fallopian tube etc.                  0   7400        0    421      0    102      0    523
Prostate                                31713      0     3099      0    598      0   3697      0
Testis                                   4257      0       42      0     27      0     69      0
Kidney                                   3976   2434      430    256    130     80    560    336
Urinary bladder                         14781   4906     1475    350    342     82   1817    432
Brain                                    4922   4310      273    208     83     75    356    283
Thyroid                                   593   1511       32     56     11     21     43     77
Hodgkin's lymphoma                        990    723       44     28     15      6     59     34
Non-Hodgkin lymphoma                     5434   4602      422    312     98     95    520    407
Multiple myeloma                         2452   1883      208    141     52     37    260    178
Leukaemia                                5423   4050      407    277    119     66    526    343
Other                                   24246  21360     2129   1696    596    461   2725   2157
Deaths                                     NA     NA       NA     NA     NA     NA     NA     NA
> # What fraction does the analysed sites comprise:
> ftable( round( 100 - 100 * nca["Other",,,drop=F] / nca[1,,,drop=F], 1 ),
+         col.vars=3:2 )
      type Well      DM/noIns      DM/Ins        DM
      sex     M    F        M    F      M    F    M    F
diag
Other      85.5 88.0     86.4 86.1   85.6 85.9 86.2 86.1
>
> sub <- c(1:3,10,5:7,9,11:28)
> dimnames(res)[[1]][-sub]
[1] "Colon incl. rectosigmoideum"       "Other colon (unspec. or multiple)"
[3] "Other"
> dimnames(res)[[1]][sub]
 [1] "All malignant neoplasms"      "Oesophagus"
 [3] "Stomach"                      "Colorectal cancer"
 [5] "Ascending colon"              "Transverse colon"
 [7] "Descending and sigmoid colon" "Rectum"
```

```
 [9] "Liver"                        "Pancreas"
[11] "Lung, bronchus and pleura"    "Melanoma of skin"
[13] "Breast"                       "Cervix uteri"
[15] "Corpus uteri"                 "Ovary, fallopian tube etc."
[17] "Prostate"                     "Testis"
[19] "Kidney"                       "Urinary bladder"
[21] "Brain"                        "Thyroid"
[23] "Hodgkin's lymphoma"           "Non-Hodgkin lymphoma"
[25] "Multiple myeloma"             "Leukaemia"
> plt( "RRa-raw0-N", width=11, height=8 )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
> Nres <- dim( res[sub,,,] )[1]
> plotEst( res[sub,"M","DM",], txtpos=Nres:1, y=Nres:1+0.15, col="#0000FF",
+          xlog=T, xlim=c(0.5,5), grid=c(6:19/10,4:10/2), vref=1, ylim=c(1,Nres),
+          xtic=c(0.5,0.7,1,1.5,2:5), xlab="RR, DM vs. non-DM" )
> linesEst( res[sub,"F","DM",], y=Nres:1-0.15, col="#FF0000" )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> text( rep(0.52,Nres), Nres:1+0.05, nca[sub,"M","DM"], col="blue", adj=c(1,0), cex=0.7 )
> text( rep(0.52,Nres), Nres:1-0.05, nca[sub,"F","DM"], col="red" , adj=c(1,1), cex=0.7 )
> dev.off()
null device
          1
>
> plt( "RRa-ins1", width=11, height=8  )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
> Nres <- dim( res[sub,,,] )[1]
> plotEst( res[sub,"M","DM/noIns",], txtpos=Nres:1, y=Nres:1+0.3, col="#0000FF",
+          xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1, ylim=c(1,Nres),
+          xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM / DM+ins vs. non-DM" )
> linesEst( res[sub,"M","DM/Ins"  ,], y=Nres:1+0.1, col="#9999FF" )
> linesEst( res[sub,"F","DM/noIns",], y=Nres:1-0.1, col="#FF0000" )
> linesEst( res[sub,"F","DM/Ins"  ,], y=Nres:1-0.3, col="#FF9999" )
> text( cnr(0.99,0.99), "Light color: on insulin",
+                            adj=c(1,1), col="#999999", font=1 )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> plt( "RRa-insRR", width=11, height=8 )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
>  plotEst( res[sub,"M","Ins vs. noIns",], txtpos=Nres:1, y=Nres:1+0.15, col="#0000FF",
+          xlog=T, xlim=c(0.2,10), grid=c(2:19/10,4:20/2), vref=1, ylim=c(1,Nres),
+          xtic=c(0.2,0.4,0.6,0.8,1,1.5,2:10), xlab="RR, DM/Insulin: Yes vs. No " )
> linesEst( res[sub,"F","Ins vs. noIns",], y=Nres:1-0.15, col="#FF0000" )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> sub <- c( grep("Oesop",dimnames(res)[["diag"]]),
+          grep("Stoma",dimnames(res)[["diag"]]),
+          grep("Color",dimnames(res)[["diag"]]),
+          grep("Liver",dimnames(res)[["diag"]]),
+          grep("Pancr",dimnames(res)[["diag"]]),
+          grep("Melan",dimnames(res)[["diag"]]),
+          grep("Corpu",dimnames(res)[["diag"]]),
+          grep("Prost",dimnames(res)[["diag"]]),
+          grep("Testi",dimnames(res)[["diag"]]),
+          grep("Kidne",dimnames(res)[["diag"]]),
+          grep("Brain",dimnames(res)[["diag"]]),
+          grep("Non-H",dimnames(res)[["diag"]]) )
> Nres <- length( sub )
>
> plt( "RRa-sub", width=5.5, height=4  )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
>  plotEst( res[sub,"M","DM",], txtpos=Nres:1, y=Nres:1+0.15, ylim=c(0.5,Nres+0.5),
+          col="#0000FF",
+          xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1,
+          xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM vs. non-DM" )
> linesEst( res[sub,"F","DM",], y=Nres:1-0.15, col="#FF0000" )
> text( cnr(0.99,0.97), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> plt( "RRa-ins-sub", width=5.5, height=4  )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
>  plotEst( res[sub,"M","DM/noIns",], txtpos=Nres:1, y=Nres:1+0.3, col="#0000FF",
+          xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1, ylim=c(0.5,Nres+0.5),
+          xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM / DM+ins vs. non-DM" )
> linesEst( res[sub,"M","DM/Ins"  ,], y=Nres:1+0.1, col="#9999FF" )
> linesEst( res[sub,"F","DM/noIns",], y=Nres:1-0.1, col="#FF0000" )
> linesEst( res[sub,"F","DM/Ins"  ,], y=Nres:1-0.3, col="#FF9999" )
> text( cnr(0.99,0.97), "M", adj=c(1,1), col="#0000FF", font=2 )
```

```
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>

 ---------------------------------------------
 Program: plot1a.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 31. marts 2011, 17:38:09
 Elapsed: 00:00:00
 ---------------------------------------------
> proc.time()
   user  system elapsed
   0.89    0.14    1.50

 R 2.12.1
 ---------------------------------------------
 Program:  plot1i.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  fredag 01. april 2011, 00:21:37
 ---------------------------------------------
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> source( "c:/stat/r/bxc/library.sources/useful/r/plt.r" )
> source( "c:/stat/r/bxc/library.sources/useful/r/cnr.r" )
> load( file="../data/ana1i.Rdata" )
> str( res )
 num [1:29, 1:2, 1:4, 1:3] 1.19 1.27 1.25 1.32 1.4 ...
 - attr(*, "dimnames")=List of 4
  ..$ diag: chr [1:29] "All malignant neoplasms" "Oesophagus" "Stomach" "Colon incl. rectosigmoideum" ...
  ..$ sex : chr [1:2] "M" "F"
  ..$ type: chr [1:4] "DM/noIns" "DM/Ins" "Ins vs. noIns" "DM"
  ..$ est : chr [1:3] "Est" "lo" "hi"
> dimnames(res)[[1]] <- gsub(" \\(excl\\. anus)","",dimnames(res)[[1]])
> res["Breast","M",,] <- NA
> Nres <- dim(res)[1]
>
> # Check that sites comprising all cancers are properly selected
> xsites <- c(1,4,10,29:31)
> dimnames(nca)[[1]][ xsites]
[1] "All malignant neoplasms"        "Colon incl. rectosigmoideum"
[3] "Colorectal cancer (excl. anus)" "Other"
[5] "PYRS"                           "Deaths"
> dimnames(nca)[[1]][-xsites]
 [1] "Oesophagus"                        "Stomach"
 [3] "Ascending colon"                   "Transverse colon"
 [5] "Descending and sigmoid colon"      "Other colon (unspec. or multiple)"
 [7] "Rectum (excl. anus)"               "Liver"
 [9] "Pancreas"                          "Lung, bronchus and pleura"
[11] "Melanoma of skin"                  "Breast"
[13] "Cervix uteri"                      "Corpus uteri"
[15] "Ovary, fallopian tube etc."        "Prostate"
[17] "Testis"                            "Kidney"
[19] "Urinary bladder"                   "Brain"
[21] "Thyroid"                           "Hodgkin's lymphoma"
[23] "Non-Hodgkin lymphoma"              "Multiple myeloma"
[25] "Leukaemia"
>        nca[      1,,] -
+ apply( nca[-xsites,,], 2:3, sum )
   type
sex  Well DM/noIns DM/Ins   DM
  M 24246     1555    234 1789
  F 21360     1225    165 1390
>        nca["Other",,]
   type
sex  Well DM/noIns DM/Ins   DM
  M 24246     1555    234 1789
  F 21360     1225    165 1390
>
> round( ftable( nca[ 30,,,drop=F], col.vars=3:2 ), 1 )
     type    Well         DM/noIns          DM/Ins              DM
     sex        M       F        M       F       M       F       M       F
diag
PYRS      37646.2 37991.5    664.5   638.0   139.4   104.2   803.8   742.2
>        ftable( nca[-30,,       ], col.vars=3:2 )
                                  type   Well        DM/noIns        DM/Ins            DM
                                  sex       M      F        M      F      M      F      M      F
diag
All malignant neoplasms                167394 178744    11837   9035   1716   1258  13553  10293
Oesophagus                               3282   1304      242     65     30      8    272     73
Stomach                                  4171   2289      299    139     46     20    345    159
Colon incl. rectosigmoideum             13853  15136     1163    981    138     88   1301   1069
```

```
Ascending colon                          3636   5126      324    399     37     29    361    428
Transverse colon                         1819   2172      174    151     27     18    201    169
Descending and sigmoid colon             7292   6601      554    342     66     31    620    373
Other colon (unspec. or multiple)        1106   1237      111     89      8     10    119     99
Rectum (excl. anus)                      8876   6214      625    316     77     30    702    346
Colorectal cancer (excl. anus)          22729  21350     1788   1297    215    118   2003   1415
Liver                                    1776   1103      338     78    103     20    441     98
Pancreas                                 4041   4425      570    504    208    169    778    673
Lung, bronchus and pleura               25302  20283     1766   1129    274    163   2040   1292
Melanoma of skin                         7008   8873      314    214     38     32    352    246
Breast                                    298  52190       13   2163      4    257     17   2420
Cervix uteri                                0   5691        0    132      0     25      0    157
Corpus uteri                                0   8057        0    567      0     67      0    634
Ovary, fallopian tube etc.                  0   7400        0    313      0     38      0    351
Prostate                                31713      0     2425      0    239      0   2664      0
Testis                                   4257      0       37      0      7      0     44      0
Kidney                                   3976   2434      319    187     60     41    379    228
Urinary bladder                         14781   4906     1110    259    118     30   1228    289
Brain                                    4922   4310      219    163     33     30    252    193
Thyroid                                   593   1511       26     40      6     12     32     52
Hodgkin's lymphoma                        990    723       38     23      8      2     46     25
Non-Hodgkin lymphoma                     5434   4602      321    229     37     30    358    259
Multiple myeloma                         2452   1883      165    103     19      8    184    111
Leukaemia                                5423   4050      292    205     37     23    329    228
Other                                   24246  21360     1555   1225    234    165   1789   1390
Deaths                                 225684 237814    19737  17987   3872   2782  23609  20769
> # What fraction does the analysed sites comprise:
> ftable( round( 100 - 100 * nca["Other",,,drop=F] / nca[1,,,drop=F], 1 ),
+         col.vars=3:2 )
      type Well      DM/noIns      DM/Ins        DM
      sex     M    F        M    F      M    F    M    F
diag
Other      85.5 88.0     86.9 86.4   86.4 86.9 86.8 86.5
>
> sub <- c(1:3,10,5:7,9,11:28)
> dimnames(res)[[1]][-sub]
[1] "Colon incl. rectosigmoideum"       "Other colon (unspec. or multiple)"
[3] "Other"
> dimnames(res)[[1]][sub]
 [1] "All malignant neoplasms"      "Oesophagus"
 [3] "Stomach"                      "Colorectal cancer"
 [5] "Ascending colon"              "Transverse colon"
 [7] "Descending and sigmoid colon" "Rectum"
 [9] "Liver"                        "Pancreas"
[11] "Lung, bronchus and pleura"    "Melanoma of skin"
[13] "Breast"                       "Cervix uteri"
[15] "Corpus uteri"                 "Ovary, fallopian tube etc."
[17] "Prostate"                     "Testis"
[19] "Kidney"                       "Urinary bladder"
[21] "Brain"                        "Thyroid"
[23] "Hodgkin's lymphoma"           "Non-Hodgkin lymphoma"
[25] "Multiple myeloma"             "Leukaemia"
>
> plt( "RRi-raw0-N", width=11, height=8 )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
> Nres <- dim( res[sub,,,] )[1]
> plotEst( res[sub,"M","DM",], txtpos=Nres:1, y=Nres:1+0.15, col="#0000FF",
+           xlog=T, xlim=c(0.5,5), grid=c(6:19/10,4:10/2), vref=1, ylim=c(1,Nres),
+           xtic=c(0.5,0.7,1,1.5,2:5), xlab="RR, DM vs. non-DM" )
> linesEst( res[sub,"F","DM",], y=Nres:1-0.15, col="#FF0000" )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> text( rep(0.52,Nres), Nres:1+0.05, nca[sub,"M","DM"], col="blue", adj=c(1,0), cex=0.7 )
> text( rep(0.52,Nres), Nres:1-0.05, nca[sub,"F","DM"], col="red" , adj=c(1,1), cex=0.7 )
> dev.off()
null device
          1
>
> plt( "RRi-ins0", width=11, height=8 )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
> Nres <- dim( res[sub,,,] )[1]
> plotEst( res[sub,"M","DM/noIns",], txtpos=Nres:1, y=Nres:1+0.3, col="#0000FF",
+           xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1, ylim=c(1,Nres),
+           xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM / DM+ins vs. non-DM" )
> linesEst( res[sub,"M","DM/Ins"  ,], y=Nres:1+0.1, col="#9999FF" )
> linesEst( res[sub,"F","DM/noIns",], y=Nres:1-0.1, col="#FF0000" )
> linesEst( res[sub,"F","DM/Ins"  ,], y=Nres:1-0.3, col="#FF9999" )
> text( cnr(0.99,0.99), "Light color: on insulin",
+                             adj=c(1,1), col="#999999", font=1 )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> plt( "RRi-ins1", width=9, height=10 )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
> delta <- 0.08
> Nres <- dim( res[sub,,,] )[1]
```

```
> plotEst( res[sub,"M","DM/noIns",], txtpos=Nres:1, y=Nres:1+3*delta, col="#0000FF",
+           xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1, ylim=c(1,Nres),
+           xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM / DM+ins vs. non-DM" )
> linesEst( res[sub,"M","DM/Ins"  ,], y=Nres:1+1*delta, col="#AAAAFF" )
> linesEst( res[sub,"F","DM/noIns",], y=Nres:1-1*delta, col="#FF0000" )
> linesEst( res[sub,"F","DM/Ins"  ,], y=Nres:1-3*delta, col="#FFAAAA" )
> text( cnr(0.99,0.99), "Light color: insulin users",
+                            adj=c(1,1), col="#AAAAAA", font=1 )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> plt( "RRi-ins1w", width=11, height=8 )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
> Nres <- dim( res[sub,,,] )[1]
> plotEst( res[sub,"M","DM/noIns",], txtpos=Nres:1, y=Nres:1+0.3, col="#0000FF",
+           xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1, ylim=c(1,Nres),
+           xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM / DM+ins vs. non-DM" )
> linesEst( res[sub,"M","DM/Ins"  ,], y=Nres:1+0.1, col="#9999FF" )
> linesEst( res[sub,"F","DM/noIns",], y=Nres:1-0.1, col="#FF0000" )
> linesEst( res[sub,"F","DM/Ins"  ,], y=Nres:1-0.3, col="#FF9999" )
> text( cnr(0.99,0.99), "Light color: on insulin",
+                            adj=c(1,1), col="#999999", font=1 )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> plt( "RRi-insRR", width=9, height=10 )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
>  plotEst( res[sub,"M","Ins vs. noIns",], txtpos=Nres:1, y=Nres:1+0.15, col="#0000FF",
+           xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1, ylim=c(1,Nres),
+           xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM+ins vs. DM" )
> linesEst( res[sub,"F","Ins vs. noIns",], y=Nres:1-0.15, col="#FF0000" )
> text( cnr(0.99,0.95), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> sub <- c( grep("Oesop",dimnames(res)[["diag"]]),
+           grep("Stoma",dimnames(res)[["diag"]]),
+           grep("Color",dimnames(res)[["diag"]]),
+           grep("Liver",dimnames(res)[["diag"]]),
+           grep("Pancr",dimnames(res)[["diag"]]),
+           grep("Melan",dimnames(res)[["diag"]]),
+           grep("Corpu",dimnames(res)[["diag"]]),
+           grep("Prost",dimnames(res)[["diag"]]),
+           grep("Testi",dimnames(res)[["diag"]]),
+           grep("Kidne",dimnames(res)[["diag"]]),
+           grep("Brain",dimnames(res)[["diag"]]),
+           grep("Non-H",dimnames(res)[["diag"]]) )
> Nres <- length( sub )
>
> plt( "RRi-sub", width=5.5, height=4  )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
>  plotEst( res[sub,"M","DM",], txtpos=Nres:1, y=Nres:1+0.15, ylim=c(0.5,Nres+0.5),
+           col="#0000FF",
+           xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1,
+           xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM vs. non-DM" )
> linesEst( res[sub,"F","DM",], y=Nres:1-0.15, col="#FF0000" )
> text( cnr(0.99,0.97), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>
> plt( "RRi-ins-sub", width=5.5, height=4  )
> par( mar=c(3,1,1,1), mgp=c(3,1,0)/1.6 )
>  plotEst( res[sub,"M","DM/noIns",], txtpos=Nres:1, y=Nres:1+0.3, col="#0000FF",
+           xlog=T, xlim=c(0.5,5), grid=c(5:15/10,4:10/2), vref=1, ylim=c(0.5,Nres+0.5),
+           xtic=c(0.5,0.7,1,1.5,2,3,4,5), xlab="RR, DM / DM+ins vs. non-DM" )
> linesEst( res[sub,"M","DM/Ins"  ,], y=Nres:1+0.1, col="#9999FF" )
> linesEst( res[sub,"F","DM/noIns",], y=Nres:1-0.1, col="#FF0000" )
> linesEst( res[sub,"F","DM/Ins"  ,], y=Nres:1-0.3, col="#FF9999" )
> text( cnr(0.99,0.97), "M", adj=c(1,1), col="#0000FF", font=2 )
> text( cnr(0.99,0.92), "F", adj=c(1,1), col="#FF0000", font=2 )
> dev.off()
null device
          1
>

 ---------------------------------------------
 Program: plot1i.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: fredag 01. april 2011, 00:21:38
```

```
 Elapsed: 00:00:00
 ---------------------------------------------
> proc.time()
   user  system elapsed
   0.85    0.14    1.39
```

2.4 Analysis incorporating duration

```
 R 2.13.0
 ---------------------------------------------
 Program:  ana3dx.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  tirsdag 21. juni 2011, 13:55:35
 ---------------------------------------------
> options( width=135 )
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> library( splines )
> source( "c:/stat/r/bxc/library.sources/Epi/pkg/r/Wald.R" )
> Wald
function (obj, H0 = 0, ...)
{
    rl <- ci.lin(obj, ..., vcov = TRUE)
    beta <- rl$est
    vcov <- rl$vcov
    if (missing(H0))
        H0 <- beta * 0
    if (length(H0) != length(beta))
        stop("H0 has length ", length(H0), " but the set of selected paramteters has length ",
            length(beta), ":\n", paste(round(beta, options()[["digits"]]),
                collapse = " "))
    chi <- t(beta - H0) %*% solve(vcov, beta - H0)
    df <- length(beta)
    p <- 1 - pchisq(chi, df)
    c(Chisq = chi, d.f. = df, P = p)
}
>
> ###############################################################################
> # A wrapper for ns() where boundary knots are taken as the
> # smallest and largest of the knots= argument
> source( "C:/Bendix/Steno/DM-register/NDR/R/Ns.r" )
> Ns
function (x, df = NULL, knots = NULL, intercept = FALSE, Boundary.knots = NULL)
{
    if (is.null(Boundary.knots)) {
        if (!is.null(knots)) {
            knots <- sort(unique(knots))
            ok <- c(1, length(knots))
            Boundary.knots <- knots[ok]
            knots <- knots[-ok]
        }
    }
    ns(x, df = df, knots = knots, intercept = intercept, Boundary.knots = Boundary.knots)
}
>
> ###############################################################################
> # Get the data file ;
> load( file = "../data/dmcaD.Rdata" )
> dim( dmca )
[1] 508062     41
> names( dmca )
 [1] "state"  "DMtype" "sex"    "a"      "p"      "c"      "ax"     "px"     "cx"     "DMDur"  "InsDur" "y"      "d0"     "
[15] "d22"    "d24"    "d241"   "d242"   "d243"   "d249"   "d251"   "d259"   "d26"    "d28"    "d33"    "d51"    "d70"    "
[29] "d83"    "d84"    "d91"    "d92"    "d101"   "d103"   "d113"   "d121"   "d131"   "d132"   "d133"   "d139"   "d999"
> # Collapse to a two-level ( DM / non-DM ) factor
> dmca$State <- Relevel( dmca$state, list(1,2:3) )
>
> ###############################################################################
> # Compute the quantiles of the durations just for inspection
> durDM  <- with( subset( dmca,  DMDur>0 ), rep( DMDur,d0) )
> durIns <- with( subset( dmca, InsDur>0 ), rep(InsDur,d0) )
> wh.dmi <- as.integer(factor(durDM))
> wh.ins <- as.integer(factor(durIns))
> durDM  <- durDM  + runif( length(durDM ), -ilength[wh.dmi]/2, ilength[wh.dmi]/2 )
> durIns <- durIns + runif( length(durIns), -ilength[wh.ins]/2, ilength[wh.ins]/2 )
> print( round( cbind( quantile( durDM , probs=(0:20)/20 ),
+                      quantile( durIns, probs=(0:20)/20 ) ), 1 ) )
     [,1] [,2]
0%    0.1  0.1
```

```
5%    0.3  0.2
10%   0.5  0.4
15%   0.8  0.5
20%   1.1  0.7
25%   1.5  1.0
30%   1.8  1.3
35%   2.2  1.6
40%   2.6  1.8
45%   3.0  2.2
50%   3.5  2.5
55%   4.0  2.9
60%   4.5  3.3
65%   5.0  3.8
70%   5.6  4.3
75%   6.3  5.0
80%   7.5  5.7
85%   8.0  6.6
90%   9.2  7.9
95%  10.7  9.4
100% 15.0 15.0
>
> ################################################################################
> # Subset to avoid fitting problems
> dmca <- subset( dmca, y>0 )
>
> # Compute the relevant column numbers in the data frame
> diagnames <- as.character(dxnam$d.nam)
> d.col <- dxnam$d.col
> diagnames <- diagnames[-length(d.col)]
> d.col     <- d.col[-length(d.col)]
> cbind( d.col, diagnames )
      d.col diagnames
 [1,] "13"  "All malignant neoplasms"
 [2,] "14"  "Oesophagus"
 [3,] "15"  "Stomach"
 [4,] "16"  "Colon incl. rectosigmoideum"
 [5,] "17"  "Ascending colon"
 [6,] "18"  "Transverse colon"
 [7,] "19"  "Descending and sigmoid colon"
 [8,] "20"  "Other colon (unspec. or multiple)"
 [9,] "21"  "Rectum (excl. anus)"
[10,] "22"  "Colorectal cancer (excl. anus)"
[11,] "23"  "Liver"
[12,] "24"  "Pancreas"
[13,] "25"  "Lung, bronchus and pleura"
[14,] "26"  "Melanoma of skin"
[15,] "27"  "Breast"
[16,] "28"  "Cervix uteri"
[17,] "29"  "Corpus uteri"
[18,] "30"  "Ovary, fallopian tube etc."
[19,] "31"  "Prostate"
[20,] "32"  "Testis"
[21,] "33"  "Kidney"
[22,] "34"  "Urinary bladder"
[23,] "35"  "Brain"
[24,] "36"  "Thyroid"
[25,] "37"  "Hodgkin's lymphoma"
[26,] "38"  "Non-Hodgkin lymphoma"
[27,] "39"  "Multiple myeloma"
[28,] "40"  "Leukaemia"
> c.col <- (1:ncol(dmca))[-d.col]
> Nres <- length(d.col)
>
> ################################################################################
> # Knots for the natural splines
> a.kn <- seq(  10, 100,,9)
> p.kn <- seq(1995,2009,,5)
> c.kn <- seq(1900,2005,,9)
> # Duration points
> d.pt <- seq(0,14,0.2)
> # Subsets of the duration vector
> d2 <- (d.pt>=2)
> d5 <- (d.pt>=5)
>
> ################################################################################
> # Construct structures to hold the results
>
> # An array for the estimated RRs
> dnam <- list( diag = diagnames,
+                sex = c("M","F"),
+               type = c("DMDur", "InsDur-0", "InsDur-2", "InsDur-5",
+                                 "Ins-RR-0", "Ins-RR-2", "Ins-RR-5",
+                        "DMDuri","InsDuri-0","InsDuri-2","InsDuri-5",
+                                 "Ins-RRi-0","Ins-RRi-2","Ins-RRi-5"),
+                dur = c(d.pt),
+                est = c("RR","lo","hi") )
> res  <- array( NA, dim=sapply(dnam,length), dimnames=dnam )
>
> # An array to hold the tests for Main effects, and specific interaction terms
```

```
> dnam <- list( diag = diagnames,
+                sex = c("M","F"),
+               type = c("Ins-eff","DM-eff","DM-all","DM0","Ins0","DMdur-at-Ins","DMdur*Insdur","Interact-2") )
> tst  <- array( NA, dim=sapply(dnam,length), dimnames=dnam )
>
> # A list to hold the duration knots
> knots <- list()
>
> # Input to a prediction frame for the rates to use for computing
> # cumulative risk - used both for the array and the prediction frame
> pr.int <- 0.05  # Length of interval between incidence predictions
> pr.lng <- 10    # Length of period (in years)
> pr.dur <- seq( 0, pr.lng-pr.int, pr.int )
> per.in <- 1998  # The starting year for prediction
>
> # An array to hold the predicted incidence rates (from which we later
> # shall compute the cumulative risks (probabilities of specific
> # cancers).
> dnam <- list( diag = c(diagnames,"Death"),
+                sex = c("M","F"),
+              model = c("Main","Interact"),
+             pr.dur = pr.dur,
+              state = levels( dmca$state ),
+             age.in = c(60,65,70),
+             dur.in = c(0,2) )
> prr <- array( NA, dim=sapply(dnam,length), dimnames=dnam )
>
> # Make a prediction data frame, based on the array prr - this way we
> # are sure that the prediction frame has the same structure and
> # sequence as the array:
> pr.frame <- as.data.frame( as.table( prr[1,1,1,,,,] ) )
> # Convert the three numeric classifications to proper numeric vectors
> for( i in c(1,3,4) )      pr.frame[,i] <-
+ as.numeric( as.character( pr.frame[,i] ) )
> pr.frame <- transform( pr.frame,
+                   ax =   age.in + pr.dur,
+                   px =   per.in + pr.dur,
+                DMDur = ( dur.in + pr.dur ) * (state!="Well"),
+               InsDur = ( dur.in + pr.dur ) * (state=="DM/Ins"),
+                    y = 0.05 )[c("ax","px","DMDur","InsDur","state","y")]
> str( pr.frame )
'data.frame': 3600 obs. of  6 variables:
 $ ax    : num  60 60 60.1 60.1 60.2 ...
 $ px    : num  1998 1998 1998 1998 1998 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ y     : num  0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 ...
>
> ################################################################################
> # The analysis loops over knots, sites and sexes
>
> # Knots and contrast matrices for diabetes duration and insulin duration
>
> # Sites loop
> for( i in 1:dim(res)[1] )
+ {
+ # i <- 4
+ # Copy the relevant set of cases to the column "D"
+ data <- dmca[,c(c.col,d.col[i])]
+ names(data)[ncol(data)] <- "D"
+
+ # Define number of knots depending on site
+ nd <- ifelse( i==1, 5, 4 )
+ ni <- nd - 1
+
+ # Sex loop
+ for( sx in dimnames(res)$sex )
+ {
+ # sx <- "F"
+ # Skip if there are no cancers - the knots calculation will crash
+ if( sum( data$D[data$sex==sx] ) == 0 ) next
+
+ # Define knots for DM and for insulin duration using the quantiles of
+ # the durations for cases, note the effect beyond the last is linear
+ durDM  <- with( subset( data,  DMDur>0 & sex==sx ), rep( DMDur,D) )
+ durIns <- with( subset( data, InsDur>0 & sex==sx ), rep(InsDur,D) )
+ wh.dmi <- as.integer(factor(durDM))
+ wh.ins <- as.integer(factor(durIns))
+ durDM  <- durDM  + runif( length(durDM ), -ilength[wh.dmi]/2, ilength[wh.dmi]/2 )
+ durIns <- durIns + runif( length(durIns), -ilength[wh.ins]/2, ilength[wh.ins]/2 )
+
+ # We choose the last knot so that the thast 1/nd cases are in the
+ # linear domain of the duration effect
+ d.kn <- quantile( durDM , probs=0:(nd-1)/nd )
+ i.kn <- quantile( durIns, probs=0:(ni-1)/ni )
+
+ # Define the corresponding contrast matrices
+ CD <- Ns(d.pt,knots=d.kn)
```

```
+ CI <- Ns(d.pt,knots=i.kn)
+ CL <- cbind(1,d.pt)
+
+ # Report when and where we are
+ cat( format( Sys.time(), "%H:%M:%S" ),
+        ", sex=", sx,
+        ", site=", i,
+        ", ", dimnames(res)$diag[i],
+        "\n", sep="" )
+ flush.console()
+
+ # Fit the model - remember to make it identifiable, otherwise the
+ # prediction will go wrong.
+ m1 <- glm( D ~ Ns(   ax,knots=a.kn) +
+       detrend( Ns(px   ,knots=p.kn), px ) +
+                Ns(px-ax,knots=c.kn) + state +
+                Ns( DMDur,knots=d.kn) +
+                Ns(InsDur,knots=i.kn) +
+                offset( log(y) ),
+                family = poisson,
+                data = subset(data,sex==sx) )
+ mi <- update( m1, . ~ . + I((DMDur-InsDur)*(state=="DM/Ins"))
+                         + I( DMDur*InsDur) )
+
+ # For illustration, show the parameters that we extract:
+ if( i == 1 & sx=="M" )
+   {
+   cat( "\nParameters extracted for construction of curves from main effects model:\n", i, sx )
+   print( round( ci.lin( m1, subset=c("state","DMDur","InsDur") ), 2 ) )
+   cat( "\nParameters extracted for construction of curves from interaction model:\n", i, sx )
+   print( round( ci.lin( mi, subset=c("stateDM","Dur") ), 2 ) )
+   }
+
+ # The predicted log-incidence rates saved in the array
+ prr[i,sx,"Main"    ,,,,] <- predict( m1, newdata=pr.frame )
+ prr[i,sx,"Interact",,,,] <- predict( mi, newdata=pr.frame )
+
+ # Duration effects from the main effects model
+ res[i,sx, "DMDur"  ,,] <- ci.lin( m1, subset=c("state","DMDur"),
+                             ctr.mat=cbind(1,0,CD), E=T )[,5:7]
+ res[i,sx,"InsDur-0",,] <- ci.lin( m1, subset=c("state","DMDur","InsDur"),
+                             ctr.mat=cbind(0,1,CD,CI), E=T )[,5:7]
+ res[i,sx,"InsDur-2",1:sum(d2),] <- ci.lin( m1, subset=c("state","DMDur","InsDur"),
+                             ctr.mat=cbind(0,1,CD[d2,],CI[1:sum(d2),]), E=T )[,5:7]
+ res[i,sx,"InsDur-5",1:sum(d5),] <- ci.lin( m1, subset=c("state","DMDur","InsDur"),
+                             ctr.mat=cbind(0,1,CD[d5,],CI[1:sum(d5),]), E=T )[,5:7]
+
+ # Rate-ratios relative to non-insulin treated from main-effects model
+ res[i,sx,"Ins-RR-0",,] <- ci.lin( m1, subset=c("state","DMDur","InsDur"),
+                             ctr.mat=cbind(-1,1,CD-CD,CI), E=T )[,5:7]
+ res[i,sx,"Ins-RR-2",1:sum(d2),] <- ci.lin( m1, subset=c("state","DMDur","InsDur"),
+                             ctr.mat=cbind(-1,1,CD[d2,]-CD[d2,],CI[1:sum(d2),]), E=T )[,5:7]
+ res[i,sx,"Ins-RR-5",1:sum(d5),] <- ci.lin( m1, subset=c("state","DMDur","InsDur"),
+                             ctr.mat=cbind(-1,1,CD[d5,]-CD[d5,],CI[1:sum(d5),]), E=T )[,5:7]
+
+ # Duration effects from the interaction model.
+ res[i,sx, "DMDuri"  ,,] <- ci.lin( mi, subset=c("stateDM","Dur"),
+                             ctr.mat=cbind(1,0,CD,CI-CI,0,0), E=T )[,5:7]
+ res[i,sx,"InsDuri-0",,] <- ci.lin( mi, subset=c("stateDM","Dur"),
+                             ctr.mat=cbind(0,1,CD,CI,0,d.pt^2), E=T )[,5:7]
+ res[i,sx,"InsDuri-2",1:sum(d2),] <- ci.lin( mi, subset=c("stateDM","Dur"),
+                             ctr.mat=cbind(0,1,CD[d2,],CI[1:sum(d2),],2,d.pt[d2]*d.pt[1:sum(d2)]), E=T )[,5:7]
+ res[i,sx,"InsDuri-5",1:sum(d5),] <- ci.lin( mi, subset=c("stateDM","Dur"),
+                             ctr.mat=cbind(0,1,CD[d5,],CI[1:sum(d5),],5,d.pt[d5]*d.pt[1:sum(d5)]), E=T )[,5:7]
+
+ # Rate-ratios relative to non-insulin treated from interaction model
+ res[i,sx,"Ins-RRi-0",,] <- ci.lin( mi, subset=c("stateDM","Dur"),
+                             ctr.mat=cbind(-1,1,CD-CD,CI,0,d.pt*d.pt), E=T )[,5:7]
+ res[i,sx,"Ins-RRi-2",1:sum(d2),] <- ci.lin( mi, subset=c("stateDM","Dur"),
+                             ctr.mat=cbind(-1,1,CD[d2,]-CD[d2,],CI[1:sum(d2),],2,d.pt[d2]*d.pt[1:sum(d2)]), E=T )[,5:7]
+ res[i,sx,"Ins-RRi-5",1:sum(d5),] <- ci.lin( mi, subset=c("stateDM","Dur"),
+                             ctr.mat=cbind(-1,1,CD[d5,]-CD[d5,],CI[1:sum(d5),],5,d.pt[d5]*d.pt[1:sum(d5)]), E=T )[,5:7]
+
+ # Test for insulin effect, diabetes effect and duration interctions etc.
+ # A Contrast matrix is needed in order to test wheter the difference
+ # between the two interceps are 0 simultameously with the insulin
+ # duration being 0
+ IC <- diag(ni+1)[-2,]
+ IC[1,2] <- -1
+ Ins.test <- Wald( m1, subset=c("stateDM","InsDur"), ctr.mat=IC )
+ All.test <- Wald( m1, subset=c("stateDM","InsDur","DMDur") )
+  DM.test <- c( "Chisq"=All.test[1]-Ins.test[1],
+                 "d.f."=All.test[2]-Ins.test[2],
+                    "P"=1-pchisq(All.test[1]-Ins.test[1],All.test[2]-Ins.test[2]) )
+
+ tst[i,sx,] <- c(Ins.test[3], DM.test[3], All.test[3],
+                 ci.lin(mi,subset=c("stateDM","I\\("))[,4],
+                 1-pchisq( m1$deviance-mi$deviance, m1$df.residual-mi$df.residual ) )
+ knots <- c( knots, list( list(d.kn=d.kn,i.kn=i.kn) ) )
```

```
+ names( knots )[length(knots)] <- dimnames(res)[[1]][i]
+ } # end of sex loop
+ } # end of sites loop
13:55:45, sex=M, site=1, All malignant neoplasms

Parameters extracted for construction of curves from main effects model:
 1 M                          Estimate StdErr      z P  2.5% 97.5%
stateDM                       0.65   0.04  17.16 0  0.58  0.73
stateDM/Ins                   1.42   0.10  14.82 0  1.23  1.60
Ns(DMDur, knots = d.kn)1     -0.43   0.04 -10.12 0 -0.51 -0.34
Ns(DMDur, knots = d.kn)2     -0.30   0.03  -9.65 0 -0.36 -0.24
Ns(DMDur, knots = d.kn)3     -1.03   0.09 -12.04 0 -1.19 -0.86
Ns(DMDur, knots = d.kn)4     -0.19   0.02  -8.47 0 -0.24 -0.15
Ns(InsDur, knots = i.kn)1    -0.39   0.08  -5.10 0 -0.55 -0.24
Ns(InsDur, knots = i.kn)2    -1.14   0.18  -6.35 0 -1.49 -0.79
Ns(InsDur, knots = i.kn)3    -0.30   0.07  -4.68 0 -0.43 -0.18

Parameters extracted for construction of curves from interaction model:
 1 M                                          Estimate StdErr      z    P  2.5% 97.5%
stateDM                                       0.65   0.04  16.89 0.00  0.57  0.72
stateDM/Ins                                   1.55   0.10  14.98 0.00  1.35  1.76
Ns(DMDur, knots = d.kn)1                     -0.43   0.04 -10.11 0.00 -0.51 -0.34
Ns(DMDur, knots = d.kn)2                     -0.29   0.03  -9.14 0.00 -0.35 -0.23
Ns(DMDur, knots = d.kn)3                     -1.01   0.09 -11.80 0.00 -1.18 -0.84
Ns(DMDur, knots = d.kn)4                     -0.18   0.02  -7.56 0.00 -0.22 -0.13
Ns(InsDur, knots = i.kn)1                    -0.45   0.08  -5.58 0.00 -0.61 -0.29
Ns(InsDur, knots = i.kn)2                    -1.40   0.22  -6.37 0.00 -1.83 -0.97
Ns(InsDur, knots = i.kn)3                    -0.58   0.14  -4.03 0.00 -0.87 -0.30
I((DMDur - InsDur) * (state == "DM/Ins"))    -0.04   0.01  -3.16 0.00 -0.06 -0.01
I(DMDur * InsDur)                             0.01   0.00   1.89 0.06  0.00  0.01
13:56:47, sex=F, site=1, All malignant neoplasms
13:57:45, sex=M, site=2, Oesophagus
13:59:36, sex=F, site=2, Oesophagus
14:01:35, sex=M, site=3, Stomach
14:03:05, sex=F, site=3, Stomach
14:04:29, sex=M, site=4, Colon incl. rectosigmoideum
14:05:50, sex=F, site=4, Colon incl. rectosigmoideum
14:07:08, sex=M, site=5, Ascending colon
14:08:26, sex=F, site=5, Ascending colon
14:09:46, sex=M, site=6, Transverse colon
14:11:13, sex=F, site=6, Transverse colon
14:12:56, sex=M, site=7, Descending and sigmoid colon
14:14:30, sex=F, site=7, Descending and sigmoid colon
14:15:53, sex=M, site=8, Other colon (unspec. or multiple)
14:17:33, sex=F, site=8, Other colon (unspec. or multiple)
14:19:08, sex=M, site=9, Rectum (excl. anus)
14:20:39, sex=F, site=9, Rectum (excl. anus)
14:22:08, sex=M, site=10, Colorectal cancer (excl. anus)
14:23:28, sex=F, site=10, Colorectal cancer (excl. anus)
14:24:46, sex=M, site=11, Liver
14:25:58, sex=F, site=11, Liver
14:27:15, sex=M, site=12, Pancreas
14:28:43, sex=F, site=12, Pancreas
14:29:59, sex=M, site=13, Lung, bronchus and pleura
14:31:20, sex=F, site=13, Lung, bronchus and pleura
14:32:43, sex=M, site=14, Melanoma of skin
14:33:55, sex=F, site=14, Melanoma of skin
14:35:08, sex=M, site=15, Breast
14:37:11, sex=F, site=15, Breast
14:38:31, sex=F, site=16, Cervix uteri
14:39:54, sex=F, site=17, Corpus uteri
14:41:09, sex=F, site=18, Ovary, fallopian tube etc.
14:42:20, sex=M, site=19, Prostate
14:43:56, sex=M, site=20, Testis
14:45:12, sex=M, site=21, Kidney
14:46:22, sex=F, site=21, Kidney
14:47:34, sex=M, site=22, Urinary bladder
14:48:55, sex=F, site=22, Urinary bladder
14:50:07, sex=M, site=23, Brain
14:51:18, sex=F, site=23, Brain
14:52:27, sex=M, site=24, Thyroid
14:53:46, sex=F, site=24, Thyroid
14:55:00, sex=M, site=25, Hodgkin's lymphoma
14:56:17, sex=F, site=25, Hodgkin's lymphoma
14:57:40, sex=M, site=26, Non-Hodgkin lymphoma
14:58:51, sex=F, site=26, Non-Hodgkin lymphoma
15:00:03, sex=M, site=27, Multiple myeloma
15:01:43, sex=F, site=27, Multiple myeloma
15:03:42, sex=M, site=28, Leukaemia
15:04:55, sex=F, site=28, Leukaemia
There were 50 or more warnings (use warnings() to see the first 50)
>
> # Get rid of the male/females in the wrong places
> no.M <- c( grep("uteri",dimnames(res)[["diag"]]),
+            grep("Ovary",dimnames(res)[["diag"]]) )
> no.F <- c( grep("Prost",dimnames(res)[["diag"]]),
+            grep("Testi",dimnames(res)[["diag"]]) )
> res[no.M,"M",,,] <- NA
> res[no.F,"F",,,] <- NA
```

```
>
> save( res, prr, pr.frame, tst, knots, file="../data/ana3dx.Rdata" )
>

 ---------------------------------------------
 Program: ana3dx.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: tirsdag 21. juni 2011, 15:06:10
 Elapsed: 01:10:34
 ---------------------------------------------
> proc.time()
   user  system elapsed
3782.25  450.98 4236.15

 R 2.13.0
 ---------------------------------------------
 Program:  plot3dx.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 23. juni 2011, 17:22:53
 ---------------------------------------------
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> # library( Useful )
> source( "c:/stat/r/bxc/library.sources/useful/r/plt.r" )
> source( "c:/stat/r/bxc/library.sources/useful/r/cnr.r" )
>
> # Functions used to plot the duration effects
> ######################################################################
> # A function to do one site for one sex
> plot.one <-
+ function( i, sex, clr=c("blue","red")[(sex=="F")+1], what=c("dm","i0","i2","i5"),
+           xax=FALSE, yax=FALSE, yl=c(1/2,5), anno=TRUE, raw=TRUE, int=FALSE,
+           lt=1, ci=TRUE, knpl=FALSE, ... )
+ {
+ if( int %in% c("mr","ir") ) what <- "i0"
+ # clr <- c(clr,clr)[1:2]
+ plot( NA, xlim=c(0,14)+c(-1,0)/2, ylim=yl, log="y",
+           xaxt="n", yaxt="n", xlab="", ylab="", yaxs="i", ... )
+ if( xax )
+   {
+   axis( side=1, at=seq(0,12,3), las=1 )
+   axis( side=1, at=seq(0,14,1), labels=rep("",15) )
+ #  mtext( side=1, line=2, at=6, "DM duration" )
+   }
+ if( yax ) axis( side=2, las=1 )
+ abline( v=0:25,
+         h=c(c(5:20,seq(25,50,5))/100,
+             c(5:20,seq(25,50,5))/10,
+             c(5:20,seq(25,50,5)),
+             c(5:20,seq(25,50,5))*10,
+             c(5:20,seq(25,50,5))*100),
+         col=gray(0.9) )
+ abline(h=1)
+ if( "dm" %in% what )
+ matlines( d.pt, dur[i,sex,switch( int, "mc"="DMDur",
+                                        "mr"="Ins-RR-0",
+                                        "ic"="DMDuri",
+                                        "ir"="Ins-RRi-0" ),,],
+           type="l", lty=1, lwd=if(ci) c(3,1,1) else c(3,NA,NA),col=clr )
+ if( "i0" %in% what )
+ matlines( d.pt, dur[i,sex,switch( int, "mc"="InsDur-0",
+                                        "mr"="Ins-RR-0",
+                                        "ic"="InsDuri-0",
+                                        "ir"="Ins-RRi-0" ),,],
+          type="l",lty=c("21","42","42"), lwd=if(ci) c(3,1,1) else c(2,NA,NA),col=clr )
+ if( "i2" %in% what )
+ matlines( d.pt+2, dur[i,sex,switch( int, "mc"="InsDur-2",
+                                          "mr"="Ins-RR-2",
+                                          "ic"="InsDuri-2",
+                                          "ir"="Ins-RRi-2" ),,],
+           type="l",lty=c("21","42","42"), lwd=if(ci) c(3,1,1) else c(2,NA,NA),col=clr )
+ if( "i5" %in% what )
+ matlines( d.pt+5, dur[i,sex,switch( int, "mc"="InsDur-5",
+                                          "mr"="Ins-RR-5",
+                                          "ic"="InsDuri-5",
+                                          "ir"="Ins-RRi-5" ),,],
+           type="l",lty=c("21","42","42"),lwd=if(ci) c(3,1,1) else c(2,NA,NA),col=clr )
+ if( anno )
+ {
+ dnam <- paste( diagnames[i], ", ", sex, sep="" )
+ wd <- strwidth( dnam, font=2, cex=1.2 )
+ rect( -1, 10^(par("usr")[4])*0.9, ceiling(wd), 10^(par("usr")[4]),
+       col="white", border=gray(0.9) )
```

```
+ text( -0.5, 10^(par("usr")[4])*0.95, dnam, adj=c(0,0.5), font=2, cex=1.2 )
+ }
+ box()
+ if( raw )
+ {
+ if( int %in% c("mc","ic") )
+   {
+ e.pt <- 1:2/3-1
+ points( e.pt, c(res[i,sex,"DM/noIns","Est"],
+                 res[i,sex,"DM/Ins"  ,"Est"]),
+         col=if(clr=="blue") c("#0000FF","#AAAAFF")
+             else          c("#FF0000","#FFAAAA"), pch=16 )
+ segments( e.pt, c(res[i,sex,"DM/noIns","lo"],
+                   res[i,sex,"DM/Ins"  ,"lo"]),
+           e.pt, c(res[i,sex,"DM/noIns","hi"],
+                   res[i,sex,"DM/Ins"  ,"hi"]),
+           col=if(clr=="blue") c("#0000FF","#AAAAFF")
+               else            c("#FF0000","#FFAAAA"), lwd=2 )
+   }
+ else
+   {
+ e.pt <- -0.5
+ points( e.pt, res[i,sex,"Ins vs. noIns","Est"],
+         col=clr, pch=16 )
+ segments( e.pt, res[i,sex,"Ins vs. noIns","lo"],
+           e.pt, res[i,sex,"Ins vs. noIns","hi"],
+           col=clr, lwd=2 )
+   }
+ }
+ if( knpl )
+ {
+ kl <- knots[grep(substr(diagnames[i],1,8),names(knots))]
+ if( length(kl)==2 ) kl <- kl[(sex=="F")+1]
+ if( "dm" %in% what ) rug( kl[[1]][[1]], side=1, col=clr, lwd=2 )
+ if( "i0" %in% what ) rug( kl[[1]][[2]], side=3, col=clr, lwd=2 )
+ }
+ } # End of function
>
> # The category 'unspecified colon has crept in, it is deleted as is "others"
> load( file="../data/ana3dx.Rdata" )
> dur <- res[-c(8,29),,,,]
> load( file="../data/ana1i.Rdata" )
> res <- res[-c(8,29),,,]
> # The naming of the cancers is a bit unfortunate
> dimnames(res)[[1]] <- gsub( " \\(excl. anus\\)", "", dimnames(res)[[1]] )
> dimnames(dur)[[1]] <- gsub( " \\(excl. anus\\)", "", dimnames(dur)[[1]] )
> cbind( dimnames(res)[[1]],
+        dimnames(dur)[[1]] )
      [,1]                           [,2]
 [1,] "All malignant neoplasms"      "All malignant neoplasms"
 [2,] "Oesophagus"                   "Oesophagus"
 [3,] "Stomach"                      "Stomach"
 [4,] "Colon incl. rectosigmoideum"  "Colon incl. rectosigmoideum"
 [5,] "Ascending colon"              "Ascending colon"
 [6,] "Transverse colon"             "Transverse colon"
 [7,] "Descending and sigmoid colon" "Descending and sigmoid colon"
 [8,] "Rectum"                       "Rectum"
 [9,] "Colorectal cancer"            "Colorectal cancer"
[10,] "Liver"                        "Liver"
[11,] "Pancreas"                     "Pancreas"
[12,] "Lung, bronchus and pleura"    "Lung, bronchus and pleura"
[13,] "Melanoma of skin"             "Melanoma of skin"
[14,] "Breast"                       "Breast"
[15,] "Cervix uteri"                 "Cervix uteri"
[16,] "Corpus uteri"                 "Corpus uteri"
[17,] "Ovary, fallopian tube etc."   "Ovary, fallopian tube etc."
[18,] "Prostate"                     "Prostate"
[19,] "Testis"                       "Testis"
[20,] "Kidney"                       "Kidney"
[21,] "Urinary bladder"              "Urinary bladder"
[22,] "Brain"                        "Brain"
[23,] "Thyroid"                      "Thyroid"
[24,] "Hodgkin's lymphoma"           "Hodgkin's lymphoma"
[25,] "Non-Hodgkin lymphoma"         "Non-Hodgkin lymphoma"
[26,] "Multiple myeloma"             "Multiple myeloma"
[27,] "Leukaemia"                    "Leukaemia"
> str( dur )
 num [1:27, 1:2, 1:14, 1:71, 1:3] 2.05 1.04 1.57 2.31 2.33 ...
 - attr(*, "dimnames")=List of 5
  ..$ diag: chr [1:27] "All malignant neoplasms" "Oesophagus" "Stomach" "Colon incl. rectosigmoideum" ...
  ..$ sex : chr [1:2] "M" "F"
  ..$ type: chr [1:14] "DMDur" "InsDur-0" "InsDur-2" "InsDur-5" ...
  ..$ dur : chr [1:71] "0" "0.2" "0.4" "0.6" ...
  ..$ est : chr [1:3] "RR" "lo" "hi"
> str( res )
 num [1:27, 1:2, 1:4, 1:3] 1.19 1.27 1.25 1.32 1.4 ...
 - attr(*, "dimnames")=List of 4
  ..$ diag: chr [1:27] "All malignant neoplasms" "Oesophagus" "Stomach" "Colon incl. rectosigmoideum" ...
  ..$ sex : chr [1:2] "M" "F"
```

```
  ..$ type: chr [1:4] "DM/noIns" "DM/Ins" "Ins vs. noIns" "DM"
  ..$ est : chr [1:3] "Est" "lo" "hi"
>
> # Get the number of sites and the duration points for the estimates
> Nres <- dim( dur )[1]
> d.pt <- as.numeric(dimnames(dur)$dur)
> diagnames <- dimnames(dur)$diag
>
> ################################################################################
> # Loop over marginal / interaction model ("m","i") and comparisons ("c","r")
> for( tp in c("mc","mr","ic","ir") )
+ # tp <- "mc"
+ {
+ if( tp %in% c("mc","ic") )
+   {
+ rrtxt <- "Rate ratio: DM/no-Ins, DM/Ins vs. non-DM"
+ durtxt <- "Diabetes duration (years)"
+   }
+ else
+   {
+ rrtxt <- "Rate ratio: DM/Ins vs. DM/no-Ins"
+ durtxt <- "Insulin duration (years)"
+   }
+
+ # Single organs
+ for( i in 1:(dim(dur)[1]) )
+    {
+ # i <- 1
+ # tp <- "mr"
+ plt( paste( substr(gsub(" ","",dimnames(dur)[[1]][i]),1,4), tp, sep="-" ),
+      height=5+6/8, width=6+5/8,  pointsize=10 )
+ par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
+ plot.one( i, "M", xax=TRUE, yax=TRUE , anno=FALSE, yl=c(0.5,5),
+           raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,97), "M", font=1, cex=1.5, adj=c(1,1) )
+ plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+           raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,97), "F", font=1, cex=1.5, adj=c(1,1) )
+ mtext( side=1, line=2, durtxt, outer=T )
+ mtext( side=2, line=2, rrtxt, outer=T )
+ mtext( side=3, line=0.1, diagnames[i], outer=T, adj=0, cex=1.5 )
+ dev.off()
+     }
+
+ # Prostate & breast in one display
+ plt( paste("PrBr", tp, sep="-" ),
+      height=5+6/8, width=6+5/8,  pointsize=10 )
+ par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
+ plot.one( 18, "M", xax=TRUE, yax=TRUE, anno=FALSE, yl=c(0.2,2),
+                    raw=TRUE,  int=tp, knpl=TRUE )
+ plot.one( 14, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,97), "F", font=1, cex=1.5, adj=c(1,1) )
+ mtext( side=1, line=2, durtxt, outer=T )
+ mtext( side=2, line=2, rrtxt, outer=T )
+ mtext( side=3, line=0.1, diagnames[18], outer=T, adj=0, cex=1.5 )
+ mtext( side=3, line=0.1, diagnames[14], outer=T, adj=0, cex=1.5, at=0.5 )
+ dev.off()
+
+ # Testis and ovary in one display
+ plt( paste("TeOv", tp, sep="-" ),
+      height=5+6/8, width=6+5/8,  pointsize=10 )
+ par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
+ plot.one( 19, "M", xax=TRUE, yax=TRUE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE,  int=tp, knpl=TRUE )
+ plot.one( 17, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE,  int=tp, knpl=TRUE )
+ mtext( side=1, line=2, durtxt, outer=T )
+ mtext( side=2, line=2, rrtxt, outer=T )
+ mtext( side=3, line=0.1, diagnames[19], outer=T, adj=0, cex=1.5 )
+ mtext( side=3, line=0.1, diagnames[17], outer=T, adj=0, cex=1.5, at=0.5 )
+ dev.off()
+
+ # Cervix and corpus uteri in one display
+ plt( paste("Uter", tp, sep="-" ),
+      height=5+6/8, width=6+5/8,  pointsize=10 )
+ par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
+ plot.one( 16, "F", xax=TRUE, yax=TRUE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE, int=tp, knpl=TRUE )
+ plot.one( 17, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE, int=tp, knpl=TRUE )
+ text( cnr(95,97), "F", font=1, cex=1.5, adj=c(1,1) )
+ mtext( side=1, line=2, durtxt, outer=T )
+ mtext( side=2, line=2, rrtxt, outer=T )
+ mtext( side=3, line=0.1, diagnames[16], outer=T, adj=0, cex=1.5 )
+ mtext( side=3, line=0.1, diagnames[17], outer=T, adj=0, cex=1.5, at=0.5 )
+ dev.off()
+
+ # Ovary and corpus uteri in one display
```

```
+ plt( paste("OvCo", tp, sep="-" ),
+      height=5+6/8, width=6+5/8,  pointsize=10 )
+ par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
+ plot.one( 17, "F", xax=TRUE, yax=TRUE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE, int=tp, knpl=TRUE )
+ plot.one( 16, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE, int=tp, knpl=TRUE )
+ text( cnr(95,97), "F", font=1, cex=1.5, adj=c(1,1) )
+ mtext( side=1, line=2, durtxt, outer=T )
+ mtext( side=2, line=2, rrtxt, outer=T )
+ mtext( side=3, line=0.1, diagnames[17], outer=T, adj=0, cex=1.5 )
+ mtext( side=3, line=0.1, diagnames[16], outer=T, adj=0, cex=1.5, at=0.5 )
+ dev.off()
+
+ # Redo liver and pancreas
+ for( i in 10:11 )
+    {
+ fl <- 1.6
+ plt( paste( substr(gsub(" ","",dimnames(dur)[[1]][i]),1,4), tp, sep="-" ),
+      height=5*fl+5/8, width=6+5/8,  pointsize=10 )
+ par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
+ plot.one( i, "M", xax=TRUE, yax=TRUE , anno=FALSE, yl=c(0.5,0.5*10^fl),
+                   raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,98), "M", font=1, cex=1.5, adj=c(1,1) )
+ plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,0.5*10^fl),
+                   raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,98), "F", font=1, cex=1.5, adj=c(1,1) )
+ mtext( side=1, line=2, durtxt, outer=T )
+ mtext( side=2, line=2, rrtxt, outer=T )
+ mtext( side=3, line=0.1, diagnames[i], outer=T, adj=0, cex=1.5 )
+ dev.off()
+     }
+
+ } # end of loop over c("mc","mr","ic","ir")
There were 50 or more warnings (use warnings() to see the first 50)
>
> ########################################################################
> # Graphs for the paper
> zz <- strsplit(diagnames,"")
> dnsp <- sapply( lapply( zz, FUN=function(x,p) grep(p,x), " " ), FUN = function(x) x[1] ) - 1
> cbind( diagnames, dnsp )
      diagnames                      dnsp
 [1,] "All malignant neoplasms"      "3"
 [2,] "Oesophagus"                   NA
 [3,] "Stomach"                      NA
 [4,] "Colon incl. rectosigmoideum"  "5"
 [5,] "Ascending colon"              "9"
 [6,] "Transverse colon"             "10"
 [7,] "Descending and sigmoid colon" "10"
 [8,] "Rectum"                       NA
 [9,] "Colorectal cancer"            "10"
[10,] "Liver"                        NA
[11,] "Pancreas"                     NA
[12,] "Lung, bronchus and pleura"    "5"
[13,] "Melanoma of skin"             "8"
[14,] "Breast"                       NA
[15,] "Cervix uteri"                 "6"
[16,] "Corpus uteri"                 "6"
[17,] "Ovary, fallopian tube etc."   "6"
[18,] "Prostate"                     NA
[19,] "Testis"                       NA
[20,] "Kidney"                       NA
[21,] "Urinary bladder"              "7"
[22,] "Brain"                        NA
[23,] "Thyroid"                      NA
[24,] "Hodgkin's lymphoma"           "9"
[25,] "Non-Hodgkin lymphoma"         "11"
[26,] "Multiple myeloma"             "8"
[27,] "Leukaemia"                    NA
> dnshort <- substring( diagnames, 1, pmin(dnsp,nchar(diagnames),na.rm=T) )
> dnshort <- gsub(",","", dnshort )
>
> # First one:
> lomat <- rbind( c(18,1,2,13,3,4),
+                 rep(16,6),
+                 c(19,5,6,14,7,8),
+                 rep(17,6),
+                 c(20,9,10,15,11,12),
+                 rep(21,6) )
> rw <- c(10,35,35,10,35,35)
> rh <- c(60,5,60,5,60,10)
> tp <- "mc"
>
> plt( "sub6", height=10.2,width=8)
> layout( lomat, widths=rw, heights=rh )
> par( mai=c(0,0,0.2,0), mgp=c(3,1,0)/1.6 )
> for( i in c(3,9,12,13) )
+ {
+ plot.one( i, "M", xax=TRUE, yax=TRUE , anno=FALSE, yl=c(0.5,5),
```

```
+           raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,97), "M", font=1, cex=1.2, adj=c(1,1) )
+ mtext( dnshort[i], font=1, cex=0.8, adj=0, side=3, line=0.1 )
+ plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+           raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,97), "F", font=1, cex=1.2, adj=c(1,1) )
+ }
> # Prostate and breast
> plot.one( 18, "M", xax=TRUE, yax=TRUE, anno=FALSE, yl=c(0.2,2),
+                    raw=TRUE,  int=tp, knpl=TRUE )
> text( cnr(95,97), "M", font=1, cex=1.2, adj=c(1,1) )
> mtext( dnshort[18], font=1, cex=0.8, adj=0, side=3, line=0.1 )
> plot.one( 14, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE,  int=tp, knpl=TRUE )
> text( cnr(95,97), "F", font=1, cex=1.2, adj=c(1,1) )
> mtext( dnshort[14], font=1, cex=0.8, adj=0, side=3, line=0.1 )
> # Ovary and Corpus uteri
> plot.one( 17, "F", xax=TRUE, yax=TRUE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE, int=tp, knpl=TRUE )
> text( cnr(95,97), "F", font=1, cex=1.2, adj=c(1,1) )
> mtext( dnshort[17], font=1, cex=0.8, adj=0, side=3, line=0.1 )
> plot.one( 16, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+                    raw=TRUE, int=tp, knpl=TRUE )
> text( cnr(95,97), "F", font=1, cex=1.2, adj=c(1,1) )
> mtext( diagnames[16], font=1, cex=0.8, adj=0, side=3, line=0.1 )
> mtext( "Diabetes duration (years)", side=1, line=-1, cex=0.8, outer=T )
> mtext( "Rate ratio versus the non-diabetic population", side=2,
+       line=-1, cex=0.8, outer=T )
> dev.off()
null device
          1
>
> lomat <- rbind( c(11,1,2,9,3,4),
+                 rep(12,6),
+                 c(14,5,6,10,7,8),
+                 rep(13,6) )
> fl <- 1.6
> rw <- c(10,35,35,10,35,35)
> rh <- c(60*fl,5,60,10)
> tp <- "mc"
>
> plt( "sub4", height=10*((75+60*fl)/200)+0.2,width=8)
> layout( lomat, widths=rw, heights=rh )
> par( mai=c(0,0,0.2,0), mgp=c(3,1,0)/1.6 )
> for( i in c(10:11,20:21) )
+ {
+ fl <- ifelse( i<15, fl, 1 )
+ plot.one( i, "M", xax=TRUE, yax=TRUE , anno=FALSE, yl=c(0.5,0.5*10^fl),
+                   raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,98), "M", font=1, cex=1.5, adj=c(1,1) )
+ mtext( diagnames[i], font=1, cex=0.8, adj=0, side=3, line=0.1 )
+ plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,0.5*10^fl),
+                   raw=TRUE,  int=tp, knpl=TRUE )
+ text( cnr(95,98), "F", font=1, cex=1.5, adj=c(1,1) )
+ }
> mtext( "Diabetes duration (years)", side=1, line=-1, cex=0.8, outer=T )
> mtext( "Rate ratio versus the non-diabetic population", side=2,
+       line=-1, cex=0.8, outer=T )
> dev.off()
null device
          1
>
> ######################################################################
> # Graphs for explanation of the curves
> i <- 1
>
> plt( "Allm-exp1",
+      height=5+6/8, width=6+5/8,  pointsize=10 )
> par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
> plot( NA, axes=F, xlab="", ylab="", xlim=0:1, ylim=0:1 )
> plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+           clr=c("blue","red"), raw=TRUE,  int="mc", knpl=FALSE, what="dm" )
Warning messages:
1: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
2: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
> mtext( side=1, line=2, durtxt, outer=T )
> mtext( side=2, line=2, "Rate ratio", outer=F )
> dev.off()
null device
          1
>
> plt( "Allm-exp2",
+      height=5+6/8, width=6+5/8,  pointsize=10 )
> par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
> plot( NA, axes=F, xlab="", ylab="", xlim=0:1, ylim=0:1 )
> plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+           clr=c("blue","red"), raw=TRUE,  int="mc", knpl=FALSE, what=c("dm","i0") )
```

```
Warning messages:
1: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
2: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
> mtext( side=1, line=2, durtxt, outer=T )
> mtext( side=2, line=2, "Rate ratio", outer=F )
> dev.off()
null device
          1
>
> plt( "Allm-exp3",
+      height=5+6/8, width=6+5/8,  pointsize=10 )
> par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
> plot( NA, axes=F, xlab="", ylab="", xlim=0:1, ylim=0:1 )
> plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+           clr=c("blue","red"), raw=TRUE,  int="mc", knpl=FALSE, what=c("dm","i2") )
Warning messages:
1: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
2: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
> mtext( side=1, line=2, durtxt, outer=T )
> mtext( side=2, line=2, "Rate ratio", outer=F )
> dev.off()
null device
          1
>
> plt( "Allm-exp4",
+      height=5+6/8, width=6+5/8,  pointsize=10 )
> par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
> plot( NA, axes=F, xlab="", ylab="", xlim=0:1, ylim=0:1 )
> plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+           clr=c("blue","red"), raw=TRUE,  int="mc", knpl=FALSE, what=c("dm","i5") )
Warning messages:
1: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
2: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
> mtext( side=1, line=2, durtxt, outer=T )
> mtext( side=2, line=2, "Rate ratio", outer=F )
> dev.off()
null device
          1
>
> plt( "Allm-exp5",
+      height=5+6/8, width=6+5/8,  pointsize=10 )
> par( mfrow=c(1,2), mar=c(0,0,0,0), omi=c(4,4,2,1)/8, mgp=c(3,1,0)/1.6 )
> plot( NA, axes=F, xlab="", ylab="", xlim=0:1, ylim=0:1 )
> plot.one( i, "F", xax=TRUE, yax=FALSE, anno=FALSE, yl=c(0.5,5),
+           clr=c("blue","red"), raw=TRUE,  int="mc", knpl=FALSE, what=c("dm","i0","i2","i5") )
Warning messages:
1: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
2: In if (clr == "blue") c("#0000FF", "#AAAAFF") else c("#FF0000",  :
  the condition has length > 1 and only the first element will be used
> mtext( side=1, line=2, durtxt, outer=T )
> mtext( side=2, line=2, "Rate ratio", outer=F )
> dev.off()
null device
          1
>
>

 ---------------------------------------------
 Program: plot3dx.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 23. juni 2011, 17:22:59
 Elapsed: 00:00:05
 ---------------------------------------------
> proc.time()
   user  system elapsed
   4.18    0.34    5.82
```

2.5 Analysis of mortality and cumulative mortality

```
 R 2.13.0
 ---------------------------------------------
 Program:  anam.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  tirsdag 21. juni 2011, 20:57:59
 ---------------------------------------------
> library( Epi )

Attaching package: 'Epi'
```

```
The following object(s) are masked from 'package:base':

    merge.data.frame

> library( splines )
>
> ###############################################################################
> # Includes a temporary fix for a bug that crashed apc.fit with only
> # two parameters in one of the effects (a drop=FALSE was missing)
> source( "C:/stat/R/BxC/library.sources/Epi/pkg/R/apc.fit.r" )
>
> ###############################################################################
> # A wrapper for ns() where boundary knots are taken as the
> # smallest and largest of the knots= argument
> source( "C:/Bendix/Steno/DM-register/NDR/R/Ns.r" )
> Ns
function (x, df = NULL, knots = NULL, intercept = FALSE, Boundary.knots = NULL)
{
    if (is.null(Boundary.knots)) {
        if (!is.null(knots)) {
            knots <- sort(unique(knots))
            ok <- c(1, length(knots))
            Boundary.knots <- knots[ok]
            knots <- knots[-ok]
        }
    }
    ns(x, df = df, knots = knots, intercept = intercept, Boundary.knots = Boundary.knots)
}
> source("c:/stat/r/bxc/library.sources/useful/R/cnr.r")
>
> # Utility for deriving the RR from two independent set of rates with ci
> mkRR <-
+ function( A, B )
+ {
+   erf <- exp( 1.96 *  sqrt( (log(A[,3]/A[,1])/1.96)^2 +
+                             (log(B[,3]/B[,1])/1.96)^2 ) )
+   RR <- cbind( A[,1]/B[,1],
+                A[,1]/B[,1]/erf,
+                A[,1]/B[,1]*erf )
+   RR
+ }
>
> load( file="../data/DMmD.Rdata" )
> str(DMm)
'data.frame': 284374 obs. of  8 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ a     : num  0 0 0 0 0 0 0 0 0 0 ...
 $ p     : num  1995 1996 1997 1998 1999 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ dd    : num  196 219 187 160 169 208 163 159 164 153 ...
 $ y     : num  35895 35486 34834 34442 34014 ...
> names( DMm )[match( c("a" ,"p" ), names(DMm) )] <-
+                    c("ax","px")
>
> # First fit APC-models, disregarding duration:
> str( DMm )
'data.frame': 284374 obs. of  8 variables:
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ sex   : Factor w/ 2 levels "M","F": 1 1 1 1 1 1 1 1 1 1 ...
 $ ax    : num  0 0 0 0 0 0 0 0 0 0 ...
 $ px    : num  1995 1996 1997 1998 1999 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ dd    : num  196 219 187 160 169 208 163 159 164 153 ...
 $ y     : num  35895 35486 34834 34442 34014 ...
> DMmA <- aggregate( DMm[,c("dd","y")],
+              by = DMm[,c("ax","px","sex","state")],
+             FUN = sum )
> names( DMmA )
[1] "ax"    "px"    "sex"   "state" "dd"    "y"
> names( DMmA )[match( c("ax","px","dd","y"), names(DMmA) )] <- c("A","P","D","Y")
> names( DMmA )
[1] "A"     "P"     "sex"   "state" "D"     "Y"
>
> # Separate APC-models for each sex and state, with slightly different sets of knots
> # for the three states
> Wpar <- list( A=seq(0,100,,10),
+              P=seq(1995,2009,,4),
+              C=seq(1895,2007,,7) )
> Dpar <-
+ Ipar <- list( A=seq(0,100,,7),
+              P=seq(1995,2009,,4),
+              C=seq(1895,2007,,6) )
> apc.WMp <- apc.fit( subset( DMmA, state=="Well"   & sex=="M"), parm="APC", scale=1000, npar=Wpar, ref.p=2005 )
[1] "ML of APC-model Poisson with log(Y) offset : ( APC ):\n"
```

```
Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1490    11837.5
Age-drift              1489     8073.0  1   3764.5 < 2.2e-16
Age-Cohort             1484     7509.2  5    563.8 < 2.2e-16
Age-Period-Cohort      1482     7451.2  2     58.0 2.554e-13
Age-Period             1487     8050.3 -5   -599.1 < 2.2e-16
Age-drift              1489     8073.0 -2    -22.6 1.217e-05
> apc.WMc <- apc.fit( subset( DMmA, state=="Well"   & sex=="M"), parm="ACP", scale=1000, npar=Wpar, ref.c=1940 )
[1] "ML of APC-model Poisson with log(Y) offset : ( ACP ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1490    11837.5
Age-drift              1489     8073.0  1   3764.5 < 2.2e-16
Age-Cohort             1484     7509.2  5    563.8 < 2.2e-16
Age-Period-Cohort      1482     7451.2  2     58.0 2.554e-13
Age-Period             1487     8050.3 -5   -599.1 < 2.2e-16
Age-drift              1489     8073.0 -2    -22.6 1.217e-05
> apc.WFp <- apc.fit( subset( DMmA, state=="Well"   & sex=="F"), parm="APC", scale=1000, npar=Wpar, ref.p=2005 )
[1] "ML of APC-model Poisson with log(Y) offset : ( APC ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1490      14184
Age-drift              1489      12205  1  1979.40 < 2.2e-16
Age-Cohort             1484      11590  5   614.70 < 2.2e-16
Age-Period-Cohort      1482      11576  2    14.13  0.000853
Age-Period             1487      12204 -5  -628.06 < 2.2e-16
Age-drift              1489      12205 -2    -0.77  0.679170
> apc.WFc <- apc.fit( subset( DMmA, state=="Well"   & sex=="F"), parm="ACP", scale=1000, npar=Wpar, ref.c=1940 )
[1] "ML of APC-model Poisson with log(Y) offset : ( ACP ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1490      14184
Age-drift              1489      12205  1  1979.40 < 2.2e-16
Age-Cohort             1484      11590  5   614.70 < 2.2e-16
Age-Period-Cohort      1482      11576  2    14.13  0.000853
Age-Period             1487      12204 -5  -628.06 < 2.2e-16
Age-drift              1489      12205 -2    -0.77  0.679170
> apc.DMp <- apc.fit( subset( DMmA, state=="DM"     & sex=="M"), parm="APC", scale=1000, npar=Dpar, ref.p=2005 )
[1] "ML of APC-model Poisson with log(Y) offset : ( APC ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1488     1560.9
Age-drift              1487     1200.7  1   360.24   < 2e-16
Age-Cohort             1483     1102.4  4    98.24   < 2e-16
Age-Period-Cohort      1481     1094.7  2     7.72   0.02109
Age-Period             1485     1192.7 -4   -98.01   < 2e-16
Age-drift              1487     1200.7 -2    -7.95   0.01881
> apc.DMc <- apc.fit( subset( DMmA, state=="DM"     & sex=="M"), parm="ACP", scale=1000, npar=Dpar, ref.c=1940 )
[1] "ML of APC-model Poisson with log(Y) offset : ( ACP ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1488     1560.9
Age-drift              1487     1200.7  1   360.24   < 2e-16
Age-Cohort             1483     1102.4  4    98.24   < 2e-16
Age-Period-Cohort      1481     1094.7  2     7.72   0.02109
Age-Period             1485     1192.7 -4   -98.01   < 2e-16
Age-drift              1487     1200.7 -2    -7.95   0.01881
> apc.DFp <- apc.fit( subset( DMmA, state=="DM"     & sex=="F"), parm="APC", scale=1000, npar=Dpar, ref.p=2005 )
[1] "ML of APC-model Poisson with log(Y) offset : ( APC ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1489     1410.9
Age-drift              1488     1230.1  1  180.802 < 2.2e-16
Age-Cohort             1484     1157.1  4   73.012 5.244e-15
Age-Period-Cohort      1482     1156.3  2    0.797    0.6712
Age-Period             1486     1229.0 -4  -72.663 6.216e-15
Age-drift              1488     1230.1 -2   -1.147    0.5636
> apc.DFc <- apc.fit( subset( DMmA, state=="DM"     & sex=="F"), parm="ACP", scale=1000, npar=Dpar, ref.c=1940 )
[1] "ML of APC-model Poisson with log(Y) offset : ( ACP ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1489     1410.9
Age-drift              1488     1230.1  1  180.802 < 2.2e-16
```

```
Age-Cohort             1484     1157.1  4   73.012 5.244e-15
Age-Period-Cohort      1482     1156.3  2    0.797    0.6712
Age-Period             1486     1229.0 -4  -72.663 6.216e-15
Age-drift              1488     1230.1 -2   -1.147    0.5636
> apc.IMp <- apc.fit( subset( DMmA, state=="DM/Ins" & sex=="M"), parm="APC", scale=1000, npar=Ipar, ref.p=2005 )
[1] "ML of APC-model Poisson with log(Y) offset : ( APC ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1453     1187.1
Age-drift              1452     1135.8  1   51.346 7.746e-13
Age-Cohort             1448     1124.7  4   11.111  0.025341
Age-Period-Cohort      1446     1116.5  2    8.229  0.016334
Age-Period             1450     1126.2 -4   -9.690  0.045987
Age-drift              1452     1135.8 -2   -9.650  0.008025
> apc.IMc <- apc.fit( subset( DMmA, state=="DM/Ins" & sex=="M"), parm="ACP", scale=1000, npar=Ipar, ref.c=1940 )
[1] "ML of APC-model Poisson with log(Y) offset : ( ACP ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1453     1187.1
Age-drift              1452     1135.8  1   51.346 7.746e-13
Age-Cohort             1448     1124.7  4   11.111  0.025341
Age-Period-Cohort      1446     1116.5  2    8.229  0.016334
Age-Period             1450     1126.2 -4   -9.690  0.045987
Age-drift              1452     1135.8 -2   -9.650  0.008025
> apc.IFp <- apc.fit( subset( DMmA, state=="DM/Ins" & sex=="F"), parm="APC", scale=1000, npar=Ipar, ref.p=2005 )
[1] "ML of APC-model Poisson with log(Y) offset : ( APC ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1459     1117.6
Age-drift              1458     1108.8  1   8.8381   0.00295
Age-Cohort             1454     1104.5  4   4.2849   0.36882
Age-Period-Cohort      1452     1103.3  2   1.1281   0.56891
Age-Period             1456     1107.3 -4  -3.9439   0.41365
Age-drift              1458     1108.8 -2  -1.4691   0.47973
> apc.IFc <- apc.fit( subset( DMmA, state=="DM/Ins" & sex=="F"), parm="ACP", scale=1000, npar=Ipar, ref.c=1940 )
[1] "ML of APC-model Poisson with log(Y) offset : ( ACP ):\n"

Analysis of deviance for Age-Period-Cohort model

                  Resid. Df Resid. Dev Df Deviance P(>|Chi|)
Age                    1459     1117.6
Age-drift              1458     1108.8  1   8.8381   0.00295
Age-Cohort             1454     1104.5  4   4.2849   0.36882
Age-Period-Cohort      1452     1103.3  2   1.1281   0.56891
Age-Period             1456     1107.3 -4  -3.9439   0.41365
Age-drift              1458     1108.8 -2  -1.4691   0.47973
>
> # Plot the estimates from the period-major parmaetrizations
> # and save the estimates at the same time
> pdf( "../graph/APC.pdf", width=10 )
> par( mar=c(3,4,1,4), mgp=c(3,1,0)/1.6, las=1 )
> apc.frame( a.lab=seq(0,100,20), a.tic=seq(0,100,10),
+           cp.lab=seq(1920,2010,20), cp.tic=seq(1900,2010,10),
+            r.lab=outer(c(1,2,5),10^(-2:2)), gap=7,
+            r.tic=outer(1:9,10^(-2:2)),
+            r.txt="Mortality rate per 1000 PY" )
> WMP <- apc.lines( apc.WMp, col="blue", lwd=1 )
> WFP <- apc.lines( apc.WFp, col="red" , lwd=1 )
> DMP <- apc.lines( apc.DMp, col="blue", lwd=2 )
> DFP <- apc.lines( apc.DFp, col="red" , lwd=2 )
> IMP <- apc.lines( apc.IMp, col="blue", lwd=3 )
> IFP <- apc.lines( apc.IFp, col="red" , lwd=3 )
> dev.off()
null device
          1
>
> # Plot the estimates from the cohort-major parmaetrizations
> pdf( "../graph/ACP.pdf", width=10 )
> par( mar=c(3,4,1,4), mgp=c(3,1,0)/1.6, las=1 )
> apc.frame( a.lab=seq(0,90,20), a.tic=seq(0,90,10),
+           cp.lab=seq(1920,2000,20), cp.tic=seq(1900,2010,10),
+            r.lab=outer(c(1,2,5),10^(-2:2)),
+            r.tic=outer(1:9,10^(-2:2)), gap=7,
+            r.txt="Mortality rate per 1000 PY" )
> apc.lines( apc.WMc, col="blue", lwd=1 )
> apc.lines( apc.WFc, col="red" , lwd=1 )
> apc.lines( apc.DMc, col="blue", lwd=2 )
> apc.lines( apc.DFc, col="red" , lwd=2 )
> apc.lines( apc.IMc, col="blue", lwd=3 )
> apc.lines( apc.IFc, col="red" , lwd=3 )
> dev.off()
null device
          1
```

```
>
> # Plot the RRs from the period-major parametrizations
> pdf( "../graph/APC-RR.pdf", width=10 )
> par( mar=c(3,4,1,4), mgp=c(3,1,0)/1.6, las=1 )
> apc.frame( a.lab=seq(0,90,20), a.tic=seq(0,90,10),
+           cp.lab=seq(1920,2000,20), cp.tic=seq(1900,2010,10),
+            r.lab=outer(c(1,2,5),10^(-2:2)),
+            r.tic=outer(1:9,10^(-2:2)),
+            r.txt="Mortality rate ratio" )
>    matlines( WMP$A[,1], mkRR(DMP$A[,-1],WMP$A[,-1]), lty=1, col="blue", lwd=c(3,1,1) )
> pc.matlines( WMP$P[,1], mkRR(DMP$P[,-1],WMP$P[,-1]), lty=1, col="blue", lwd=c(3,1,1) )
> pc.matlines( WMP$C[,1], mkRR(DMP$C[,-1],WMP$C[,-1]), lty=1, col="blue", lwd=c(3,1,1) )
Warning messages:
1: In (log(A[, 3]/A[, 1])/1.96)^2 + (log(B[, 3]/B[, 1])/1.96)^2 :
  longer object length is not a multiple of shorter object length
2: In A[, 1]/B[, 1] :
  longer object length is not a multiple of shorter object length
3: In A[, 1]/B[, 1] :
  longer object length is not a multiple of shorter object length
4: In A[, 1]/B[, 1] :
  longer object length is not a multiple of shorter object length
> mia <- match( IMP$A[,1], WMP$A[,1] )
> mip <- match( IMP$P[,1], WMP$P[,1] )
> mic <- match( IMP$C[,1], WMP$C[,1] )
>    matlines( IMP$A[,1], mkRR(IMP$A[,-1],WMP$A[mia,-1]), lty=1, col="red", lwd=c(3,1,1) )
> pc.matlines( IMP$P[,1], mkRR(IMP$P[,-1],WMP$P[mip,-1]), lty=1, col="red", lwd=c(3,1,1) )
> pc.matlines( IMP$C[,1], mkRR(IMP$C[,-1],WMP$C[mic,-1]), lty=1, col="red", lwd=c(3,1,1) )
>
>    matlines( WFP$A[,1], mkRR(DFP$A[,-1],WFP$A[,-1]), lty=3, col="blue", lwd=c(3,1,1) )
> pc.matlines( WFP$P[,1], mkRR(DFP$P[,-1],WFP$P[,-1]), lty=3, col="blue", lwd=c(3,1,1) )
> pc.matlines( WFP$C[,1], mkRR(DFP$C[,-1],WFP$C[,-1]), lty=3, col="blue", lwd=c(3,1,1) )
Warning messages:
1: In (log(A[, 3]/A[, 1])/1.96)^2 + (log(B[, 3]/B[, 1])/1.96)^2 :
  longer object length is not a multiple of shorter object length
2: In A[, 1]/B[, 1] :
  longer object length is not a multiple of shorter object length
3: In A[, 1]/B[, 1] :
  longer object length is not a multiple of shorter object length
4: In A[, 1]/B[, 1] :
  longer object length is not a multiple of shorter object length
> mia <- match( IFP$A[,1], WFP$A[,1] )
> mip <- match( IFP$P[,1], WFP$P[,1] )
> mic <- match( IFP$C[,1], WFP$C[,1] )
>    matlines( IFP$A[,1], mkRR(IFP$A[,-1],WFP$A[mia,-1]), lty=3, col="red", lwd=c(3,1,1) )
> pc.matlines( IFP$P[,1], mkRR(IFP$P[,-1],WFP$P[mip,-1]), lty=3, col="red", lwd=c(3,1,1) )
> pc.matlines( IFP$C[,1], mkRR(IFP$C[,-1],WFP$C[mic,-1]), lty=3, col="red", lwd=c(3,1,1) )
> dev.off()
null device
          1
>
> # Knots for the natural splines in the model for mortality
> a.kn <- seq(  10, 100,,9)
> p.kn <- seq(1995,2009,,5)
> c.kn <- seq(1900,2005,,9)
> # Duration points
> d.pt <- seq(0,14,0.2)
> # Knots for diabetes duration and insulin duration
> d.kn <- c(0,1,3,5,10)
> i.kn <- c(0,1, 4 ,10)
>
> load( file="../data/ana3dx.Rdata" )
> # Check the prediction frame supplied from ana3dx.r
> str( pr.frame )
'data.frame':	3600 obs. of  6 variables:
 $ ax    : num  60 60 60.1 60.1 60.2 ...
 $ px    : num  1998 1998 1998 1998 1998 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ y     : num  0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 ...
>
> sx <- levels(DMm$sex)[1]
> for( sx in levels(DMm$sex) )
+ {
+ # We allow for different age-period and cohort effects between
+ # the three states (as opposed to what we did for incidence rates),
+ # but since we are using predict to
+ # Fit the model separately for diabetics and non-diabetics
+ mp <- glm( dd ~ -1 +
+                 ( Ns(   ax,knots=a.kn,i=T) +
+         detrend( Ns(px   ,knots=p.kn    ), px ) +
+                   Ns(px-ax,knots=c.kn    ) ):state +
+                   Ns( DMDur,knots=d.kn) +
+                   Ns(InsDur,knots=i.kn) +
+                 offset( log(y) ),
+                 family = poisson,
+                 data = subset(DMm,sex==sx) )
+ mi <- update( mp, . ~ . + I((DMDur-InsDur)*(state=="DM/Ins"))
+                         + I( DMDur*InsDur) )
```

```
+ # The predicted log-incidence rates saved in the array
+ # Note this depends critically on the order of rows in the
+ # prediction frame and the definition of the last two dimensions in
+ # the array prr:
+ prr["Death",sx,"Main"    ,,,,] <- predict( mp, newdata=pr.frame )
+ prr["Death",sx,"Interact",,,,] <- predict( mi, newdata=pr.frame )
+ }
Warning messages:
1: glm.fit: fitted rates numerically 0 occurred
2: glm.fit: fitted rates numerically 0 occurred
> # End of sex loop
> str( pr.frame )
'data.frame': 3600 obs. of  6 variables:
 $ ax    : num  60 60 60.1 60.1 60.2 ...
 $ px    : num  1998 1998 1998 1998 1998 ...
 $ DMDur : num  0 0 0 0 0 0 0 0 0 0 ...
 $ InsDur: num  0 0 0 0 0 0 0 0 0 0 ...
 $ state : Factor w/ 3 levels "Well","DM","DM/Ins": 1 1 1 1 1 1 1 1 1 1 ...
 $ y     : num  0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 0.05 ...
> str( prr )
 num [1:29, 1:2, 1:2, 1:200, 1:3, 1:3, 1:2] -7.76 -11.49 -11.24 -10.23 -11.61 ...
 - attr(*, "dimnames")=List of 7
  ..$ diag  : chr [1:29] "All malignant neoplasms" "Oesophagus" "Stomach" "Colon incl. rectosigmoideum" ...
  ..$ sex   : chr [1:2] "M" "F"
  ..$ model : chr [1:2] "Main" "Interact"
  ..$ pr.dur: chr [1:200] "0" "0.05" "0.1" "0.15" ...
  ..$ state : chr [1:3] "Well" "DM" "DM/Ins"
  ..$ age.in: chr [1:3] "60" "65" "70"
  ..$ dur.in: chr [1:2] "0" "2"
>
> save( res, prr, tst, file="../data/ana3dm.Rdata" )
>

 ---------------------------------------------
 Program: anam.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: tirsdag 21. juni 2011, 21:00:44
 Elapsed: 00:02:44
 ---------------------------------------------
> proc.time()
   user  system elapsed
 150.04    8.93  165.73

 R 2.13.0
 ---------------------------------------------
 Program:  prob3dx.R
  Folder:  C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
 Started:  torsdag 23. juni 2011, 17:39:48
 ---------------------------------------------
> library( Epi )

Attaching package: 'Epi'

The following object(s) are masked from 'package:base':

    merge.data.frame

> library( splines )
>
> load( file="../data/ana3dm.Rdata" )
> str( prr )
 num [1:29, 1:2, 1:2, 1:200, 1:3, 1:3, 1:2] -7.76 -11.49 -11.24 -10.23 -11.61 ...
 - attr(*, "dimnames")=List of 7
  ..$ diag  : chr [1:29] "All malignant neoplasms" "Oesophagus" "Stomach" "Colon incl. rectosigmoideum" ...
  ..$ sex   : chr [1:2] "M" "F"
  ..$ model : chr [1:2] "Main" "Interact"
  ..$ pr.dur: chr [1:200] "0" "0.05" "0.1" "0.15" ...
  ..$ state : chr [1:3] "Well" "DM" "DM/Ins"
  ..$ age.in: chr [1:3] "60" "65" "70"
  ..$ dur.in: chr [1:2] "0" "2"
>
> # The array prr contains the predicted log-rates from two different
> # models for 29 different events, computed for 200 timepoints starting
> # at 3 different ages and two different durations and 3 different states
> dnam <- dimnames( prr )
> s.can <- array( NA, dimnames  =dnam,
+                     dim=sapply(dnam,length) )
> p.can <- array( NA, dimnames  =dnam[-4],
+                     dim=sapply(dnam[-4],length) )
>
> # Just teh firt of each for use in debugging
> # dg <- dimnames(p.can)[["diag"]][1]
> # sx <- dimnames(p.can)[["sex"]][1]
> # mo <- dimnames(p.can)[["model"]][1]
> # st <- dimnames(p.can)[["state"]][1]
> # ai <- dimnames(p.can)[["age.in"]][1]
> # di <- dimnames(p.can)[["dur.in"]][1]
>
> for( sx in dimnames(p.can)[["sex"]] )
```

```
+ for( mo in dimnames(p.can)[["model"]] )
+ for( st in dimnames(p.can)[["state"]] )
+ for( ai in dimnames(p.can)[["age.in"]] )
+ for( di in dimnames(p.can)[["dur.in"]] )
+ {
+ # The overall survival, only two events possible cancer or death
+ surv <- exp( -cumsum( exp(prr[      1,sx,mo,,st,ai,di])+
+                       exp(prr["Death",sx,mo,,st,ai,di]) ) )
+ # The cumulative risk for each of the diagnoses
+ for( dg in dimnames(p.can)[["diag"]] )
+ s.can[dg,sx,mo,,st,ai,di] <- cumsum( surv *
+                                      exp(prr[dg,sx,mo,,st,ai,di]) )
+ }
> # The probability of getting cancer after 10 yeras is just the last element
> p.can <- s.can[,,,dim(s.can)[4],,,]
> p.can[p.can>1] <- 0
> formatC( ftable( p.can[,,"Interact",,,]*100, col.vars=c(5,3,2), row.vars=c(4,1) ), format="f", digits=2)
                                         dur.in     0                                    2
                                         state   Well          DM       DM/Ins        Well          DM       DM/Ins
                                         sex        M     F     M     F      M     F     M     F     M     F      M     F
age.in diag
60     All malignant neoplasms                  13.05 11.55 13.70 12.30  13.94 13.88 13.05 11.55 13.23 11.88  12.22 12.61
       Oesophagus                               0.27  0.09  0.31  0.08   0.35  0.13  0.27  0.09  0.30  0.07   0.44  0.15
       Stomach                                  0.32  0.14  0.36  0.16   0.35  0.19  0.32  0.14  0.35  0.15   0.35  0.29
       Colon incl. rectosigmoideum              1.08  0.91  1.28  1.01   1.13  0.66  1.08  0.91  1.24  0.99   1.04  0.59
       Ascending colon                          0.27  0.29  0.33  0.35   0.35  0.30  0.27  0.29  0.34  0.35   0.31  0.27
       Transverse colon                         0.14  0.12  0.18  0.15   0.24  0.09  0.14  0.12  0.18  0.16   0.20  0.08
       Descending and sigmoid colon             0.59  0.42  0.65  0.41   0.48  0.17  0.59  0.42  0.61  0.40   0.46  0.17
       Other colon (unspec. or multiple)        0.09  0.07  0.12  0.08   0.06  0.10  0.09  0.07  0.10  0.07   0.04  0.07
       Rectum (excl. anus)                      0.76  0.43  0.80  0.41   0.58  0.36  0.76  0.43  0.79  0.42   0.53  0.31
       Colorectal cancer (excl. anus)           1.84  1.34  2.08  1.42   1.72  1.01  1.84  1.34  2.03  1.41   1.58  0.90
       Liver                                    0.14  0.06  0.48  0.09   1.07  0.18  0.14  0.06  0.54  0.09   1.03  0.20
       Pancreas                                 0.35  0.30  0.60  0.45   2.41  1.98  0.35  0.30  0.46  0.31   0.61  0.52
       Lung, bronchus and pleura                2.22  1.75  2.19  1.73   2.74  2.43  2.22  1.75  2.09  1.68   2.78  2.30
       Melanoma of skin                         0.46  0.39  0.41  0.29   0.25  0.22  0.46  0.39  0.41  0.29   0.26  0.23
       Breast                                   0.02  3.56  0.01  3.54   0.05  3.19  0.02  3.56  0.02  3.51   0.08  3.22
       Cervix uteri                              NA   0.17   NA   0.18    NA   0.24   NA   0.17   NA   0.19    NA   0.26
       Corpus uteri                              NA   0.64   NA   0.94    NA   0.84   NA   0.64   NA   0.95    NA   0.87
       Ovary, fallopian tube etc.                NA   0.52   NA   0.52    NA   0.49   NA   0.52   NA   0.51    NA   0.46
       Prostate                                 2.89   NA   2.48   NA    1.54   NA   2.89   NA   2.39   NA    1.41   NA
       Testis                                   0.03   NA   0.03   NA    0.01   NA   0.03   NA   0.02   NA    0.01   NA
       Kidney                                   0.30  0.16  0.38  0.24   0.49  0.36  0.30  0.16  0.35  0.23   0.40  0.33
       Urinary bladder                          1.15  0.38  1.23  0.34   1.05  0.54  1.15  0.38  1.19  0.31   1.14  0.51
       Brain                                    0.27  0.19  0.26  0.21   0.24  0.20  0.27  0.19  0.23  0.20   0.15  0.13
       Thyroid                                  0.03  0.04  0.03  0.04   0.04  0.04  0.03  0.04  0.03  0.03   0.04  0.03
       Hodgkin's lymphoma                       0.03  0.01  0.05  0.02   0.03  0.01  0.03  0.01  0.05  0.02   0.02  0.01
       Non-Hodgkin lymphoma                     0.36  0.31  0.40  0.31   0.30  0.27  0.36  0.31  0.39  0.30   0.26  0.25
       Multiple myeloma                         0.21  0.13  0.20  0.12   0.12  0.13  0.21  0.13  0.18  0.11   0.12  0.13
       Leukaemia                                0.35  0.20  0.33  0.22   0.22  0.23  0.35  0.20  0.33  0.20   0.22  0.20
       Death                                    8.35  5.10  17.07 10.64  29.28 21.21 8.35  5.10  18.06 11.05  29.50 20.92
65     All malignant neoplasms                  17.33 13.55 17.92 14.30  17.95 16.05 17.33 13.55 17.19 13.75  15.46 14.45
       Oesophagus                               0.34  0.11  0.38  0.10   0.39  0.16  0.34  0.11  0.36  0.09   0.50  0.19
       Stomach                                  0.41  0.19  0.45  0.21   0.41  0.24  0.41  0.19  0.43  0.20   0.42  0.36
       Colon incl. rectosigmoideum              1.54  1.30  1.79  1.42   1.52  0.93  1.54  1.30  1.72  1.39   1.42  0.83
       Ascending colon                          0.38  0.45  0.45  0.53   0.46  0.45  0.38  0.45  0.46  0.52   0.42  0.40
       Transverse colon                         0.20  0.19  0.26  0.22   0.33  0.15  0.20  0.19  0.26  0.24   0.28  0.13
       Descending and sigmoid colon             0.84  0.56  0.91  0.53   0.66  0.21  0.84  0.56  0.86  0.52   0.63  0.22
       Other colon (unspec. or multiple)        0.12  0.10  0.16  0.11   0.09  0.15  0.12  0.10  0.14  0.10   0.05  0.11
       Rectum (excl. anus)                      0.98  0.54  1.00  0.51   0.71  0.46  0.98  0.54  0.99  0.52   0.64  0.41
       Colorectal cancer (excl. anus)           2.52  1.84  2.78  1.94   2.23  1.38  2.52  1.84  2.70  1.91   2.05  1.22
       Liver                                    0.19  0.09  0.60  0.13   1.35  0.26  0.19  0.09  0.67  0.13   1.26  0.28
       Pancreas                                 0.43  0.40  0.75  0.60   3.21  2.80  0.43  0.40  0.56  0.41   0.76  0.70
       Lung, bronchus and pleura                3.19  2.31  3.10  2.27   3.69  3.12  3.19  2.31  2.95  2.19   3.76  2.98
       Melanoma of skin                         0.47  0.38  0.41  0.28   0.24  0.21  0.47  0.38  0.41  0.28   0.25  0.22
       Breast                                   0.03  3.38  0.02  3.33   0.06  2.95  0.03  3.38  0.02  3.30   0.10  3.00
       Cervix uteri                              NA   0.20   NA   0.20    NA   0.27   NA   0.20   NA   0.21    NA   0.29
       Corpus uteri                              NA   0.74   NA   1.07    NA   0.93   NA   0.74   NA   1.08    NA   0.98
       Ovary, fallopian tube etc.                NA   0.60   NA   0.59    NA   0.56   NA   0.60   NA   0.59    NA   0.53
       Prostate                                 4.03   NA   3.41   NA    2.12   NA   4.03   NA   3.29   NA    1.92   NA
       Testis                                   0.03   NA   0.02   NA    0.01   NA   0.03   NA   0.02   NA    0.01   NA
       Kidney                                   0.37  0.22  0.46  0.32   0.57  0.48  0.37  0.22  0.42  0.31   0.46  0.44
       Urinary bladder                          1.71  0.50  1.81  0.45   1.45  0.70  1.71  0.50  1.74  0.41   1.57  0.67
       Brain                                    0.29  0.22  0.29  0.24   0.26  0.25  0.29  0.22  0.25  0.23   0.16  0.15
       Thyroid                                  0.03  0.05  0.03  0.04   0.03  0.04  0.03  0.05  0.03  0.03   0.04  0.03
       Hodgkin's lymphoma                       0.03  0.02  0.05  0.03   0.04  0.02  0.03  0.02  0.04  0.02   0.02  0.02
       Non-Hodgkin lymphoma                     0.43  0.36  0.47  0.37   0.34  0.31  0.43  0.36  0.46  0.34   0.31  0.29
       Multiple myeloma                         0.27  0.17  0.25  0.16   0.14  0.17  0.27  0.17  0.23  0.15   0.14  0.17
       Leukaemia                                0.48  0.28  0.44  0.30   0.28  0.32  0.48  0.28  0.43  0.28   0.29  0.27
       Death                                    13.72 9.09  24.36 16.51  38.70 28.58 13.72 9.09  25.75 17.13  39.44 28.37
70     All malignant neoplasms                  20.32 14.73 20.66 15.31  20.71 16.93 20.32 14.73 19.61 14.64  17.34 15.07
       Oesophagus                               0.38  0.14  0.43  0.13   0.39  0.18  0.38  0.14  0.41  0.11   0.52  0.22
       Stomach                                  0.47  0.22  0.50  0.25   0.45  0.25  0.47  0.22  0.48  0.24   0.46  0.39
       Colon incl. rectosigmoideum              1.94  1.73  2.20  1.85   1.82  1.21  1.94  1.73  2.10  1.80   1.71  1.07
       Ascending colon                          0.49  0.61  0.58  0.72   0.56  0.60  0.49  0.61  0.58  0.69   0.53  0.51
       Transverse colon                         0.26  0.27  0.33  0.30   0.40  0.20  0.26  0.27  0.32  0.32   0.35  0.18
       Descending and sigmoid colon             1.04  0.72  1.10  0.67   0.77  0.26  1.04  0.72  1.03  0.65   0.76  0.26
       Other colon (unspec. or multiple)        0.15  0.14  0.19  0.15   0.11  0.21  0.15  0.14  0.16  0.13   0.06  0.15
       Rectum (excl. anus)                      1.12  0.62  1.11  0.58   0.79  0.52  1.12  0.62  1.10  0.59   0.69  0.47
       Colorectal cancer (excl. anus)           3.07  2.36  3.30  2.43   2.58  1.72  3.07  2.36  3.19  2.39   2.37  1.52
```

```
       Liver                                    0.22  0.12  0.65  0.18   1.51  0.35  0.22  0.12  0.72  0.19   1.35  0.37
       Pancreas                                 0.47  0.48  0.85  0.75   4.02  3.68  0.47  0.48  0.61  0.49   0.86  0.85
       Lung, bronchus and pleura                3.81  2.45  3.65  2.38   4.12  3.18  3.81  2.45  3.43  2.27   4.22  3.05
       Melanoma of skin                         0.45  0.37  0.38  0.26   0.22  0.19  0.45  0.37  0.38  0.26   0.23  0.20
       Breast                                   0.04  3.00  0.02  2.90   0.07  2.50  0.04  3.00  0.03  2.87   0.11  2.55
       Cervix uteri                              NA   0.22   NA   0.21    NA   0.27   NA   0.22   NA   0.23    NA   0.30
       Corpus uteri                              NA   0.77   NA   1.10    NA   0.92   NA   0.77   NA   1.11    NA   1.00
       Ovary, fallopian tube etc.                NA   0.63   NA   0.61    NA   0.57   NA   0.63   NA   0.61    NA   0.55
       Prostate                                 4.70   NA   3.91   NA    2.48   NA   4.70   NA   3.76   NA    2.21   NA
       Testis                                   0.02   NA   0.02   NA    0.01   NA   0.02   NA   0.01   NA    0.01   NA
       Kidney                                   0.41  0.26  0.51  0.39   0.63  0.58  0.41  0.26  0.45  0.37   0.48  0.51
       Urinary bladder                          2.19  0.57  2.27  0.51   1.71  0.76  2.19  0.57  2.17  0.46   1.85  0.75
       Brain                                    0.31  0.24  0.30  0.27   0.29  0.28  0.31  0.24  0.27  0.26   0.17  0.16
       Thyroid                                  0.03  0.05  0.03  0.04   0.03  0.05  0.03  0.05  0.03  0.03   0.03  0.03
       Hodgkin's lymphoma                       0.03  0.02  0.04  0.03   0.03  0.02  0.03  0.02  0.04  0.03   0.01  0.02
       Non-Hodgkin lymphoma                     0.49  0.39  0.52  0.39   0.37  0.33  0.49  0.39  0.51  0.37   0.34  0.31
       Multiple myeloma                         0.31  0.21  0.29  0.20   0.16  0.20  0.31  0.21  0.27  0.18   0.16  0.20
       Leukaemia                                0.59  0.37  0.53  0.38   0.33  0.40  0.59  0.37  0.52  0.36   0.34  0.35
       Death                                    23.52 16.36 35.72 26.05  49.75 39.67 23.52 16.36 37.64 26.97  51.39 39.63
>   round( ftable( p.can[,,"Interact",,,]*100, col.vars=c(5,3,2), row.vars=c(4,1) ), 1 )
                                         dur.in    0                               2
                                         state  Well        DM      DM/Ins      Well        DM      DM/Ins
                                         sex       M    F    M    F      M    F    M    F    M    F      M    F
age.in diag
60     All malignant neoplasms                  13.0 11.5 13.7 12.3   13.9 13.9 13.0 11.5 13.2 11.9   12.2 12.6
       Oesophagus                                0.3  0.1  0.3  0.1    0.4  0.1  0.3  0.1  0.3  0.1    0.4  0.2
       Stomach                                   0.3  0.1  0.4  0.2    0.3  0.2  0.3  0.1  0.3  0.2    0.4  0.3
       Colon incl. rectosigmoideum               1.1  0.9  1.3  1.0    1.1  0.7  1.1  0.9  1.2  1.0    1.0  0.6
       Ascending colon                           0.3  0.3  0.3  0.4    0.4  0.3  0.3  0.3  0.3  0.4    0.3  0.3
       Transverse colon                          0.1  0.1  0.2  0.1    0.2  0.1  0.1  0.1  0.2  0.2    0.2  0.1
       Descending and sigmoid colon              0.6  0.4  0.6  0.4    0.5  0.2  0.6  0.4  0.6  0.4    0.5  0.2
       Other colon (unspec. or multiple)         0.1  0.1  0.1  0.1    0.1  0.1  0.1  0.1  0.1  0.1    0.0  0.1
       Rectum (excl. anus)                       0.8  0.4  0.8  0.4    0.6  0.4  0.8  0.4  0.8  0.4    0.5  0.3
       Colorectal cancer (excl. anus)            1.8  1.3  2.1  1.4    1.7  1.0  1.8  1.3  2.0  1.4    1.6  0.9
       Liver                                     0.1  0.1  0.5  0.1    1.1  0.2  0.1  0.1  0.5  0.1    1.0  0.2
       Pancreas                                  0.3  0.3  0.6  0.4    2.4  2.0  0.3  0.3  0.5  0.3    0.6  0.5
       Lung, bronchus and pleura                 2.2  1.7  2.2  1.7    2.7  2.4  2.2  1.7  2.1  1.7    2.8  2.3
       Melanoma of skin                          0.5  0.4  0.4  0.3    0.3  0.2  0.5  0.4  0.4  0.3    0.3  0.2
       Breast                                    0.0  3.6  0.0  3.5    0.1  3.2  0.0  3.6  0.0  3.5    0.1  3.2
       Cervix uteri                               NA  0.2   NA  0.2     NA  0.2   NA  0.2   NA  0.2     NA  0.3
       Corpus uteri                               NA  0.6   NA  0.9     NA  0.8   NA  0.6   NA  1.0     NA  0.9
       Ovary, fallopian tube etc.                 NA  0.5   NA  0.5     NA  0.5   NA  0.5   NA  0.5     NA  0.5
       Prostate                                  2.9   NA  2.5   NA    1.5   NA  2.9   NA  2.4   NA    1.4   NA
       Testis                                    0.0   NA  0.0   NA    0.0   NA  0.0   NA  0.0   NA    0.0   NA
       Kidney                                    0.3  0.2  0.4  0.2    0.5  0.4  0.3  0.2  0.3  0.2    0.4  0.3
       Urinary bladder                           1.1  0.4  1.2  0.3    1.0  0.5  1.1  0.4  1.2  0.3    1.1  0.5
       Brain                                     0.3  0.2  0.3  0.2    0.2  0.2  0.3  0.2  0.2  0.2    0.1  0.1
       Thyroid                                   0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0
       Hodgkin's lymphoma                        0.0  0.0  0.1  0.0    0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0
       Non-Hodgkin lymphoma                      0.4  0.3  0.4  0.3    0.3  0.3  0.4  0.3  0.4  0.3    0.3  0.2
       Multiple myeloma                          0.2  0.1  0.2  0.1    0.1  0.1  0.2  0.1  0.2  0.1    0.1  0.1
       Leukaemia                                 0.4  0.2  0.3  0.2    0.2  0.2  0.4  0.2  0.3  0.2    0.2  0.2
       Death                                     8.3  5.1 17.1 10.6   29.3 21.2  8.3  5.1 18.1 11.1   29.5 20.9
65     All malignant neoplasms                  17.3 13.6 17.9 14.3   18.0 16.1 17.3 13.6 17.2 13.8   15.5 14.5
       Oesophagus                                0.3  0.1  0.4  0.1    0.4  0.2  0.3  0.1  0.4  0.1    0.5  0.2
       Stomach                                   0.4  0.2  0.4  0.2    0.4  0.2  0.4  0.2  0.4  0.2    0.4  0.4
       Colon incl. rectosigmoideum               1.5  1.3  1.8  1.4    1.5  0.9  1.5  1.3  1.7  1.4    1.4  0.8
       Ascending colon                           0.4  0.4  0.5  0.5    0.5  0.4  0.4  0.4  0.5  0.5    0.4  0.4
       Transverse colon                          0.2  0.2  0.3  0.2    0.3  0.1  0.2  0.2  0.3  0.2    0.3  0.1
       Descending and sigmoid colon              0.8  0.6  0.9  0.5    0.7  0.2  0.8  0.6  0.9  0.5    0.6  0.2
       Other colon (unspec. or multiple)         0.1  0.1  0.2  0.1    0.1  0.1  0.1  0.1  0.1  0.1    0.1  0.1
       Rectum (excl. anus)                       1.0  0.5  1.0  0.5    0.7  0.5  1.0  0.5  1.0  0.5    0.6  0.4
       Colorectal cancer (excl. anus)            2.5  1.8  2.8  1.9    2.2  1.4  2.5  1.8  2.7  1.9    2.0  1.2
       Liver                                     0.2  0.1  0.6  0.1    1.3  0.3  0.2  0.1  0.7  0.1    1.3  0.3
       Pancreas                                  0.4  0.4  0.7  0.6    3.2  2.8  0.4  0.4  0.6  0.4    0.8  0.7
       Lung, bronchus and pleura                 3.2  2.3  3.1  2.3    3.7  3.1  3.2  2.3  2.9  2.2    3.8  3.0
       Melanoma of skin                          0.5  0.4  0.4  0.3    0.2  0.2  0.5  0.4  0.4  0.3    0.2  0.2
       Breast                                    0.0  3.4  0.0  3.3    0.1  3.0  0.0  3.4  0.0  3.3    0.1  3.0
       Cervix uteri                               NA  0.2   NA  0.2     NA  0.3   NA  0.2   NA  0.2     NA  0.3
       Corpus uteri                               NA  0.7   NA  1.1     NA  0.9   NA  0.7   NA  1.1     NA  1.0
       Ovary, fallopian tube etc.                 NA  0.6   NA  0.6     NA  0.6   NA  0.6   NA  0.6     NA  0.5
       Prostate                                  4.0   NA  3.4   NA    2.1   NA  4.0   NA  3.3   NA    1.9   NA
       Testis                                    0.0   NA  0.0   NA    0.0   NA  0.0   NA  0.0   NA    0.0   NA
       Kidney                                    0.4  0.2  0.5  0.3    0.6  0.5  0.4  0.2  0.4  0.3    0.5  0.4
       Urinary bladder                           1.7  0.5  1.8  0.5    1.4  0.7  1.7  0.5  1.7  0.4    1.6  0.7
       Brain                                     0.3  0.2  0.3  0.2    0.3  0.2  0.3  0.2  0.3  0.2    0.2  0.2
       Thyroid                                   0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0
       Hodgkin's lymphoma                        0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0
       Non-Hodgkin lymphoma                      0.4  0.4  0.5  0.4    0.3  0.3  0.4  0.4  0.5  0.3    0.3  0.3
       Multiple myeloma                          0.3  0.2  0.3  0.2    0.1  0.2  0.3  0.2  0.2  0.1    0.1  0.2
       Leukaemia                                 0.5  0.3  0.4  0.3    0.3  0.3  0.5  0.3  0.4  0.3    0.3  0.3
       Death                                    13.7  9.1 24.4 16.5   38.7 28.6 13.7  9.1 25.8 17.1   39.4 28.4
70     All malignant neoplasms                  20.3 14.7 20.7 15.3   20.7 16.9 20.3 14.7 19.6 14.6   17.3 15.1
       Oesophagus                                0.4  0.1  0.4  0.1    0.4  0.2  0.4  0.1  0.4  0.1    0.5  0.2
       Stomach                                   0.5  0.2  0.5  0.3    0.4  0.3  0.5  0.2  0.5  0.2    0.5  0.4
       Colon incl. rectosigmoideum               1.9  1.7  2.2  1.8    1.8  1.2  1.9  1.7  2.1  1.8    1.7  1.1
       Ascending colon                           0.5  0.6  0.6  0.7    0.6  0.6  0.5  0.6  0.6  0.7    0.5  0.5
       Transverse colon                          0.3  0.3  0.3  0.3    0.4  0.2  0.3  0.3  0.3  0.3    0.3  0.2
       Descending and sigmoid colon              1.0  0.7  1.1  0.7    0.8  0.3  1.0  0.7  1.0  0.7    0.8  0.3
```

```
       Other colon (unspec. or multiple)         0.1  0.1  0.2  0.2    0.1  0.2  0.1  0.1  0.2  0.1    0.1  0.2
       Rectum (excl. anus)                       1.1  0.6  1.1  0.6    0.8  0.5  1.1  0.6  1.1  0.6    0.7  0.5
       Colorectal cancer (excl. anus)            3.1  2.4  3.3  2.4    2.6  1.7  3.1  2.4  3.2  2.4    2.4  1.5
       Liver                                     0.2  0.1  0.7  0.2    1.5  0.3  0.2  0.1  0.7  0.2    1.4  0.4
       Pancreas                                  0.5  0.5  0.8  0.7    4.0  3.7  0.5  0.5  0.6  0.5    0.9  0.8
       Lung, bronchus and pleura                 3.8  2.5  3.7  2.4    4.1  3.2  3.8  2.5  3.4  2.3    4.2  3.1
       Melanoma of skin                          0.5  0.4  0.4  0.3    0.2  0.2  0.5  0.4  0.4  0.3    0.2  0.2
       Breast                                    0.0  3.0  0.0  2.9    0.1  2.5  0.0  3.0  0.0  2.9    0.1  2.6
       Cervix uteri                               NA  0.2   NA  0.2     NA  0.3   NA  0.2   NA  0.2     NA  0.3
       Corpus uteri                               NA  0.8   NA  1.1     NA  0.9   NA  0.8   NA  1.1     NA  1.0
       Ovary, fallopian tube etc.                 NA  0.6   NA  0.6     NA  0.6   NA  0.6   NA  0.6     NA  0.5
       Prostate                                  4.7   NA  3.9   NA    2.5   NA  4.7   NA  3.8   NA    2.2   NA
       Testis                                    0.0   NA  0.0   NA    0.0   NA  0.0   NA  0.0   NA    0.0   NA
       Kidney                                    0.4  0.3  0.5  0.4    0.6  0.6  0.4  0.3  0.4  0.4    0.5  0.5
       Urinary bladder                           2.2  0.6  2.3  0.5    1.7  0.8  2.2  0.6  2.2  0.5    1.9  0.7
       Brain                                     0.3  0.2  0.3  0.3    0.3  0.3  0.3  0.2  0.3  0.3    0.2  0.2
       Thyroid                                   0.0  0.1  0.0  0.0    0.0  0.1  0.0  0.1  0.0  0.0    0.0  0.0
       Hodgkin's lymphoma                        0.0  0.0  0.0  0.0    0.0  0.0  0.0  0.0  0.0  0.0    0.0  0.0
       Non-Hodgkin lymphoma                      0.5  0.4  0.5  0.4    0.4  0.3  0.5  0.4  0.5  0.4    0.3  0.3
       Multiple myeloma                          0.3  0.2  0.3  0.2    0.2  0.2  0.3  0.2  0.3  0.2    0.2  0.2
       Leukaemia                                 0.6  0.4  0.5  0.4    0.3  0.4  0.6  0.4  0.5  0.4    0.3  0.4
       Death                                    23.5 16.4 35.7 26.0   49.7 39.7 23.5 16.4 37.6 27.0   51.4 39.6
>
> save( p.can, file="../data/prcan.Rdata" )
> load( file="../data/prcan.Rdata" )
> round( ftable( (p.can[,,,,,1]/p.can[,,,,,2]-1)*100, col.vars=c(5,3,2),  row.vars=c(4,1) ), 1 )
                                         age.in   60                            65                            70
                                         model  Main       Interact           Main       Interact           Main       Interact
                                         sex       M     F        M     F     M     F        M     F     M     F        M
state  diag
Well   All malignant neoplasms                   0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Oesophagus                                0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Stomach                                   0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Colon incl. rectosigmoideum               0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Ascending colon                           0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Transverse colon                          0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Descending and sigmoid colon              0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Other colon (unspec. or multiple)         0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Rectum (excl. anus)                       0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Colorectal cancer (excl. anus)            0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Liver                                     0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Pancreas                                  0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Lung, bronchus and pleura                 0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Melanoma of skin                          0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Breast                                    0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Cervix uteri                               NA   0.0       NA   0.0    NA   0.0       NA   0.0    NA   0.0       NA
       Corpus uteri                               NA   0.0       NA   0.0    NA   0.0       NA   0.0    NA   0.0       NA
       Ovary, fallopian tube etc.                 NA   0.0       NA   0.0    NA   0.0       NA   0.0    NA   0.0       NA
       Prostate                                  0.0    NA      0.0    NA   0.0    NA      0.0    NA   0.0    NA      0.0
       Testis                                    0.0    NA      0.0    NA   0.0    NA      0.0    NA   0.0    NA      0.0
       Kidney                                    0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Urinary bladder                           0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Brain                                     0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Thyroid                                   0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Hodgkin's lymphoma                        0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Non-Hodgkin lymphoma                      0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Multiple myeloma                          0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Leukaemia                                 0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
       Death                                     0.0   0.0      0.0   0.0   0.0   0.0      0.0   0.0   0.0   0.0      0.0
DM     All malignant neoplasms                   4.0   3.5      3.6   3.5   4.6   4.0      4.2   4.0   5.5   4.5      5.3
       Oesophagus                                4.7   9.0      5.9  11.1   4.2   9.1      5.3  11.2   3.6   9.1      4.8
       Stomach                                   2.4   1.4      3.5   5.6   2.8   1.5      3.9   5.3   3.5   1.5      4.5
       Colon incl. rectosigmoideum               2.8   1.0      3.3   1.7   3.4   1.3      3.9   2.1   4.3   2.0      5.0
       Ascending colon                          -1.3   1.9     -2.6   0.4  -0.8   3.5     -1.9   2.0   0.8   5.6      0.1
       Transverse colon                          0.5  -8.3     -0.8  -6.5   1.5  -8.0      0.5  -6.3   2.9  -7.5      2.3
       Descending and sigmoid colon              4.1  -1.3      6.1   2.2   4.1  -1.3      5.9   2.3   4.3  -1.0      6.1
       Other colon (unspec. or multiple)        15.3  19.3     15.3  15.7  15.8  19.2     15.7  15.6  16.6  18.7     16.3
       Rectum (excl. anus)                       1.2  -0.5      1.4  -1.8   1.1  -0.6      1.3  -1.8   1.0  -0.6      1.3
       Colorectal cancer (excl. anus)            2.2   0.6      2.6   0.9   2.6   1.0      3.0   1.3   3.2   1.6      3.7
       Liver                                    -6.0  -2.1    -10.5  -1.3  -6.1  -2.2    -10.2  -1.2  -5.6  -2.4     -9.3
       Pancreas                                 35.1  35.5     31.6  42.6  38.0  39.7     34.4  46.9  42.7  45.6     38.8
       Lung, bronchus and pleura                 4.6   4.2      4.5   3.1   5.3   4.7      5.3   3.7   6.5   5.4      6.6
       Melanoma of skin                         -1.2  -1.5     -0.3   1.1  -1.1  -1.7     -0.2   0.8  -0.8  -1.8      0.1
       Breast                                  -18.4   1.0    -29.7   0.9 -12.0   1.0    -21.9   0.9  -6.6   1.1    -15.2
       Cervix uteri                               NA  -4.6       NA  -5.9    NA  -4.8       NA  -6.1    NA  -5.0       NA
       Corpus uteri                               NA  -2.4       NA  -1.5    NA  -2.2       NA  -1.3    NA  -2.0       NA
       Ovary, fallopian tube etc.                 NA   0.4       NA   0.6    NA   0.4       NA   0.6    NA   0.5       NA
       Prostate                                  3.8    NA      3.7    NA   3.8    NA      3.7    NA   4.0    NA      4.1
       Testis                                   10.3    NA     14.6    NA  10.8    NA     15.2    NA  11.9    NA     16.2
       Kidney                                    9.1   0.3     10.0   3.5  10.1   1.1     11.1   4.2  11.6   2.6     12.7
       Urinary bladder                           2.5  12.8      3.4  10.5   3.0  12.7      3.8  10.6   3.7  12.7      4.5
       Brain                                    14.2   2.4     13.6   4.1  14.3   2.8     13.7   4.2  14.6   3.2     14.0
       Thyroid                                   5.8  16.8     14.9  40.5   5.4  16.0     14.2  40.2   5.0  17.8     13.4
       Hodgkin's lymphoma                        5.4  11.8     13.1   8.9   8.0  14.5     14.2  11.7  11.4  19.0     16.7
       Non-Hodgkin lymphoma                      1.5   4.2      1.1   6.3   1.6   4.4      1.3   6.4   1.9   4.9      1.7
       Multiple myeloma                          3.9  13.5      7.0  11.5   4.2  12.9      7.2  11.1   4.8  12.5      7.5
       Leukaemia                                -1.6   6.7      1.6   6.3  -0.7   6.5      2.3   6.1   0.7   6.3      3.5
       Death                                    -4.2  -2.4     -5.5  -3.7  -4.3  -2.5     -5.4  -3.7  -4.1  -2.3     -5.1
DM/Ins All malignant neoplasms                  13.0  10.6     14.1  10.1  15.1  11.8     16.2  11.1  18.4  13.6     19.4
```

```
       Oesophagus                               -16.2 -13.2    -20.0 -14.0 -17.7 -13.9    -22.4 -16.2 -19.4 -15.1    -25.3
       Stomach                                    2.1 -25.8     -0.2 -33.3   1.1 -26.5     -1.4 -34.2  -0.1 -27.1     -2.8
       Colon incl. rectosigmoideum               11.8   9.3      8.4  11.3  12.2   9.0      7.3  11.7  12.9   8.8      6.3
       Ascending colon                           13.8   3.8     12.7  10.2  15.1   5.8     10.0  13.0  18.0   8.7      5.7
       Transverse colon                          19.8  18.0     18.2  12.4  23.2  15.8     16.6  10.2  27.8  13.7     15.8
       Descending and sigmoid colon              11.2   4.7      5.6  -0.4   9.1   4.3      3.6  -0.9   7.0   3.4      1.3
       Other colon (unspec. or multiple)         -8.4  17.5     56.6  32.7  -7.4  16.8     63.1  33.7  -5.6  15.6     71.5
       Rectum (excl. anus)                        8.9  12.5      9.7  15.7  10.2   9.5     11.7  12.9  12.3   7.2     15.0
       Colorectal cancer (excl. anus)            11.0  10.3      8.7  12.5  11.7   9.5      8.7  12.6  12.9   8.9      9.1
       Liver                                     -2.9  -8.3      3.3  -7.8   0.1  -9.4      6.6  -9.2   4.9  -7.0     11.6
       Pancreas                                 267.0 281.0    293.5 281.0 291.4 302.5    323.9 302.8 325.1 333.2    365.5
       Lung, bronchus and pleura                  0.5   5.3     -1.5   5.4   1.4   6.1     -2.0   4.7   2.9   7.8     -2.3
       Melanoma of skin                          -0.4   3.1     -1.8  -4.3  -1.4   2.8     -3.0  -5.0  -3.0   2.7     -4.4
       Breast                                   -44.7  -0.6    -39.2  -1.1 -39.9  -0.7    -36.1  -1.5 -35.3  -0.7    -33.3
       Cervix uteri                                NA  -9.2       NA  -8.0    NA  -9.0       NA  -8.2    NA  -8.1       NA
       Corpus uteri                                NA   1.7       NA  -3.4    NA   0.4       NA  -5.9    NA  -0.9       NA
       Ovary, fallopian tube etc.                  NA   7.6       NA   7.1    NA   6.4       NA   5.7    NA   5.1       NA
       Prostate                                  11.3    NA      9.0    NA  11.4    NA     10.6    NA  11.9    NA     12.5
       Testis                                     0.1    NA    -14.5    NA   6.0    NA    -11.4    NA  18.3    NA     -3.9
       Kidney                                    26.6  12.1     20.6   7.6  32.6  14.4     24.1  10.0  41.1  19.1     29.5
       Urinary bladder                           -4.3   3.7     -8.0   6.6  -3.1   2.3     -7.9   4.3  -1.2   0.6     -7.4
       Brain                                     47.1  23.0     63.3  52.6  48.2  26.1     66.2  62.2  50.2  29.6     71.8
       Thyroid                                   23.4  52.8      2.5  55.9  26.4  52.6     -2.6  55.3  30.5  52.7     -7.6
       Hodgkin's lymphoma                        63.7  -5.4    107.0   0.5  66.1  -4.2    123.5   1.2  69.9  -1.9    136.2
       Non-Hodgkin lymphoma                      14.8   8.3     14.2   9.1  13.6   6.4     12.0   8.4  12.0   4.0      9.2
       Multiple myeloma                           4.3 -13.4     -1.5  -3.7   3.6 -12.9     -1.6  -2.1   2.6 -11.9     -1.0
       Leukaemia                                  5.0  17.5     -1.4  17.6   3.1  16.4     -2.8  16.1   1.0  15.1     -4.5
       Death                                     -4.9  -3.7     -0.7   1.4  -5.4  -3.9     -1.9   0.7  -5.9  -4.0     -3.2
>
> # To prevent barplot from doing silly things.
> dimnames(p.can)[["state"]] <- rep("",3)
> ages <- as.numeric( dimnames(s.can)[["ages"]] )
>
> # Color scheme for cancer/dead/alive
> # clr <- c("lawngreen","blue","red")
> clr <- gray(c(5,1,9)/10)
>
> # Show the state occupancy functions
> # Put the probabilities togehter
> ff <- cbind( p.can[      1,"F",1,3:1,2,"2"],
+              p.can["Death","F",1,3:1,2,"2"] )
> ff <- cbind( ff, 1-apply(ff,1,sum) )
> mm <- cbind( p.can[      1,"M",1,3:1,2,"2"],
+              p.can["Death","M",1,3:1,2,"2"] )
> mm <- cbind( mm, 1-apply(mm,1,sum) )
> ff <- rbind( mm, ff)[c(3,6,2,5,1,4),]
> rownames(ff) <- rep(c("M","F"),3)
>
> pdf( "../graph/state-stack.pdf", height=9 )
> cex.all <- 1.2
> par( mar=c(3,3,3.5*cex.all,1), mgp=c(3,1,0)/1.5,
+      las=1, cex.axis=cex.all )
> barplot( t(ff), col=clr, space=c(0,1,4,1,4,1)/10,
+          yaxt="n", xaxt="n" )
> axis( side=2, at=0:5/5, labels=0:5*20 )
> mtext( c("Well","DM","DM / Ins"), font=2, cex=cex.all,
+        at=c(1,3.5,6), side=1, line=1.5 )
> mtext( rep(c("M","F"),3), font=2, cex=cex.all,
+        at=c(0.5,1.5,3,4,5.5,6.5), side=1, line=0.25 )
> mtext( "Cancer (alive or dead)", cex=cex.all,
+        col=clr[1], font=2, at=0, adj=0, side=3, line=0.5 )
> mtext( "Dead without cancer", cex=cex.all,
+        col=clr[2], font=2, at=0, adj=0, side=3, line=0.5+cex.all )
> mtext( "Alive without cancer", cex=cex.all,
+        col=clr[3], font=2, at=0, adj=0, side=3, line=0.5+cex.all*2 )
> mtext( "Born 1933,", cex=cex.all,
+        at=7, adj=1, side=3, line=0.5+cex.all*2 )
> mtext( "followed 1.1.1998-1.1.2007,", cex=cex.all,
+        at=7, adj=1, side=3, line=0.5+cex.all )
> mtext( "in ages 65-75", cex=cex.all,
+        at=7, adj=1, side=3, line=0.5 )
> abline( h=1:9/10, lty="19", col="white" )
> dev.off()
null device
          1
>
> pdf( "../graph/state-stack-w.pdf", width=9 )
> cex.all <- 1.2
> par( mar=c(3,3,3.5*cex.all,1), mgp=c(3,1,0)/1.5,
+      las=1, cex.axis=cex.all )
> barplot( t(ff), col=clr, space=c(0,1,4,1,4,1)/10,
+          yaxt="n", xaxt="n" )
> axis( side=2, at=0:5/5, labels=0:5*20 )
> mtext( c("Well","DM","DM / Ins"), font=2, cex=cex.all,
+        at=c(1,3.5,6), side=1, line=1.5 )
> mtext( rep(c("M","F"),3), font=2, cex=cex.all,
+        at=c(0.5,1.5,3,4,5.5,6.5), side=1, line=0.25 )
> mtext( "Cancer (alive or dead)", cex=cex.all,
+        col=clr[1], font=2, at=0, adj=0, side=3, line=0.5 )
```

```
> mtext( "Dead without cancer", cex=cex.all,
+        col=clr[2], font=2, at=0, adj=0, side=3, line=0.5+cex.all )
> mtext( "Alive without cancer", cex=cex.all,
+        col=clr[3], font=2, at=0, adj=0, side=3, line=0.5+cex.all*2 )
> mtext( "Born 1933,", cex=cex.all,
+        at=7, adj=1, side=3, line=0.5+cex.all*2 )
> mtext( "followed 1.1.1998-1.1.2007,", cex=cex.all,
+        at=7, adj=1, side=3, line=0.5+cex.all )
> mtext( "in ages 65-75", cex=cex.all,
+        at=7, adj=1, side=3, line=0.5 )
> abline( h=1:9/10, lty="19", col="white" )
> dev.off()
null device
          1
>
> mclr <- c("#9999FF","#0000DD","#DDDDFF")
> fclr <- c("#FF9999","#DD0000","#FFDDDD")
> bclr <- c("transparent","transparent","transparent")
>
> pdf( "../graph/state-stack-2-3.pdf", height=8 )
> par( mfcol=c(2,3), mar=c(1,2,0,0), mgp=c(3,1,0)/1.5,
+      oma=c(3,3,2.5,1.5), las=1 )
> for( ai in dimnames(p.can)[["age.in"]] )
+ for( di in dimnames(p.can)[["dur.in"]] )
+ {
+ # Put the probabilities together
+ ff <- cbind( p.can[      1,"F",1,3:1,ai,di],
+              p.can["Death","F",1,3:1,ai,di] )
+ ff <- cbind( ff, 1-apply(ff,1,sum) )
+ mm <- cbind( p.can[      1,"M",1,3:1,ai,di],
+              p.can["Death","M",1,3:1,ai,di] )
+ mm <- cbind( mm, 1-apply(mm,1,sum) )
+ ff <- rbind( mm, ff)[c(3,6,2,5,1,4),]
+ rownames(ff) <- rep(c("M","F"),3)
+
+ barplot( t(ff), col=mclr, border=bclr, space=c(0,1,4,1,4,1)/10, width=1,
+          yaxt="n", xaxt="n", lwd=5 )
+ par( new=TRUE )
+ zz <- ff
+ zz[c(1,3,5),] <- 0
+ barplot( t(zz), col=fclr, border=bclr, space=c(0,1,4,1,4,1)/10, width=1,
+          yaxt="n", xaxt="n", lwd=5 )
+
+ abline( h=1:9/10, lty="14", col="white" )
+
+ if( ai==dimnames(p.can)[["age.in"]][1] )
+   axis( side=2, at=0:5/5, labels=0:5*20 )
+
+ if( di==dimnames(p.can)[["dur.in"]][2] )
+   {
+   mtext( "Duration 1 year", at=50, line=1, side=2 )
+   mtext( c("No DM","DM","DM / Ins"), font=1,
+          at=c(1,3.5,6), side=1, line=1.5 )
+   mtext( rep(c("M","F"),3), font=1,
+          at=c(0.5,1.5,3,4,5.5,6.5), side=1, line=0.25 )
+   }
+ mtext( paste("Duration at start:",dimnames(p.can)[["dur.in"]][1]), side=2, at=3/4, outer=T, las=0, line=0.5 )
+ mtext( paste("Duration at start:",dimnames(p.can)[["dur.in"]][2]), side=2, at=1/4, outer=T, las=0, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][1]), side=3, at=1/6, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][2]), side=3, at=3/6, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][3]), side=3, at=5/6, outer=T, line=0.5 )
+ }
>
> dev.off()
null device
          1
>
> pdf( "../graph/state-stack-3-2.pdf", height=8 )
> par( mfcol=c(3,2), mar=c(1,2,0,0), mgp=c(3,1,0)/1.5,
+      oma=c(3,3,2.5,1.5), las=1 )
> for( di in dimnames(p.can)[["dur.in"]] )
+ for( ai in dimnames(p.can)[["age.in"]] )
+ {
+ # Put the probabilities together
+ ff <- cbind( p.can[      1,"F",1,3:1,ai,di],
+              p.can["Death","F",1,3:1,ai,di] )
+ ff <- cbind( ff, 1-apply(ff,1,sum) )
+ mm <- cbind( p.can[      1,"M",1,3:1,ai,di],
+              p.can["Death","M",1,3:1,ai,di] )
+ mm <- cbind( mm, 1-apply(mm,1,sum) )
+ ff <- rbind( mm, ff)[c(3,6,2,5,1,4),]
+ rownames(ff) <- rep(c("M","F"),3)
+
+ barplot( t(ff), col=mclr, border=bclr, space=c(0,1,4,1,4,1)/10, width=1,
+          yaxt="n", xaxt="n", lwd=5 )
+ par( new=TRUE )
+ zz <- ff
+ zz[c(1,3,5),] <- 0
+ barplot( t(zz), col=fclr, border=bclr, space=c(0,1,4,1,4,1)/10, width=1,
```

```
+          yaxt="n", xaxt="n", lwd=5 )
+
+ abline( h=1:9/10, lty="14", col="white" )
+
+ if( ai==dimnames(p.can)[["age.in"]][1] )
+   axis( side=2, at=0:5/5, labels=0:5*20 )
+
+ if( di==dimnames(p.can)[["dur.in"]][2] )
+   {
+   mtext( "Duration 1 year", at=50, line=1, side=2 )
+   mtext( c("No DM","DM","DM / Ins"), font=1,
+          at=c(1,3.5,6), side=1, line=1.5 )
+   mtext( rep(c("M","F"),3), font=1,
+          at=c(0.5,1.5,3,4,5.5,6.5), side=1, line=0.25 )
+   }
+ mtext( paste("Duration at start:",dimnames(p.can)[["dur.in"]][1]), side=3, at=1/4, outer=T, line=0.5 )
+ mtext( paste("Duration at start:",dimnames(p.can)[["dur.in"]][2]), side=3, at=3/4, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][3]), side=2, at=1/6, las=0, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][2]), side=2, at=3/6, las=0, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][1]), side=2, at=5/6, las=0, outer=T, line=0.5 )
+ }
>
> dev.off()
null device
          1
>
> if(FALSE){
+ pdf( "../graph/state-stack-3-2.pdf", width=9 )
+ par( mfcol=c(3,2), mar=c(1,2,0,0), mgp=c(3,1,0)/1.5,
+       oma=c(3,3,2.5,1.5), las=1 )
+ for( di in dimnames(p.can)[["dur.in"]] )
+ for( ai in dimnames(p.can)[["age.in"]] )
+ {
+ # Put the probabilities togehter
+ ff <- cbind( p.can[      1,"F",1,3:1,ai,di],
+              p.can["Death","F",1,3:1,ai,di] )
+ ff <- cbind( ff, 1-apply(ff,1,sum) )
+ mm <- cbind( p.can[      1,"M",1,3:1,ai,di],
+              p.can["Death","M",1,3:1,ai,di] )
+ mm <- cbind( mm, 1-apply(mm,1,sum) )
+ ff <- rbind( mm, ff)[c(3,6,2,5,1,4),]
+ rownames(ff) <- rep(c("M","F"),3)
+
+ barplot( t(ff), col=clr, border=clr, space=c(0,1,4,1,4,1)/10,
+          yaxt="n", xaxt="n" )
+ abline( h=1:9/10, lty="14", col="white" )
+
+ if( di==dimnames(p.can)[["dur.in"]][1] )
+   axis( side=2, at=0:5/5, labels=0:5*20 )
+
+ if( ai==dimnames(p.can)[["age.in"]][3] )
+   {
+   mtext( "Duration 1 year", at=50, line=1, side=2 )
+   mtext( c("Well","DM","DM / Ins"), font=1,
+          at=c(1,3.5,6), side=1, line=1.5 )
+   mtext( rep(c("M","F"),3), font=1,
+          at=c(0.5,1.5,3,4,5.5,6.5), side=1, line=0.25 )
+   }
+ mtext( paste("Duration at start:",dimnames(p.can)[["dur.in"]][1]), side=3, at=1/4, outer=T, line=0.5 )
+ mtext( paste("Duration at start:",dimnames(p.can)[["dur.in"]][2]), side=3, at=3/4, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][3]), side=2, at=1/6, las=0, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][2]), side=2, at=3/6, las=0, outer=T, line=0.5 )
+ mtext( paste("Age at start:",dimnames(p.can)[["age.in"]][1]), side=2, at=5/6, las=0, outer=T, line=0.5 )
+ }
+ dev.off()
+ }
>

 --------------------------------------------
 Program: prob3dx.R
  Folder: C:\Bendix\Steno\DM-register\NDR\projects\Cancer\r
   Ended: torsdag 23. juni 2011, 17:39:49
 Elapsed: 00:00:01
 --------------------------------------------
> proc.time()
   user  system elapsed
   1.50    0.23    1.95
```