DHS Contraceptive Calendar Tutorial

The Demographic and Health Surveys Program

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Contents

Introduction

The Demographic and Health Surveys (DHS) Contraceptive Calendar Tutorial is designed to help DHS data users understand the DHS Contraceptive Calendar, its history, how it is completed in an interview, how the data are stored in the Individual Recode (IR) datasets, uses of the calendar data, and how to analyze the data.

The DHS Contraceptive Calendar Tutorial is aimed at data analysts who are very familiar with statistical software and have prior experience working with DHS datasets, and who wish to learn to analyze the DHS calendar data. This tutorial does not provide an introduction to statistical software or the DHS datasets - to learn about DHS datasets, please see the DHS Program tutorial video series.

The tutorial is presented in six modules:

Module 1: What is the contraceptive (or reproductive) calendar?

Module 1 describes the DHS Contraceptive Calendar. The module provides some background and history for the DHS Contraceptive Calendar, and describes the structure of the calendar in the questionnaire and how the data are collected.

Module 2: How are the calendar data stored in datasets and how do I analyze the calendar data?

Module 2 discusses how the data are stored in the recode file, the string variables used to hold the calendar data, the coding scheme used for the calendar variables in the recode files, and how to "read" the calendar data, and introduces the three main approaches used to process the calendar data - string parsing, single month files, and event files.

Module 3: String parsing of the calendar

Module 3 describes the first approach to extracting data from the calendar, and provides four examples of the use of string parsing.

Module 4: Restructuring the calendar into a file of single months

Module 4 discusses the second approach - converting the calendar strings into a file of single months - and provides two examples of using this approach in analyzing the calendar data.

Module 5: Introduction to event files and how to use them

Module 5 introduces the third approach – creating event files – and provides an example program for producing an event file from a DHS Individual Recode (IR) file. It then provides an example of using the event file to analyze the reasons for discontinuation of contraception.

Module 6: Contraceptive discontinuation, failure and switching rates

Module 6 tackles a subject of interest to many DHS data users - contraceptive discontinuation, failure and switching rates. It provides a description of the multiple decrement life table approach used in DHS

reports, and briefly discusses single decrement life tables. It then provides an example of the contraceptive discontinuation rates using the event file.

Programs and coding resources

The tutorial is accompanied by a set of programs written in Stata and in SPSS to support the examples.

Additionally, two videos are also available to facilitate understanding the calendar data:

1. DHS Contraceptive Calendar Tutorial Part 1: Completing the Contraceptive Calendar
2. DHS Contraceptive Calendar Tutorial Part 2: Data Structure of the Contraceptive Calendar

All materials can be found at the DHS Contraceptive Calendar Tutorial website at dhsprogram.com/data/calendar-tutorial.

Additional information can be found in the online Guide to DHS Statistics or the PDF version. The Guide to DHS Statistics defines and explains how statistics in DHS final reports are calculated and includes several topics that use calendar data.

Module 1: What is the contraceptive (or reproductive) calendar?

<u>Goal of the module:</u> For analysts to understand what the DHS calendar is, its history, and how the data are collected.

1.1. What is the calendar?

The DHS calendar is a month by month history of certain key events in the life of the respondent for the calendar period preceding the date of interview. It is sometimes known as the reproductive calendar or the contraceptive calendar as the main information collected in the calendar relate to reproduction and contraception. The calendar is "recent" in that only events occurring in the year of the survey plus the five[1] full calendar years preceding the current year are included.

In the survey, each column of the calendar typically includes 72 boxes[2] (each representing one month of time) divided into six sections (each representing one year or 12 months of time) in which to record information about the woman's experiences with childbearing and contraceptive use. The calendar is divided into separate columns for different types of activities or event. In the current standard DHS-7 questionnaire the calendar consists of two columns:

1) Births, pregnancies, terminations and contraceptive use
2) Reasons for discontinuation of contraceptive use

The calendar collects a complete history of women's reproduction and contraceptive use for a period of between 5 and 7 years prior to the survey. The exact length of the period covered by the contraceptive calendar varies depending on the duration of data collection, whether the survey overlapped two years and the month in which the respondent was interviewed. In most surveys the period covered by the calendar (referred to as the "calendar period") includes the months up to the month of interview in the year of interview, plus the five[1] calendar years preceding the year of interview. For example, if the interview took place in April 2015, the calendar period would cover April 2015 back to January 2010, a total of 64 months. In surveys that overlap two calendar years, where an interview is carried out in the second of those years, the period can include six calendar years prior to the year of interview. We will refer to the calendar period throughout this tutorial, meaning the period for which data were collected for a respondent. The calendar period will vary from respondent to respondent depending on the date of interview.

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[1] Six years for surveys overlapping two years.
[2] In surveys overlapping two years, an additional 12 boxes for the additional year may be included in the calendar.

For each month in the calendar period a single letter or digit code is used to record information concerning the events and activities. For example, any of the following events during the calendar period would be documented:

- For each birth a letter "B" (Birth) is recorded in column 1 for the month of birth.
- For each preceding month of pregnancy a letter "P" (Pregnancy) is recorded in column 1.
- If the respondent had a miscarriage, abortion, or stillbirth, a letter "T" (Termination) is recorded in column 1 for the month the pregnancy ended, and a letter "P" (Pregnancy) is recorded for each preceding month of pregnancy.
- If the respondent used contraception in the intervening months between pregnancies, then each month of use of a contraceptive method is recorded in column 1 using the code for that method.

Below are the codes used in the DHS-7 questionnaire for column 1 (Births, pregnancies and contraceptive use) and column 2 (Reasons for discontinuation of contraceptive use):

Table 1. Standard codes used in calendar in DHS7 questionnaire

	Column 1		Column 2
Code	Births, pregnancies or contraceptive use	Code	Reason for discontinuation
B	Births		
P	Pregnancies		
T	Terminations		
0	No method	0	Infrequent sex/husband away
1	Female sterilization	1	Became pregnant while using
2	Male sterilization	2	Wanted to become pregnant
3	IUD	3	Husband/partner disapproved
4	Injectables	4	Wanted more effective method
5	Implants	5	Side effects/health concerns
6	Pill	6	Lack of access/too far
7	Condom	7	Costs too much
8	Female condom	8	Inconvenient to use
9	Diaphragm	F	Up to God/fatalistic
J	Foam or jelly	A	Difficult to get pregnant/menopausal
K	Lactational amenorrhea method	D	Marital dissolution/separation
L	Rhythm method	X	Other
M	Withdrawal	Z	Don't know
X	Other modern method		
Y	Other traditional method		

DHS-7 Contraceptive Calendar

INSTRUCTIONS:

ONLY ONE CODE SHOULD APPEAR IN ANY BOX.
COLUMN 1 REQUIRES A CODE IN EVERY MONTH.

CODES FOR EACH COLUMN:

COLUMN 1: BIRTHS, PREGNANCIES, CONTRACEPTIVE USE (2)

- B BIRTHS
- P PREGNANCIES
- T TERMINATIONS

- 0 NO METHOD

- 1 FEMALE STERILIZATION
- 2 MALE STERILIZATION
- 3 IUD
- 4 INJECTABLES
- 5 IMPLANTS
- 6 PILL
- 7 CONDOM
- 8 FEMALE CONDOM
- 9 EMERGENCY CONTRACEPTION
- J STANDARD DAYS METHOD
- K LACTATIONAL AMENORRHEA METHOD
- L RHYTHM METHOD

- M WITHDRAWAL
- X OTHER MODERN METHOD
- Y OTHER TRADITIONAL METHOD

COLUMN 2: DISCONTINUATION OF CONTRACEPTIVE USE

- 0 INFREQUENT SEX/HUSBAND AWAY
- 1 BECAME PREGNANT WHILE USING
- 2 WANTED TO BECOME PREGNANT
- 3 HUSBAND/PARTNER DISAPPROVED
- 4 WANTED MORE EFFECTIVE METHOD
- 5 SIDE EFFECTS/HEALTH CONCERNS

- 6 LACK OF ACCESS/TOO FAR
- 7 COSTS TOO MUCH
- 8 INCONVENIENT TO USE
- F UP TO GOD/FATALISTIC
- A DIFFICULT TO GET PREGNANT/MENOPAUSAL
- D MARITAL DISSOLUTION/SEPARATION
- X OTHER

_____
(SPECIFY)
- Z DON'T KNOW

(1) Year of fieldwork is assumed to be 2015. For fieldwork beginning in 2016, all references to calendar years should be increased by one; for example, 2009 should be changed to 2010, 2010 should be changed to 2011, 2011 should be changed to 2012, and similarly for all years throughout the questionnaire.

(2) Response categories may be added for other methods, including fertility awareness methods.

Year		Month	#	COL. 1	COL. 2	Year
2 0 1 5 (1)	12	DEC	01			2 0 1 5
	11	NOV	02			
	10	OCT	03			
	09	SEP	04			
	08	AUG	05			
	07	JUL	06			
	06	JUN	07			
	05	MAY	08			
	04	APR	09			
	03	MAR	10			
	02	FEB	11			
	01	JAN	12			
2 0 1 4	12	DEC	13			2 0 1 4
	11	NOV	14			
	10	OCT	15			
	09	SEP	16			
	08	AUG	17			
	07	JUL	18			
	06	JUN	19			
	05	MAY	20			
	04	APR	21			
	03	MAR	22			
	02	FEB	23			
	01	JAN	24			
2 0 1 3	12	DEC	25			2 0 1 3
	11	NOV	26			
	10	OCT	27			
	09	SEP	28			
	08	AUG	29			
	07	JUL	30			
	06	JUN	31			
	05	MAY	32			
	04	APR	33			
	03	MAR	34			
	02	FEB	35			
	01	JAN	36			
2 0 1 2	12	DEC	37			2 0 1 2
	11	NOV	38			
	10	OCT	39			
	09	SEP	40			
	08	AUG	41			
	07	JUL	42			
	06	JUN	43			
	05	MAY	44			
	04	APR	45			
	03	MAR	46			
	02	FEB	47			
	01	JAN	48			
2 0 1 1	12	DEC	49			2 0 1 1
	11	NOV	50			
	10	OCT	51			
	09	SEP	52			
	08	AUG	53			
	07	JUL	54			
	06	JUN	55			
	05	MAY	56			
	04	APR	57			
	03	MAR	58			
	02	FEB	59			
	01	JAN	60			
2 0 1 0	12	DEC	61			2 0 1 0
	11	NOV	62			
	10	OCT	63			
	09	SEP	64			
	08	AUG	65			
	07	JUL	66			
	06	JUN	67			
	05	MAY	68			
	04	APR	69			
	03	MAR	70			
	02	FEB	71			
	01	JAN	72			

1.2. How is the calendar completed in interviews?

The calendar data are collected in a series of steps throughout the interview:

1) Birth history

After the birth history section has been completed in the women's interview, the interviewer checks the number of births in the calendar period. For each birth within the calendar period the interviewer places a "B" in the first column in the row of the calendar corresponding to the month of birth and writes the child's name to the left of the "B" code. Then the interviewer asks the respondent how many months she had been pregnant when she gave birth and records a "P" in each of the preceding months according to the duration of the pregnancy. The number of "P"s must be one less than the number of months that the pregnancy lasted as the "B" is considered to include the last month of pregnancy. This step is repeated for each birth within the calendar period. If there are twins, the birth is recorded only once in the calendar but the names of both children are recorded to the left of the month of birth.

Example: The respondent gave birth to one child in the calendar period, in November 2014. The interviewer would record a "B" in the calendar in row corresponding to November 2014. The interviewer would then ask the number of months the pregnancy lasted. If the respondent reports that she was nine months pregnant when she gave birth, the interviewer would record "P"s in each of the preceding 8 months, i.e., in the months February through October 2014, for a total of 9 months (a "B" and eight "P"s).

2) Current pregnancy

If the interviewer ascertains that the respondent is currently pregnant and has asked the duration of pregnancy, after recording the information in the body of the questionnaire, the interviewer also records the pregnancy in the calendar. The interviewer records a "P" in column 1 of the calendar in the month of interview and in each preceding month for the duration of the pregnancy. The duration of pregnancy is recorded in completed months, so if a respondent was in her fifth month of pregnancy, this would be four completed months and four "P"s would be recorded in the calendar.

3) Terminated pregnancies

The interviewer records any terminated pregnancies (includes miscarriages, stillbirths, and abortions) in the calendar period. For each pregnancy termination the interviewer records a 'T' for the pregnancy termination and a "P" for each preceding month of the pregnancy for the duration of the pregnancy. As for births, the number of "P"s is one less than the duration of the pregnancy.

Example: A respondent had a miscarriage in November 2011 and was in her fourth month of pregnancy, then she had completed only three months of pregnancy a "T" would be recorded in column 1 of the calendar in November 2010 and two "P"s in September and October 2010.

12	DEC	61			
11	NOV	62	T		
10	OCT	63	P		
09	SEP	64	P		
08	AUG	65			
07	JUL	66			
06	JUN	67			
05	MAY	68			
04	APR	69			
03	MAR	70			
02	FEB	71			
01	JAN	72			

(2010 marked on left and right margins)

4) Current contraceptive method

After recording all births and other pregnancies, the interviewer asks about contraception. If the respondent is currently using a contraceptive method, the interviewer asks for the month and year the respondent started using the method – that is the start of continuous use of the method, not the first time they used the method. The interviewer fills in the code for the contraceptive method currently used in column 1 in the row corresponding to the month of interview and in the month started using the method using the codes shown to the left of the calendar. If the respondent started using the method prior to the start of the calendar the interviewer records the code in the first row of the calendar. The interviewer then connects the first and last month of contraceptive use with a line showing continuous use of the method between these two dates (in the dataset the code for the method is repeated for each month of use).

5) Episodes of contraceptive use in the calendar period

The respondent asks about other episodes of contraceptive use in the calendar period. For each open episode (consecutive blank boxes in the calendar), the interviewer asks a series of questions to the respondent to ascertain the date and duration of use of contraception, if any, during that episode. In a survey using a paper questionnaire this part of the interview is less structured and the questions below are illustrative questions. In a survey using computer-assisted personal interviewing (CAPI) the interview is more structured and uses the following questions:

- When was the last time you used a method? Which method was that?
- Between the (EVENT1) in (MONTH AND YEAR) and the (EVENT2) in (MONTH AND YEAR) did you use a method of contraception?
  [EVENT1 may be the birth of a child, the termination of a non-live pregnancy, the end of a prior episode of contraceptive use, and EVENT2 may be the start of a pregnancy or the beginning of a later episode of contraceptive use.]
- When did you start using that method?
- How long after (EVENT1) did you start using that method?
- How long did you use the method then?
- What happened when you stopped using that method: did you not use any method, did you start using a different method, or did you become pregnant?

For the end of each episode of contraceptive use recorded in column 1 of the calendar, the interviewer asks additional questions to ascertain the reason for discontinuing use of the contraceptive method and records the code for the reason for discontinuation in column 2 of the calendar in the row corresponding to the month of ending use of the method, such as:

- Why did you stop using the (METHOD)?

Followed by probing questions, including:

- IF A PREGNANCY FOLLOWED: Did you become pregnant while using (METHOD), did you stop to get pregnant, or did you stop for some other reason?

The possible response codes are those listed in table 1. Only the main reason for discontinuation is recorded in column 2 in the row corresponding to the month the respondent stopped using the <contraceptive method.

While filling in the episodes of contraceptive use in between each birth or pregnancy, any periods in which the respondent was neither pregnant nor using a contraceptive method are filled with code "0" meaning that no method was used in that month.

After completing the data collection for the calendar, column 1 of the calendar will have a single code recorded in every row, except for those rows after the month of interview. Column 2 will have a single code in the same month as the month of discontinuation of each episode of contraceptive use. Other months in column 2 are left blank.

For many respondents completing the calendar is quite straightforward. For example, a woman who has never been sexually active, a woman who used no contraception and had no pregnancies in the calendar period, or a woman who used the same contraceptive method throughout the calendar period (e.g. sterilization, IUD or Implant) would have the same code in all months of column 1 and no codes in column 2 of the calendar.

Example of a completed calendar

Here is an example of a completed calendar. Briefly looking at the calendar, it is possible to read the reproductive and contraceptive events of this respondent.

FIRST GLANCE

The example on the right shows a completed calendar of a respondent. At a first glance it is possible to know several pieces of information:

- The respondent was interviewed in September 2015.
- The calendar spans 5 years and 9 months.
- There was a birth recorded (see the name written on the calendar)
- There were methods of contraception that were discontinued (note the codes present in Column 2)

REPRODUCTIVE AND CONTRACEPTIVE EVENTS

Walking through the series of steps the interviewer goes through and using Table 1 to interpret the codes, it is possible to see there are five categories of information we can read from this calendar:

1) **Birth history**
   Birth in 2014 after 9 complete months of pregnancy.
2) **Current pregnancy**
   The respondent is not currently pregnant.
3) **Terminated pregnancies**
   One terminated pregnancy in November 2010 after three completed months of pregnancy.
4) **Current contraceptive method**
   The current method being used is the pill.
5) **Episodes of contraceptive use**
   From 2010 to 2014, the respondent had several episodes of contraceptive use including using injectables, the pill, and the rhythm method (periodic abstinence). Her reasons for discontinuing these methods included side effects or health concerns and becoming pregnant while using.

Year	Month	Name	#	COL. 1	COL. 2
2015 (1)	12 DEC		01		
	11 NOV		02		
	10 OCT		03		
	09 SEP		04	6	
	08 AUG		05	6	
	07 JUL		06	6	
	06 JUN		07	6	
	05 MAY		08	6	
	04 APR		09	6	
	03 MAR		10	6	
	02 FEB		11	6	
	01 JAN		12	0	
2014	12 DEC	Sara	13	0	
	11 NOV		14	0	
	10 OCT		15	B	
	09 SEP		16	P	
	08 AUG		17	P	
	07 JUL		18	P	
	06 JUN		19	P	
	05 MAY		20	P	
	04 APR		21	P	
	03 MAR		22	P	
	02 FEB		23	P	
	01 JAN		24	L	1
2013	12 DEC		25	L	
	11 NOV		26	L	
	10 OCT		27	L	
	09 SEP		28	L	
	08 AUG		29	0	
	07 JUL		30	0	
	06 JUN		31	0	
	05 MAY		32	0	
	04 APR		33	0	
	03 MAR		34	0	
	02 FEB		35	0	
	01 JAN		36	0	
2012	12 DEC		37	0	
	11 NOV		38	6	5
	10 OCT		39	6	
	09 SEP		40	6	
	08 AUG		41	6	
	07 JUL		42	6	
	06 JUN		43	6	
	05 MAY		44	6	
	04 APR		45	6	
	03 MAR		46	0	
	02 FEB		47	0	
	01 JAN		48	0	
2011	12 DEC		49	0	
	11 NOV		50	0	
	10 OCT		51	0	
	09 SEP		52	0	
	08 AUG		53	0	
	07 JUL		54	4	5
	06 JUN		55	4	
	05 MAY		56	4	
	04 APR		57	4	
	03 MAR		58	4	
	02 FEB		59	4	
	01 JAN		60	0	
2010	12 DEC		61	0	
	11 NOV		62	T	
	10 OCT		63	P	
	09 SEP		64	P	
	08 AUG		65	0	
	07 JUL		66	0	
	06 JUN		67	0	
	05 MAY		68	0	
	04 APR		69	0	
	03 MAR		70	0	
	02 FEB		71	0	
	01 JAN		72	0	

For more details on completing the calendar, watch the DHS Program tutorial video on completing the calendar or see the DHS Interviewer's manual.

1.3. Uses of the calendar data

The calendar provides information not collected in other parts of the DHS questionnaires. In particular the calendar is used to collect information on births and pregnancies, including pregnancy terminations (or non-live births) – miscarriages, abortions, and stillbirths. While the data on live births are also collected in the birth history[3] (and are more readily analyzed using the birth history), the data on all non-live pregnancies in the calendar period are only collected in the calendar[4]. These data can be used to calculate pregnancy termination rates, including stillbirth rates, and, in conjunction with early neonatal mortality data, perinatal mortality rates.

Additionally, the calendar collects information on all episodes of contraceptive use and the reasons for discontinuation of each method used. The data can be used to understand contraceptive use dynamics, and particularly contraceptive discontinuation rates, failure rates and switching rates using lifetable analyses. Further, calendar data can be used to examine whether a contraceptive method was used before a birth or pregnancy, or if and when a woman started using a method in the postpartum period.

Below are a few examples of analyses that can be conducted with calendar data. Several of these are used as examples later in the tutorial:

Analysis	Tutorial examples
Method used prior to the most recent birth	Example 2
Postpartum Family Planning: prevalence and method	Example 3
Stillbirths and perinatal mortality	Example 4
Reason for discontinuation of contraceptive method	Example 5 Example 8
Contraceptive prevalence rate overtime, or at a specified time	Example 6
Contraceptive use of any method in the prior n months	
Method switching in the prior *n* months	
Number of methods used in the five years preceding the interview	
Average duration of contraceptive use	
Average time to pregnancy after stopping use of a method	
Average time postpartum to starting use of contraception	
Contraceptive discontinuation, switching and failure rates	
Impact of contraceptive failure on unintended pregnancies	

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[3] The DHS data editing procedures attempt to ensure consistency of the information between the birth history and the calendar.
[4] Except in surveys that use a full pregnancy history, rather than a birth history, in which case all non-live births are captured in the pregnancy history too.

1.4. A brief history of the calendar in DHS

1.4.1   History

The calendar was first developed for the DHS Program in the experimental surveys conducted in Peru and Dominican Republic in 1986. In particular, these surveys looked at "the potential of a six-year calendar for the collection of monthly data on contraceptive practice, breastfeeding, amenorrhea, postpartum abstinence and exposure to risk; the comparative merits of a calendar approach vs. the standard format of collecting such information within each birth interval for estimates of fecundability, natural fertility, and contraceptive efficacy;" (Peru Experimental Survey 1986[5]).

Analysis of the data collected in the Peru survey showed improved information from the calendar format in the experimental questionnaire to the previously used tabular format. Goldman, Moreno and Westoff (1989) noted that "several different comparisons indicate that reporting of information on contraceptive histories in the experimental questionnaire is superior to that in the standard one."

Moreno, Goldman and Babakol (1991) found other major advantages to using the calendar: "it obtains more complete reports of use for periods prior to the survey; it allows for a detailed study of contraceptive use patterns; and it obtains information which is more internally consistent with other types of information."

On the basis of these experimental surveys and the analyses that followed, the use of the calendar became a standard part of the DHS Model A questionnaire for use in high contraceptive prevalence countries in the second phase of DHS (DHSII), starting in 1990.

1.4.2   Changes over time

Implementation of the DHS calendar has varied over survey phases. In phases II-IV, the calendar was included only in high contraceptive prevalence countries, which used the DHS Model A questionnaire. In these phases, the calendar included columns that collected reasons for discontinuation, as well as a column tracking women's marital/in-union status in each month of the calendar. Some calendars also included columns to capture additional information such as the source of contraception. Low contraceptive prevalence countries used the Model B questionnaire during phases II-IV, which did not include the calendar.

DHS Phases	Approximate years
I	1984-89
II	1989-93
III	1993-97
IV	1997-03
V	2003-08
VI	2008-13
7	2013-18

In DHS phase V starting in 2003, the use of separate questionnaires for high and low contraceptive prevalence countries was discontinued, and all countries used the same core questionnaire that included

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[5] http://dhsprogram.com/publications/publication-FR32-Other-Final-Reports.cfm

a calendar collecting births, pregnancies, terminations, and episodes of contraceptive use. Note that not all countries included the calendar in their questionnaires immediately. In some countries the calendar was not included until later phases of DHS, based on the data needs and interests of the country, sometimes preferring to maintain comparability with approaches used in prior surveys. Additionally, some countries adapted the calendar to collect only births, pregnancies, and terminations, excluding episodes of contraceptive use.

The current DHS-7 core questionnaire uses a two column calendar collecting month by month information on births, pregnancies and contraceptive use in column 1 and the reason for discontinuation in column 2. The DHSVI standard questionnaire followed the same format as in DHS-7. The DHSV standard questionnaire included only one column for births, pregnancies and contraceptive use, and did not include the reason for discontinuation of contraception; however countries that had previously used the calendar often included additional columns. Earlier rounds of the DHS questionnaires collected a variety of information in the calendar (see images below).

The calendar collects a complete history of women's reproduction and contraceptive use[6] for the calendar period prior to the survey. As noted earlier, the exact length of the period covered by the contraceptive calendar varies depending on the duration of data collection, whether the survey overlapped two years and the month in which the respondent was interviewed.

Table 2. Calendar columns in standard questionnaires

Calendar columns in standard questionnaires	DHSII*	DHSIII*	DHSIV*	DHSV	DHSVI	DHS-7
Births, pregnancies and contraceptive use	1	1	1	1	1	1
Reasons for discontinuation of contraception	2	2	3		2	2
Source of contraception				2		
Duration of post-partum amenorrhea	3					
Duration of post-partum abstinence	4					
Duration of breastfeeding	5					
Marital/union status	6	3	4			
Moves and types of communities	7	4				
Type of employment	8					

* Model-A questionnaires only

Some of the contraceptive methods used in column 1 of the calendar and their categorization have changed over time:

> In DHS I and II surveys, modern methods included pill, IUD, injection, vaginal methods, condom, female sterilization, and male sterilization. The vaginal methods included in a single group diaphragm, foam, and jelly. Traditional methods included periodic abstinence (of any kind), withdrawal, and all respondent- mentioned other methods.

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[6] Some surveys in DHSV did not collect information on contraceptive use in the calendar period.

In DHS III surveys, modern methods included pill, IUD, injection, vaginal methods, condom, female sterilization, male sterilization, and implants. Traditional methods included periodic abstinence (of any kind), withdrawal, and lactational amenorrhea. Folk methods included respondent-mentioned other methods and were categorized separately from traditional methods.

In DHS IV surveys, emergency contraception was added to the list of contraceptive methods but is not included as a separate method for current use (i.e., included in "other"). The questionnaire allowed for more than one method to be currently used but restricted the calendar to only one code (method) in each box according to the following hierarchy: female sterilization, male sterilization, contraceptive pill, intrauterine contraceptive device (IUD), contraceptive injection, contraceptive implants (Norplant), condoms, diaphragm, form or jelly, lactational amenorrhea method (LAM), periodic abstinence, withdrawal, and other methods.

In DHS VI surveys, other modern method and other traditional methods were added to the list. Pill was moved after implants in the methods hierarchy. In DHS-7 surveys, emergency contraception and standard days method (SDM) are listed as separate methods; diaphragm and foam or jelly are included in "other modern method".

Earlier versions of the DHS calendar can be found in:

DHSVI: http://www.dhsprogram.com/pubs/pdf/DHSQ6/DHS6_Questionnaires_5Nov2012_DHSQ6.pdf#page=89
The DHSVI calendar is the same as DHS-7 and is not shown here.

DHSV: http://www.dhsprogram.com/pubs/pdf/DHSQ5/DHS5-Woman's-QRE-22-Aug-2008.pdf#page=63
The DHSV calendar is a single column calendar, the same as the first column for DHS-7, and is not shown here.

Calendar in DHSIV:

INSTRUCTIONS:
ONLY ONE CODE SHOULD APPEAR IN ANY BOX.
FOR COLUMNS 1 AND 4, ALL MONTHS SHOULD BE FILLED IN.

INFORMATION TO BE CODED FOR EACH COLUMN

COL 1: BIRTHS, PREGNANCIES, CONTRACEPTIVE USE **
- B BIRTHS
- P PREGNANCIES
- T TERMINATIONS

- 0 NO METHOD
- 1 FEMALE STERILIZATION
- 2 MALE STERILIZATION
- 3 PILL
- 4 IUD
- 5 INJECTABLES
- 6 IMPLANTS
- 7 CONDOM
- 8 FEMALE CONDOM
- 9 DIAPHRAGM
- J FOAM OR JELLY
- K LACTATIONAL AMENORRHEA METHOD
- L PERIODIC ABSTINENCE
- M WITHDRAWAL
- X OTHER _____
           (SPECIFY)

COL 2: SOURCE OF CONTRACEPTION
- 1 GOVT. HOSPITAL
- 2 GOVT. HEALTH CENTER
- 3 FAMILY PLANNING CLINIC
- 4 GOVT. MOBILE CLINIC
- 5 GOVT. FIELDWORKER
- 6 OTHER PUBLIC
- 7 PVT. HOSPITAL/CLINIC
- 8 PHARMACY
- 9 PRIVATE DOCTOR
- A NON-GOVT. MOBILE CLINIC
- B NON-GOVT. FIELDWORKER
- C OTHER PRIVATE MEDICAL
- D SHOP
- E CHURCH
- F FRIENDS/RELATIVES
- X OTHER _____
           (SPECIFY)

COL 3: DISCONTINUATION OF CONTRACEPTIVE USE
- 0 INFREQUENT SEX/HUSBAND AWAY
- 1 BECAME PREGNANT WHILE USING
- 2 WANTED TO BECOME PREGNANT
- 3 HUSBAND/PARTNER DISAPPROVED
- 4 WANTED MORE EFFECTIVE METHOD
- 5 HEALTH CONCERNS
- 6 SIDE EFFECTS
- 7 LACK OF ACCESS/TOO FAR
- 8 COSTS TOO MUCH
- 9 INCONVENIENT TO USE
- F FATALISTIC
- A DIFFICULT TO GET PREGNANT/MENOPAUSAL
- D MARITAL DISSOLUTION/SEPARATION
- X OTHER _____
           (SPECIFY)
- Z DON'T KNOW

COL 4: MARRIAGE/UNION
- X IN UNION (MARRIED OR LIVING TOGETHER)
- 0 NOT IN UNION

* For fieldwork beginning in 2001, 2002 or 2003, the years should be adjusted.

** Response categories may be added for other methods.

		1	2	3	4		
12 DEC	01					01	DEC
11 NOV	02					02	NOV
10 OCT	03					03	OCT
09 SEP	04					04	SEP
08 AUG	05					05	AUG
07 JUL	06					06	JUL
06 JUN	07					07	JUN
05 MAY	08					08	MAY
04 APR	09					09	APR
03 MAR	10					10	MAR
02 FEB	11					11	FEB
01 JAN	12					12	JAN
12 DEC	13					13	DEC
11 NOV	14					14	NOV
10 OCT	15					15	OCT
09 SEP	16					16	SEP
08 AUG	17					17	AUG
07 JUL	18					18	JUL
06 JUN	19					19	JUN
05 MAY	20					20	MAY
04 APR	21					21	APR
03 MAR	22					22	MAR
02 FEB	23					23	FEB
01 JAN	24					24	JAN
12 DEC	25					25	DEC
11 NOV	26					26	NOV
10 OCT	27					27	OCT
09 SEP	28					28	SEP
08 AUG	29					29	AUG
07 JUL	30					30	JUL
06 JUN	31					31	JUN
05 MAY	32					32	MAY
04 APR	33					33	APR
03 MAR	34					34	MAR
02 FEB	35					35	FEB
01 JAN	36					36	JAN
12 DEC	37					37	DEC
11 NOV	38					38	NOV
10 OCT	39					39	OCT
09 SEP	40					40	SEP
08 AUG	41					41	AUG
07 JUL	42					42	JUL
06 JUN	43					43	JUN
05 MAY	44					44	MAY
04 APR	45					45	APR
03 MAR	46					46	MAR
02 FEB	47					47	FEB
01 JAN	48					48	JAN
12 DEC	49					49	DEC
11 NOV	50					50	NOV
10 OCT	51					51	OCT
09 SEP	52					52	SEP
08 AUG	53					53	AUG
07 JUL	54					54	JUL
06 JUN	55					55	JUN
05 MAY	56					56	MAY
04 APR	57					57	APR
03 MAR	58					58	MAR
02 FEB	59					59	FEB
01 JAN	60					60	JAN
12 DEC	61					61	DEC
11 NOV	62					62	NOV
10 OCT	63					63	OCT
09 SEP	64					64	SEP
08 AUG	65					65	AUG
07 JUL	66					66	JUL
06 JUN	67					67	JUN
05 MAY	68					68	MAY
04 APR	69					69	APR
03 MAR	70					70	MAR
02 FEB	71					71	FEB
01 JAN	72					72	JAN

http://www.dhsprogram.com/pubs/pdf/DHSQ4/DHS-IV-Model-A.pdf.pdf#page=110

Calendar in DHSIII


```
                                                    1    2    3    4
INSTRUCTIONS:                           12 DEC  01  |  |  |  |  |  |  | 01  DEC
ONLY ONE CODE SHOULD APPEAR IN ANY BOX. 11 NOV  02  |  |  |  |  |  |  | 02  NOV
FOR COLUMNS 1, 3, AND 4, ALL MONTHS     10 OCT  03  |  |  |  |  |  |  | 03  OCT
SHOULD BE FILLED IN.                    09 SEP  04  |  |  |  |  |  |  | 04  SEP
                                      1 08 AUG  05  |  |  |  |  |  |  | 05  AUG 1
                                      9 07 JUL  06  |  |  |  |  |  |  | 06  JUL 9
INFORMATION TO BE CODED FOR EACH COLUMN 9 06 JUN  07  |  |  |  |  |  |  | 07  JUN 9
                                      4 05 MAY  08  |  |  |  |  |  |  | 08  MAY 4
COL.1: Births, Pregnancies, Contraceptive Use * 04 APR 09  |  |  |  |  |  |  | 09  APR *
                                        03 MAR  10  |  |  |  |  |  |  | 10  MAR
     B BIRTHS                           02 FEB  11  |  |  |  |  |  |  | 11  FEB
     P PREGNANCIES                      01 JAN  12  |  |  |  |  |  |  | 12  JAN
     T TERMINATIONS

     0 NO METHOD                        12 DEC  13  |  |  |  |  |  |  | 13  DEC
     1 PILL                             11 NOV  14  |  |  |  |  |  |  | 14  NOV
     2 IUD                              10 OCT  15  |  |  |  |  |  |  | 15  OCT
     3 INJECTABLES                      09 SEP  16  |  |  |  |  |  |  | 16  SEP
     4 IMPLANTS                       1 08 AUG  17  |  |  |  |  |  |  | 17  AUG 1
     5 DIAPHRAGM/FOAM/JELLY           9 07 JUL  18  |  |  |  |  |  |  | 18  JUL 9
     6 CONDOM                         9 06 JUN  19  |  |  |  |  |  |  | 19  JUN 9
     7 FEMALE STERILIZATION           3 05 MAY  20  |  |  |  |  |  |  | 20  MAY 3
     8 MALE STERILIZATION               04 APR  21  |  |  |  |  |  |  | 21  APR
     9 PERIODIC ABSTINENCE             03 MAR  22  |  |  |  |  |  |  | 22  MAR
     A WITHDRAWAL                       02 FEB  23  |  |  |  |  |  |  | 23  FEB
     X OTHER_____                  01 JAN  24  |  |  |  |  |  |  | 24  JAN
              (SPECIFY)

                                        12 DEC  25  |  |  |  |  |  |  | 25  DEC
                                        11 NOV  26  |  |  |  |  |  |  | 26  NOV
                                        10 OCT  27  |  |  |  |  |  |  | 27  OCT
COL.2: Discontinuation of Contraceptive Use 09 SEP 28 |  |  |  |  |  |  | 28  SEP
                                      1 08 AUG  29  |  |  |  |  |  |  | 29  AUG 1
     0 INFREQUENT SEX/HUSBAND AWAY     9 07 JUL  30  |  |  |  |  |  |  | 30  JUL 9
     1 BECAME PREGNANT WHILE USING     9 06 JUN  31  |  |  |  |  |  |  | 31  JUN 9
     2 WANTED TO BECOME PREGNANT       2 05 MAY  32  |  |  |  |  |  |  | 32  MAY 2
     3 HUSBAND DISAPPROVED               04 APR  33  |  |  |  |  |  |  | 33  APR
     4 WANTED MORE EFFECTIVE METHOD     03 MAR  34  |  |  |  |  |  |  | 34  MAR
     5 HEALTH CONCERNS                  02 FEB  35  |  |  |  |  |  |  | 35  FEB
     6 SIDE EFFECTS                     01 JAN  36  |  |  |  |  |  |  | 36  JAN
     7 LACK OF ACCESS/TOO FAR
     8 COST TOO MUCH                    12 DEC  37  |  |  |  |  |  |  | 37  DEC
     9 INCONVENIENT TO USE             11 NOV  38  |  |  |  |  |  |  | 38  NOV
     F FATALISTIC                      10 OCT  39  |  |  |  |  |  |  | 39  OCT
     A DIFFICULT TO GET PREGNANT/MENOPAUSE 09 SEP 40 |  |  |  |  |  |  | 40  SEP
     D MARITAL DISSOLUTION/SEPARATION  1 08 AUG  41  |  |  |  |  |  |  | 41  AUG 1
     X OTHER_____                9 07 JUL  42  |  |  |  |  |  |  | 42  JUL 9
              (SPECIFY)               9 06 JUN  43  |  |  |  |  |  |  | 43  JUN 9
     Z DON'T KNOW                      1 05 MAY  44  |  |  |  |  |  |  | 44  MAY 1
                                        04 APR  45  |  |  |  |  |  |  | 45  APR
                                        03 MAR  46  |  |  |  |  |  |  | 46  MAR
                                        02 FEB  47  |  |  |  |  |  |  | 47  FEB
COL.3: Marriage/Union                   01 JAN  48  |  |  |  |  |  |  | 48  JAN

     X IN UNION (MARRIED OR LIVING TOGETHER) 12 DEC 49 |  |  |  |  |  |  | 49  DEC
     0 NOT IN UNION                    11 NOV  50  |  |  |  |  |  |  | 50  NOV
                                        10 OCT  51  |  |  |  |  |  |  | 51  OCT
                                        09 SEP  52  |  |  |  |  |  |  | 52  SEP
COL.4: Moves and Types of Communities 1 08 AUG  53  |  |  |  |  |  |  | 53  AUG 1
                                      9 07 JUL  54  |  |  |  |  |  |  | 54  JUL 9
     X CHANGE OF COMMUNITY             9 06 JUN  55  |  |  |  |  |  |  | 55  JUN 9
     1 CITY                            0 05 MAY  56  |  |  |  |  |  |  | 56  MAY 0
     2 TOWN                             04 APR  57  |  |  |  |  |  |  | 57  APR
     3 COUNTRYSIDE                      03 MAR  58  |  |  |  |  |  |  | 58  MAR
                                        02 FEB  59  |  |  |  |  |  |  | 59  FEB
                                        01 JAN  60  |  |  |  |  |  |  | 60  JAN

                                        12 DEC  61  |  |  |  |  |  |  | 61  DEC
                                        11 NOV  62  |  |  |  |  |  |  | 62  NOV
                                        10 OCT  63  |  |  |  |  |  |  | 63  OCT
                                        09 SEP  64  |  |  |  |  |  |  | 64  SEP
                                      1 08 AUG  65  |  |  |  |  |  |  | 65  AUG 1
                                      9 07 JUL  66  |  |  |  |  |  |  | 66  JUL 9
                                      8 06 JUN  67  |  |  |  |  |  |  | 67  JUN 8
                                      9 05 MAY  68  |  |  |  |  |  |  | 68  MAY 9
                                        04 APR  69  |  |  |  |  |  |  | 69  APR
                                        03 MAR  70  |  |  |  |  |  |  | 70  MAR
                                        02 FEB  71  |  |  |  |  |  |  | 71  FEB
                                        01 JAN  72  |  |  |  |  |  |  | 72  JAN
```

* For fieldwork beginning in 1995, 1996, or 1997, the years should be adjusted.

http://www.dhsprogram.com/pubs/pdf/DHSQ3/DHS-III-Model-A.pdf.pdf#page=90

Calendar in DHSII

INSTRUCTIONS: ONLY ONE CODE SHOULD
APPEAR IN ANY BOX. FOR COLUMNS
1, 6, 7, AND 8 ALL MONTHS SHOULD
BE FILLED IN.

INFORMATION TO BE CODED FOR EACH COLUMN

COL.1: Births, Pregnancies, Contraceptive Use
  B BIRTHS
  P PREGNANCIES
  T TERMINATIONS

  0 NO METHOD
  1 PILL
  2 IUD
  3 INJECTIONS
  4 DIAPHRAGM/FOAM/JELLY
  5 CONDOM
  6 FEMALE STERILIZATION
  7 MALE STERILIZATION
  8 PERIODIC ABSTINENCE
  9 WITHDRAWAL
  W OTHER_____
                    (SPECIFY)

COL.2: Discontinuation of Contraceptive Use
  1 BECAME PREGNANT WHILE USING
  2 WANTED TO BECOME PREGNANT
  3 HUSBAND DISAPPROVED
  4 SIDE EFFECTS
  5 HEALTH CONCERNS
  6 ACCESS/AVAILABILITY
  7 WANTED MORE EFFECTIVE METHOD
  8 INCONVENIENT TO USE
  9 INFREQUENT SEX/HUSBAND AWAY
  C COST
  F FATALISTIC
  A DIFFICULT TO GET PREGNANT/MENOPAUSE
  D MARITAL DISSOLUTION/SEPARATION
  W OTHER_____
                    (SPECIFY)
  K DON'T KNOW

COL.3: Postpartum Amenorrhea
  X PERIOD DID NOT RETURN
  0 LESS THAN ONE MONTH

COL.4: Postpartum Abstinence
  X NO SEXUAL RELATIONS
  0 LESS THAN ONE MONTH

COL.5: Breastfeeding
  X BREASTFEEDING
  0 LESS THAN ONE MONTH
  N NEVER BREASTFED

COL.6: Marriage/Union
  X IN UNION (MARRIED OR LIVING TOGETHER)
  0 NOT IN UNION

COL.7: Moves and Types of Communities
  X CHANGE OF COMMUNITY
  1 CITY
  2 TOWN
  3 COUNTRYSIDE

COL.8: Type of Employment
  0 DID NOT WORK
  1 PAID EMPLOYEE, AWAY FROM HOME
  2 PAID EMPLOYEE, AT HOME
  3 SELF-EMPLOYED, AWAY FROM HOME
  4 SELF-EMPLOYED, AT HOME
  5 UNPAID WORKER, AWAY FROM HOME
  6 UNPAID WORKER, AT HOME

LAST CHILD BORN PRIOR TO JAN. 1985**

NAME: _____

MONTH..
YEAR...

* For fieldwork beginning in 1991, 1992, or 1993, the years should be adjusted.
** For fieldwork beginning in 1991, 1992, or 1993, the year should be changed to 1986, 1987,
  or 1988, respectively.

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1.4.3 Survey-specific modifications

Various countries have made survey-specific modifications to the calendar to fit their data needs. These survey-specific modifications include the following:

Terminations and abortions: In certain surveys the terminated pregnancies are further classified as stillbirths, abortions or miscarriages. These surveys typically use a pregnancy history rather than a birth history in the women's questionnaire. These data on the types of terminations are usually recorded in a survey-specific calendar variable.

Calendars with no method use: Some surveys used the calendar just to record births, pregnancies and terminated pregnancies, but not to record episodes of contraceptive use. In these surveys, the months of use or non-use of methods are left blank in the calendar.

Survey-specific insertion and deletion of columns: Certain surveys have included additional columns in the calendar that are not typically part of the model questionnaire, or have removed standard columns from the questionnaire that are deemed less useful for the country.

Survey-specific methods: All countries adapt the calendar to include the contraceptive methods that are appropriate and are in use in the country. The coding of the methods in the calendar follows the standard DHS individual recode format, but may include survey-specific codes for non-standard methods of contraception.

Survey-specific reasons for discontinuation: As for the contraceptive methods, countries also adapt the calendar to better capture reasons for discontinuation relevant to the country. The coding of the reasons for discontinuation in the calendar also follows the standard DHS individual recode format, but may include survey-specific codes for non-standard reasons for discontinuation of contraception.

Non-western calendars: A few countries collect all of the data in the DHS questionnaire using a local calendar as the basis for all dates recorded in the questionnaire, and similarly as the basis for the DHS Contraceptive Calendar. To date these countries are:

- Ethiopia: The Ethiopian calendar is 7-8 years behind the Gregorian (Western) calendar, and the Ethiopian year starts around September 11th or 12th of each year (exact day varies). 1st July 2017 is 24 Sane (10) 2009 in the Ethiopian calendar. The Ethiopian calendar is made up of 12 months of 30 days, plus one month of 5 days (or 6 days in a leap year). The century month codes[7] in the dataset are all based on the Ethiopian calendar, but squeezing the 13th month into a 12 month calendar. The start of the DHS calendar in the Ethiopian surveys is the first month of the Ethiopian year five years before the date of start of field work.
- Nepal: The Nepali calendar is 56-57 years ahead of the Gregorian (Western) calendar, and the Nepali year starts around mid-April of each year (exact day varies). 1st July 2017 is 17 Ashad (3) 2074 in the Nepali calendar. The Nepali calendar is made up of 12 months of between 28 and 32 days, and the number of days in a month can vary from year to year. The century month codes[7]

in the dataset are all based on the Nepali calendar. The start of the DHS calendar in the Nepali surveys is the first month of the Nepali year five years before the date of start of field work.

- Afghanistan: The Afghan calendar is 621-622 years behind the Gregorian (Western) calendar, and the Afghan year starts around March 20th or 21st of each year (exact day varies). 1st July 2017 is 10 Saratan (4) 1396 in the Afghan calendar. The Afghan calendar is made up of 12 months, the first 6 of which have 31 days, next 5 months have 30 days, and the last month has 29 or 30 days in a leap year. The century month codes[7] in the dataset are all based on the Afghan calendar with 1300 as the base year, rather than 1900. The start of the DHS calendar in the Afghan surveys is the first month of the Afghan year five years before the date of start of field work.

Logic for handling survey-specific coding of the contraceptive methods and reasons for discontinuation are discussed in the section on survey-specific coding.

1.5. Limitations of the calendar data

The DHS calendar data have some limitations that need to be kept in mind when analyzing the data. First and foremost, the calendar permits a single code to be captured for each individual month. This means that whenever two different events take place within a month, only one of them is recorded in that month. For example, if a respondent was using a contraceptive method at the beginning of the month, stopped using the method and switched to a different method in the same month then only one of these methods will be recorded for that month.

There is a hierarchy to the data collected in the calendar and the priority certain events have and this follows from the order in which the data are collected, as described in the prior section. The priority order for recording events in each month is as follows:
1) Live births
2) Completed months of pregnancy preceding live births
3) Months of current pregnancy
4) Terminated pregnancies
5) Completed months of pregnancy before a terminated pregnancy
6) Months of use of the current contraceptive method
7) Discontinuation of a contraceptive method, and months of use preceding the discontinuation

This has a number of implications, including:
- The calendar only permits a single code in each month, so cannot record any dual method use. For any women reporting using two methods concurrently, only one method is recorded and this is the first (generally the most effective) method from the list of method codes. In DHSV, DHSVI, and DHS-7 the list of methods were roughly ordered according to the effectiveness of the method.
- As for the contraceptive methods, the calendar does not permit reporting of more than one reason for discontinuation of a method. Respondents are asked for the <u>main</u> reason for discontinuation and this is recorded in the calendar.
- When switching methods, typically the method that was discontinued and the reason for discontinuation are recorded in that month, and the first month of use of the new method is recorded in the following month.
- If a respondent stops using a method in a month because they become pregnant, then either the method use or the pregnancy is recorded in the month. The months of pregnancy are recorded first, but because these are reported and recorded in completed months, typically the pregnancy would be

recorded as starting in the following month, and the method will be recorded in the month in question.

For example, assume a respondent was using the condom until about 15th January 2015, when she became pregnant, and she gave birth around 15th October 2015 after 9 months of pregnancy. The interviewer would record a "B" in October 2015, and eight "P"s in September 2015 back to February 2015 (for a total of 9 months). The interviewer would also record the discontinuation of use of the condom in January 2015 together with the reason for discontinuation in column 2 of the calendar.

			COL. 1	COL. 2
12	DEC	01		
11	NOV	02		
10	OCT	03	B	
09	SEP	04	P	
08	AUG	05	P	
07	JUL	06	P	
06	JUN	07	P	
05	MAY	08	P	
04	APR	09	P	
03	MAR	10	P	
02	FEB	11	P	
01	JAN	12	7	1
12	DEC	13	7	
11	NOV	14	7	
10	OCT	15	7	

(2015 appears in left margin and right margin; (1) marked beside MAR row)

- If a delivery results in a live birth and a stillbirth in the same month then only the live birth is recorded in the calendar. This potentially results in a slight undercounting of stillbirths.
- For durations of pregnancy, respondents are asked for the number of completed months that they were pregnant, but we do not know this precisely. A birth in the calendar with a "B" and 8 "P"s is assumed to be a birth of 9 months gestation, but may be slightly shorter or longer.
- We also do not know the true duration of episodes of contraceptive use. The general rule is that completed months of pregnancy or completed months of use are recorded when durations are provided by the respondent. For example, if a respondent reported that she used a method for 8 months, we would see 8 boxes containing the code for that method.
- When respondents reported that they started use of a method in a particular month and stopped using it in a particular month, we don't know when exactly that use started and stopped. For example, if we find that a respondent used the pill from February 2015 to April 2015 as marked in the calendar, this could be from February 1 to April 30 (3 months), or could be February 28 to April 1 (closer to 1 month). As mentioned above the general rule is that completed months of use are recorded in the calendar, but the imprecision of the calendar is a limitation.

In addition to these limitations, issues of quality of the data in the calendar are of concern, particularly recall bias. These are beyond the scope of this tutorial, but are discussed in "Contraceptive use and perinatal mortality in the DHS: an assessment of the quality and consistency of calendars and histories" (Bradley, Winfrey, and Croft 2015).

Module 2: How are the calendar data stored in datasets and how do I analyze the calendar data?

Goal of the module: For analysts to understand how the data are stored in the recode dataset.

2.1. How are calendar data stored in datasets?

The calendar represents the events in the year of interview up to the date of interview and the five (or, in several surveys, six) years preceding the year of interview (known as the calendar period). The calendar is split into up to 9 variables, representing each of up to 9 columns. Most surveys do not include all 9 columns, and many will have only 1 or 2 columns.

While the calendar is oriented vertically with the top of the calendar being the most recent point in time, the variables for the calendar are oriented horizontally, such that one column of the calendar is translated into one variable in the dataset. Each of the 9 variables contains a string of characters - one character for each month in the time period. The data are stored as single variables of 80 characters, allowing for up to 80 months to be represented in the calendar. The first character in each variable represents the most recent point in time, while the 80th character position represents data for January of the year in which the calendar started – January of the calendar year five years before the date of the start of the survey. The calendar variables are fixed at the 80th character position (January of the calendar year five years before the start of the survey), such that the first few positions in the calendar strings represent points in time after the date of interview, and are consequently left blank.

The variables for the calendar are the series of `VCAL` variables, named differently in the different software to follow software specific naming conventions:

Col.	Stata	SPSS	SAS	Contents
1	vcal_1	VCAL$1	VCAL_1	Births, pregnancies, and contraceptive use
2	vcal_2	VCAL$2	VCAL_2	Reason for discontinuation of contraceptive use
3	vcal_3	VCAL$3	VCAL_3	Marital/union status (vcal_6 in DHSII recode files)
4	vcal_4	VCAL$4	VCAL_4	Moves and types of communities (vcal_7 in DHSII recode files)
5	vcal_5	VCAL$5	VCAL_5	Source of contraception
6	vcal_6	VCAL$6	VCAL_6	Survey-specific
7	vcal_7	VCAL$7	VCAL_7	Survey-specific
8	vcal_8	VCAL$8	VCAL_8	Survey-specific
9	vcal_9	VCAL$9	VCAL_9	Survey-specific

In most references from here on, the calendar variables will be referenced only by the Stata variable names, e.g. `vcal_1`, except in the examples where the appropriate name within the software is used.

The variables in the recode files are recoded to follow this standard ordering convention, which may not be the ordering of columns that was used in the survey questionnaire. Note that this standard ordering convention has been in use since DHSIII surveys onwards, but in DHSII surveys there were eight standard columns, following the standard ordering of the calendar columns in the model questionnaire at that time, plus one survey-specific calendar variable.

The codes used in each of the calendar variables also follow a standard coding scheme, **not** the coding scheme used in the survey questionnaire. Note that while the DHS-7 core questionnaire only includes two columns, the DHS recode file allows for five standard calendar variables and four survey-specific calendar variables. The standard coding scheme for the additional standard variables is used in surveys in countries that opted to collect this additional information. The codes for each standard column are given below:

Table 3. Standard coding scheme used in recode files (R) and standard DHS-7 questionnaires (Q)

R	Q	vcal_1 (Pregnancies and contraception)	R	Q	vcal_2 (Reasons for discontinuation)
B	B	Birth			
T	T	Terminated pregnancy/non-live birth			
P	P	Pregnancy			
0	0	Non-use of contraception			
1	6	Pill	1	1	Became pregnant while using
2	3	IUD	2	2	Wanted to become pregnant
3	4	Injectables	3	3	Husband disapproved
4		Diaphragm	4	5	Side effects/health concerns
5	7	Condom	5		Health concerns[3]
6	1	Female sterilization	6	6	Access/availability
7	2	Male sterilization	7	4	Wanted a more effective method
8	L	Periodic abstinence/rhythm	8	8	Inconvenient to use
9	M	Withdrawal	9		Infrequent sex/husband away
W	Y	Other traditional methods	C	7	Cost too much
N	5	Implants	F	F	Up to God/fatalistic
A		Abstinence	A	A	Difficult to get pregnant/menopausal
L	K	Lactational amenorrhea method (LAM)	D	D	Marital dissolution/separation
C	8	Female condom	W	X	Other
F		Foam and Jelly	K	Z	Don't know
E[1]	9	Emergency contraception (DHS-7)			
S[1]	J	Standard days method (DHS-7)			
M[1]	X	Other modern method (DHSVI)			
α[2]		Survey-specific method 1	α[2]		Survey-specific reason 1
ß[2]		Survey-specific method 2	ß[2]		Survey-specific reason 2
τ[2]		Survey-specific method 3	τ[2]		Survey-specific reason 3
?	?	Unknown method/missing data	?	?	Missing

		vcal_3 (Marriage)			vcal_4 (Residence)
X		In union (married or living together)	X		Change of community
0		Not in union	0		Capital/Major city (survey-specific)
			1		City
		vcal_5 (Source of contraception)	2		Town
		Survey-specific	3		Countryside
			4		Abroad (survey-specific)
			?		Missing data for type of residence

Note that the recode file coding scheme differs from the coding scheme used in the questionnaire to provide standard coding across surveys and phases of DHS.

[1] letters E, S, and M were added as standard codes in DHSVI and DHS-7, however these codes may have been used for other survey-specific methods in earlier phases of DHS

[2] α, ß, τ are place-holders and are replaced by survey-specific letters – see Calendar recoding.do or Calendar recoding.sps for the meaning of the survey-specific codes.

[3] Used separately in earlier phases of DHS, but combined with code 4 in later phases.

Rows in the calendar representing months after the month of interview are left blank. With this exception, when the columns are used, variables vcal_1, vcal_3 and vcal_4 do not contain any blank characters.

How can I understand the calendar?

The calendar data are stored in the datasets in reverse chronological order with the left hand end of the calendar string variables referring to dates near the date of interview and the right hand end of the string referring to dates five years before the date of interview. In discussing the contents of the calendar it is often useful to read the calendar data from right to left. The right hand end of the calendar, in position 80 of each string, represents January of the calendar year five years prior to the start of the survey. In this example the calendar starts January 2010, with the year of start of survey being 2015.

Below is an example of a calendar in the recode dataset.

```
Year      <-2016-><---2015---><---2014---><---2013---><---2012---><---2011---><---2010--->
Month     AJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJ
vcal_1              11111111000BPPPPPPPP888880000000001111111000000003333300TPP00000000
vcal_2                            1           4           5
vcal_3              XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX0000
vcal_4              000000000000000000000000000000X1111111111111111111111111111X33333333333
vcal_5                          2           F           2           3
Position  ....5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...80
```

Note that the character position and year and month rows have been added for illustration. Users will see only the data shown in `vcal_1` through `vcal_5` in their dataset. "Character Position" refers to the position

in the character string variable representing each column of the calendar. Position 1 is the first character, and position 80 is the last character of the string variables.

The example above uses the same information as in the [example of a completed calendar](#) for the first two columns of the calendar (`vcal_1` and `vcal_2`) and adds example data for marriage (`vcal_3`), moves and types of places of residence (`vcal_4`), and sources of contraception (`vcal_5`).

In the above example, reading from the right hand end of the calendar strings:
- In January 2010 (position 80), the respondent was not using any method of contraception (`vcal_1` = 0), was not married (`vcal_3` = 0), was living in the countryside (`vcal_4` = 3).
- In May 2010 the respondent was married (`vcal_3` position 76 = X).
- In September 2010 the respondent became pregnant (`vcal_1` position 72 = P) and the pregnancy lasted 3 months and resulted in a terminated pregnancy in November 2010 (`vcal_1` position 70 = T).
- In December 2010 the respondent moved from the countryside to a city (`vcal_4` position 69 = X, position 68 = 1).
- Two months later in February 2011 the respondent started using Injectable as a contraceptive method (`vcal_1` position 67 = 3), after she got the method from a family planning clinic (`vcal_5` position 67 = 3).
- She used the Injectable until July 2011 (`vcal_1` position 62 = 3, position 61 = 0) when she stopped using the method as she had health concerns about the method (`vcal_2` position 62 = 5).
- She did not use any method until April 2012 when she started using the Pill (`vcal_1` position 53 = 1), which she got from a government health center (`vcal_5` position 53 = 2).
- She used the Pill until November 2012 (`vcal_1` position 46 = 1, position 45 = 0) when she stopped because of side effects (`vcal_2` position 46 = 4).
- The respondent moved again in May 2013, this time to the capital city (`vcal_4` position 40 = X, position 39 = 0).
- In September 2013 the respondent start using Periodic Abstinence (or Rhythm method) (`vcal_1` position 36 = 8), a method she learned about from a friend or relative (`vcal_5` position 36 = F).
- She used Periodic Abstinence until January 2014 (`vcal_1` position 32 = 8, position 31 = P) when she discontinued because she became pregnant (`vcal_2` position 32 = 1).
- The pregnancy continued up to October 2014 when she gave birth to a child (vcal_1 position 23 = B).
- Following the birth of the child the respondent started using the Pill in February 2015 (`vcal_1` position 19 = 1). She acquired the method from a government health center (`vcal_5` position 19 = 2).
- The respondent continued using the Pill until the interview (`vcal_1` position 12 = 1).

Months in the calendar after the month of interview are filled with blank spaces (positions 1-11) in each calendar variable.

For more information, watch the [DHS Program tutorial video on the data structure of the contraceptive calendar](#).

Supplementary variables used with the calendar

There are four additional variables that are invaluable in using the calendar:

v017   Century month code[7] (CMC) for the first month of the calendar. This is constant for all cases and is the century month code of January of the year five years before the start of the survey.

v018   Row of calendar representing the month of interview. The calendar is numbered from 1 to 80, with month 80 being January of the first year of the calendar, and the month of interview typically in rows 1 to 20.

v019   Records the length of the calendar to use for this case. v019 is equal to $80-v018+1$. Typically the values are in the range of 60-80.

v019a   Number of calendar columns used in this dataset.

These variables will be used in the examples to facilitate the processing of the calendar.

In the example given above:

- v017 = 1321 = ((2010-1900)*12+1)
- v018 = 12 (equivalent to September 2015 in the example)
- v019 = 69 (the length of the used part of the calendar in vcal_1)
- v019a = 5 (as vcal_1 through vcal_5 are used)

These variables will be used in the analysis of the calendar data in the examples that follow to control character positions used in each variable string, and the dates to which the calendar data refer.

---

[7] The century month code is the number of months since the beginning of 1900 and is calculated as CMC = (YYYY − 1900)*12 + MM, where YYYY is the year and MM is the month.

2.2. Analyzing the calendar data in statistical software

There are three basic approaches to processing the data in the calendar:
- String parsing of the calendar (Module 3).
- Reshaping or restructuring the calendar into a file of single months (Module 4).
- Reshaping or restructuring the calendar into event files (Module 5).

Each of these approaches has advantages for different types of analysis. The string manipulation approach described in Module 3, does not require restructuring or reshaping the data, but does require stronger skills with the use of the string functions which we demonstrate with multiple examples. It can be a useful approach when analyzing a series of events, e.g. use of a contraceptive method following a birth. This approach is often useful when the unit of analysis is the woman and restructuring of the data is not required.

The second approach described in Module 4, restructuring the calendar into a file of single months, while conceptually simpler, does not provide as much flexibility for analysis. This approach is useful when the unit of analysis is something other than the woman, and can work well when reference to prior or following events in the calendar is not necessary.

The use of event files as described in Module 5, provides a combination of the two prior approaches, and permits more complex analyses of the data. The event file approach is particularly useful when the unit of analysis is something other than the woman, e.g. births, pregnancies, episodes of contraceptive use or non-use. Once event files are constructed, these are often simpler to use in analyses.

For all approaches some string manipulation functions are needed to handle the data, either in restructuring the data or in the analysis of the data. Additionally the concept of looping is used in the manipulation of the calendar data to 'loop' through each of the months in the calendar.

In the following modules, examples are shown for use in Stata and SPSS. Logic for Example 1 also exists for SAS, R, CSPro and Excel. Logic for all examples can be found in the Programs and coding resources: Examples files. Output is presented following the logic for each example where there is useful output, and is only presented for Stata for brevity. In many cases the output for a particular step is just a repetition of the commands and is not shown in this document. Output files for each example are available in the Programs and coding resources: Examples files for each software.

The examples that follow use the DHS Model Datasets, based on the standard DHS Individual Recode, but can be applied to any of the DHS survey datasets. However, every survey dataset has survey-specific differences and some of these can affect the calendar data. See the section on survey-specific coding for more details of these differences.

Module 3: String parsing of the calendar

Goal of the module: For analysts to understand how to use string manipulation functions to access the data.

3.1. String functions

To read the data in the calendar and extract information from the calendar, a number of string functions in the appropriate statistical software are needed. These functions are needed to extract portions of the calendar strings (substring functions), calculate the length of strings (length functions), find particular codes in the calendar strings (position functions), remove leading or trailing blanks from strings (trimming functions), reverse strings to analyze them in the opposite order (reversal functions). A list of useful functions is provided below and are demonstrated in Example 1.

In the below function descriptions, `str` is usually the calendar string variable (e.g. vcal_1/VCAL$1/VCAL_1) or a portion of it. Useful functions in each of the software include the following:

Stata

Length of a string	`strlen(str)`
Position in string	`strpos(str,str1)` – *the position in* `str` *at which* `str1` *is first found*
Substring	`substr(str,pos,len)` – *the substring of* `str`*, starting at* `pos`*, for a length of* `len`
Reverse a string	`reverse(str)`
Remove blanks	`trim(str)` – *leading and trailing blanks*
	`ltrim(str)` – *leading blanks*
	`rtrim(str)` – *trailing blanks*

Other useful string functions

`indexnot(str,str1)` – *returns position of first character in* `str` **not** *found in* `str1`

`subinstr(str,str1,str2,n)` – *substitutes* `str1` *with* `str2` *in* `str` *up to* `n` *times*

Other useful functions

`inrange(val,min,max)` – *if* `val` *is between* `min` *and* `max`

`inlist(val,val1,val2,val3,…)` – *if* `val` *is equal to one of val1, val2, val3, etc.*

SPSS

Length of a string	`char.length(str)`
Position in string	`char.index(str,str1)` – *the position in* `str` *at which* `str1` *is first found*
Substring	`char.substr(str,pos,len)` – *the substring of* `str`*, starting at* `pos`*, for a length of* `len`

Reverse a string	*See user macro* `!ReverseStr` *in Example1.sps*
Remove blanks	`rtrim(str)` *– trailing blanks*
	`ltrim(str)` *– leading blanks*
Other useful string functions	
	`string(num)` *– converts a number to a string*
	`number(str)` *– converts a string to a number*

SAS

Length of a string	`length(str)`
Position in string	`index(str,str1); find(str,str1,pos)`
Substring	`substr(str,pos,len)`
Reverse a string	`reverse(str)`
Remove blanks	`strip(str)`

R

Length of a string	`nchar(str)`
Position in string	`regexpr(str1,str,fixed=TRUE)`
Substring	`substr(str,start,stop)`
Reverse a string	

```
strReverse <- function(x) {
  sapply(lapply( strsplit(x, NULL), rev), paste, collapse="")
  return(x)
}
strReverse(str)
```

| Remove blanks | |

```
trim <- function (x) {
  gsub("^\\s+|\\s+$", "", x)
  return(x)
}
trim(str)
```

CSPro

Length of a string	`length(str)`
Position in string	`pos(str1,str)`
Substring	`str[start:len]`
Reverse a string	*See user function* `ReverseStr(str)` *in Example1.bch.apc*
Remove blanks	`strip(str)` *- trailing blanks*
	See user function `ltrim(str)` *in Example1.bch.apc*

<u>Excel</u>

Length of a string	`len(str)`
Position in string	`iferror(find(str1,str),0)`
Substring	`mid(str,pos,len)`
Reverse a string	*Use a VBA macro with the function* `StrReverse(str)`*, as follows:*

	`Function ReverseStr(str As String) As String`
	`  ReverseStr = StrReverse(str)`
	`End Function`

Remove blanks	`trim(str)` *– leading and trailing blanks*
	`ltrim(str)` *– leading blanks*
	`rtrim(str)` *– trailing blanks*

Summary of string functions

	Stata	SPSS	SAS	R	CSPro	Excel
Length of a string	`strlen(str)`	`char.length (str)`	`length(str)`	`nchar(str)`	`length(str)`	`len(str)`
Position in string	`strpos(str, str1)`	`char.index(str, str1)`	`index(str,str1)` `find(str,str1, pos)`	`regexpr(str1, str, fixed=TRUE)`	`pos(str1, str)`	`iferror( find(str1,str), 0)`
Substring	`substr (str,pos,len)`	`substr (str,pos,len)`	`substr (str,pos,len)`	`substr(str, start,stop)`	`str[start:len]`	`mid(str,pos, len)`
Reverse a string	`reverse(str)`	*SPSS user-defined macro*	`reverse(str)`	*strReverse <- { function(x) sapply(lapply(strsplit(x, NULL), rev), paste, collapse="") }* `strReverse(str)`	*CSPro user-defined function*	*Excel macro*
Removing blanks	`trim(str)` *(leading and trailing - see also* `ltrim` *and* `rtrim`*)*	`rtrim(str)` *(leading blanks - see also* `ltrim`*)*	`strip(str)` *(leading and trailing - see also* `left` *and* `trim`*)*	*trim <- function (x) { gsub("^\\s+|\\s +$", "", x) }* `trim(str)`	`strip(str)` *(removes trailing blanks only)*	`trim(str)` *(leading and trailing - see also* `ltrim` *and* `rtrim`*)*

3.2. Example data

All of the examples assume that the data and programs are stored in `C:\Data\DHS_model\` and are designed to work with the [DHS model dataset](#) for the individual (women's) recode file appropriate for the software. Change the appropriate command in each example file if the dataset is stored in a different folder. The examples assume that the following model datasets are being used:

Stata: [zzir62fl.dta](#) (Stata dataset)

SPSS: [zzir62fl.sav](#) (SPSS dataset)

SAS: [zzir62fl.sd2](#) (SAS dataset)

R: [zzir62fl.dta](#) (Stata dataset)

CSPro: [zzir62.dat](#) (Hierarchical file)

Excel: The [Excel example](#) uses `vcal_1` copied from zzir62fl.dta and pasted into Excel

Example 1 – Basic string functions

The first example demonstrates how some of the basic string functions work and the output that they give. Examples are given for some of the basic string functions for several different software:

1. Displaying the first column of the calendar for a few respondents
2. Calculating the full length of the calendar
3. Extracting a substring from the calendar, starting in position 44 and extracting 12 characters
4. Finding the position in the calendar of the first occurrence of letter "P"
5. Reversing the calendar
6. Trimming the calendar to remove leading and trailing blanks
7. Calculating the length of the calendar actually used for a case

For each example, it is useful to remember that the data shown are in reverse chronological order with the left hand end of the string being nearest to the date of interview and the right hand end of the string representing the beginning of the calendar five years prior to the year of the start of the survey.

Logic for example 1 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example1.do	Stata\Example1.log
SPSS	SPSS\Example1.sps	SPSS\Example1.txt
SAS	SAS\Example1.sas	SAS\Example1.pdf
R	R\Example1.R	R\Example1.txt
CSPro	CSPro\Example1.bch.apc	CSPro\Example1.lst
Excel	Excel\Example1.xlsx	

E1.1   Displaying the first column of the calendar for a few respondents

Let us start by displaying the calendar data from the first column (vcal_1/VCAL$1) for the first few cases in the dataset, just to see what the calendar data look like.

Stata

```
* DHS Calendar Tutorial - Example 1
* Basic string manipulation

* download the model dataset for individual women's recode: "ZZIR62FL.DTA"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
cd "C:\Data\DHS_model"

* open the dataset, selecting just the variables we are going to use
use vcal_1 v000 v005 v007 v008 v017 v018 v019 using "ZZIR62FL.DTA", clear

* 1) display column 1 of the calendar for the first 6 respondents
list vcal_1 in 1/5
```

SPSS

```
* DHS Calendar Tutorial - Example 1.
* Basic string manipulation.

* download the model dataset for individual women's recode: "ZZIR62FL.SAV"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm .

* change to a working directory where the data are stored
* or add the full path to the 'get file' command below.
cd "C:\Data\DHS_model".

* open the dataset, and just keep the variables we are going to use.
get file="ZZIR62FL.SAV" / keep vcal$1 v000 v005 v007 v008 v017 v018 v019.

* 1) display column 1 of the calendar for the first 6 respondents.
list variables = vcal$1 /cases from 1 to 5.
```

Stata output

```
. * 1) display column 1 of the calendar for the first 6 respondents
. list vcal_1 in 1/5


     +--------------------------------------------------------------------------------+
     |                                                                        vcal_1 |
     |--------------------------------------------------------------------------------|
  1. |           00000BPPPPPPPP000000000000000000000BPPPPPPPP00000000000000000000000 |
  2. |           PPPPPP00000000000000000000000BPPPPPPPP00000000000000000000000000000 |
  3. |           0000000000000000000000000000000000000000000000000000000000000000000 |
  4. |           0000000000BPPPPPPPP00000000000BPPPPPPPP00000000000000000000000000000 |
  5. |           0BPPPPPPPP00000000000000000000000BPPPPPPPP00000000000000000000000000 |
     +--------------------------------------------------------------------------------+
```

E1.2   Calculating the length of the calendar

Let us next check how long the calendar strings are. In the standard individual recode format, the calendar strings are 80 characters long, but we can confirm that by calculating the length. The function `strlen` (in Stata) or `char.length` (in SPSS) will return the length of the calendar string.

Stata

```
* 2) calculate the full length of calendar by displaying length of strings
gen vcal_len = strlen(vcal_1)
label variable vcal_len "length of calendar"
list vcal_len in 1/5
```

SPSS

```
* 2) calculate the full length of calendar by displaying length of strings.
compute vcal_len = char.length(vcal$1).
variable labels vcal_len "Length of calendar".
print formats vcal_len (F2.0).
list variables = vcal_len /cases from 1 to 5.
```

Stata output

```
. * 2) calculate the full length of calendar by displaying length of strings
. gen vcal_len = strlen(vcal_1)

. label variable vcal_len "length of calendar"

. list vcal_len in 1/5
```

```
    +----------+
    | vcal_len |
    |----------|
 1. |       80 |
 2. |       80 |
 3. |       80 |
 4. |       80 |
 5. |       80 |
    +----------+
```

E1.3   Extracting a substring from the calendar

Let us say that we want to look at a particular part of the calendar, say, a year prior to or following a particular date, and for this example let us use the 12-month window from position 44-55 of the calendar.

In Stata we can use the `substr` function to extract a piece of a substring. In SPSS we use the `char.substr` function, but we must remember to define the string variable (`string piece (A12).`) we are putting the piece of the string into, and make sure it is big enough to hold the string.

Stata
```
* 3) take a piece of a string from column 1
gen piece = substr(vcal_1,44,12) // start at position 44 for 12 characters
label variable piece "piece of calendar"
list piece in 1/5
```
SPSS
```
* 3) take a piece of a string from column 1.
string piece (A12).
compute piece = char.substr(vcal$1,44,12).
variable labels piece "Piece of calendar".
print formats piece (A12).
list variables = piece /cases from 1 to 5.
```

Stata output
```
. * 3) take a piece of a string from column 1
. gen piece = substr(vcal_1,44,12) // start at position 44 for 12 characters

. label variable piece "piece of calendar"

. list piece in 1/5

    +--------------+
    |        piece |
    |--------------|
 1. | 00000000BPPP |
 2. | 0BPPPPPPPP00 |
 3. | 000000000000 |
 4. | 0BPPPPPPPP00 |
 5. | 00000BPPPPPP |
    +--------------+
```

Often we will this method of extraction just to capture a single character from the calendar, representing a single month, for example to capture the type of contraceptive method used in a particular month x using either `substr(vcal_1,x,1)` or `char.substr(vcal$1,x,1)`.

E1.4   Finding the position in the calendar of the first occurrence of letter "P"

We can use the `strpos` (Stata) or `char.index` (SPSS) functions to find the position in the calendar string where something happens, such as a birth, a month of pregnancy, or the use or non-use of contraception. In the below example, we look for the last use of the letter "P" in the calendar (i.e. nearest to the date of interview). This may be because the woman is currently pregnant, but could also be the last month of pregnancy before the month in which the birth of a child or a pregnancy termination took place.

Stata

```
* 4) find the position of a substring within a string
gen pos = strpos(vcal_1,"P") // look for first occurrence of "P"
label variable pos "position in calendar"
list pos in 1/5
```

SPSS

```
* 4) find the position of a substring within a string.
compute pos = char.index(vcal$1,"P").
variable labels pos "Position in calendar".
print formats pos (F2.0).
list variables = pos /cases from 1 to 5.
```

Stata output

```
. * 4) find the position of a substring within a string
. gen pos = strpos(vcal_1,"P") // look for first occurrence of "P"

. label variable pos "position in calendar"

. list pos in 1/5

     +-----+
     | pos |
     |-----|
  1. |  21 |
  2. |  15 |
  3. |   0 |
  4. |  26 |
  5. |  17 |
     +-----+
```

E1.5   Reversing the calendar

The calendar is organized with the most recent point in time at the beginning of the string and the point furthest back in time at the end of the string. Sometimes, though, it is easier to work with the calendar in the opposite order with the first position being the furthest back in time and the last positions being the most recent. This can be achieved by reversing the calendar string. In Stata there is a function `reverse` to do just this, however, in SPSS no equivalent exists. Instead, we can write a macro that achieves the same thing. In the SPSS logic below, we define a macro called `!ReverseStr` that will reverse a string, and then use that macro in the logic below.

Stata

```
* 5) reverse a string
gen rev_cal = reverse(vcal_1) // calendar from oldest to most recent month (L to R)
label variable rev_cal "reversed calendar"
list rev_cal in 1/5
```

SPSS

```
* 5) reverse a string
* macro to reverse a string.
define !ReverseStr(!positional !tokens(1) /!positional !tokens(1))
* first parameter is old variable, second is new variable.
compute !2 = !1.
string #a (A1).
compute #l = length(rtrim(!2)).
loop #i = 1 to #l/2.
+ compute #j = #l - #i + 1.
+ compute #a = char.substr(!2,#i,1).
+ compute substr(!2,#i,1) = char.substr(!2,#j,1).
+ compute substr(!2,#j,1) = #a.
end loop.
execute.
!enddefine.

* reverse a string.
string rev_cal (a80).
* reverse vcal$1 into rev_cal.
!ReverseStr vcal$1 rev_cal
variable labels rev_cal "Reversed calendar".
print formats rev_cal (A80).
list variables = rev_cal /cases from 1 to 5.
```

Stata output

```
. * 5) reverse a string
. gen rev_cal = reverse(vcal_1) // calendar from oldest to most recent month (L to R)

. label variable rev_cal "reversed calendar"

. list rev_cal in 1/5


    +-------------------------------------------------------------------------------+
    |                                                                      rev_cal |
    |-------------------------------------------------------------------------------|
  1. | 00000000000000000000PPPPPPPPPB0000000000000000000000PPPPPPPPB00000            |
  2. | 0000000000000000000000000000PPPPPPPPPB000000000000000000000000PPPPPP          |
  3. | 0000000000000000000000000000000000000000000000000000000000000000000000        |
  4. | 0000000000000000000000000000PPPPPPPPPB00000000000PPPPPPPPPB0000000000          |
  5. | 00000000000000000000000PPPPPPPPPB0000000000000000000000PPPPPPPPPB0             |
    +-------------------------------------------------------------------------------+
```

E1.6   Trimming the calendar to remove leading and trailing blanks

It is sometimes useful to trim a string to exclude blanks from the beginning or end (or both) of a string, for example, if we wanted to remove the empty months after the date of interview from the beginning of the calendar. Functions `ltrim` and `rtrim` can be used in both Stata and SPSS, and Stata also includes just `trim` that removes blanks from both ends of a string. In SPSS we need to use a combination of `ltrim` and `rtrim` to do the same.

Stata

```
* 6) trim a string of leading and trailing spaces
gen trim_cal = trim(vcal_1)
label variable trim_cal "trimmed calendar"
list trim_cal in 1/5
```

SPSS

```
* 6) trim a string of leading and trailing spaces.
string trim_cal (a80).
compute trim_cal = rtrim(ltrim(vcal$1)).
variable labels trim_cal "Trimmed calendar".
print formats trim_cal (A80).
list variables = trim_cal /cases from 1 to 5.
```

Stata output

```
. * 6) trim a string of leading and trailing spaces
. gen trim_cal = trim(vcal_1)

. label variable trim_cal "trimmed calendar"

. list trim_cal in 1/5


     +------------------------------------------------------------------+
     |                                                         trim_cal |
     |------------------------------------------------------------------|
  1. | 00000BPPPPPPPP000000000000000000000BPPPPPPPP0000000000000000000000 |
  2. | PPPPPP000000000000000000000000BPPPPPPPP00000000000000000000000000 |
  3. | 00000000000000000000000000000000000000000000000000000000000000000 |
  4. | 0000000000BPPPPPPPP00000000000BPPPPPPPP0000000000000000000000000 |
  5. | 0BPPPPPPPP00000000000000000000000BPPPPPPPP00000000000000000000000 |
     +------------------------------------------------------------------+
```

E1.7   Calculating the length of the calendar actually used

Finally, we can calculate the length of the calendar that is actually used, dropping the months after the date of interview. We can do this by calculating the length of the trimmed calendar.

Stata

```
* 7) display the length of calendar actually used, from the trimmed version
gen vcal_used = strlen(trim_cal)
label variable vcal_used "length of calendar used"
* should be the same as v019
list vcal_used v019 in 1/5
```

SPSS

```
* 7) display the length of calendar actually used, from the trimmed version.
compute vcal_used = char.length(trim_cal).
variable labels vcal_used "Length of calendar used".
print formats vcal_used (F2.0).
* should be the same as v019.
list variables = vcal_used v019 /cases from 1 to 5.
```

Stata output

```
. * 7) display the length of calendar actually used, from the trimmed version
. gen vcal_used = strlen(trim_cal)

. label variable vcal_used "length of calendar used"

. * should be the same as v019
. list vcal_used v019 in 1/5

     +-----------------+
     | vcal_u~d   v019 |
     |-----------------|
  1. |       66     66 |
  2. |       66     66 |
  3. |       66     66 |
  4. |       66     66 |
  5. |       66     66 |
     +-----------------+
```

These are just a few of the most useful string parsing functions that can be used, but are the ones that are used most commonly in processing the calendar data.

Example 2 – Last pregnancy, duration of pregnancy and method used before pregnancy

For this next example, we are interested in looking at contraceptive use prior to the last birth or terminated pregnancy. We will use this example to find the last live birth or terminated pregnancy in the calendar, and then look for contraceptive use prior to that pregnancy, and can then compare contraceptive use or non-use prior to a live birth or a terminated pregnancy.

This example provides logic that goes through the following steps:

    0. Open the dataset and set up the data

Example 2A – Find the century month code (CMC) of the last pregnancy in the calendar

    1. Get the length of the calendar
    2. Find the position of the last birth or terminated pregnancy in the calendar
    3. Calculate the century month code (CMC) of the last pregnancy in the calendar

Example 2B – Find the duration of pregnancy for the last pregnancy

    4. Calculate the duration of the pregnancy and find the position of the month before the pregnancy for the last pregnancy

Example 2C - Check if a contraceptive method was used at some time before the pregnancy, but in the 5 years preceding the survey, and find the method

    5. Find the last month before the pregnancy but within the last 5 years that the respondent has a code different from 0 (something other than non-use of contraception), and
    6. Check if the respondent used a method at that time
    7. Convert the alphanumeric string variable for the method to a numeric code
    8. Label the method variable and codes
    9. Weight and tabulate the method used by type of pregnancy

Logic for example 2 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example2.do	Stata\Example2.log
SPSS	SPSS\Example2.sps	SPSS\Example2.txt

As mentioned before, remember that the calendar is stored in reverse chronological order and the left hand end of a string represents a more recent time point than the right hand end of the string. Example 1 demonstrated the use of functions to return the length of a string, search a string and find the position of an event in the string, capture the code at a particular position in the string, and create substrings to carry out the steps laid out above. In Example 2, the logic looks for the last birth or terminated pregnancy, then the month before the pregnancy, and then the last month of use of contraception progressing from left (more recent) to right (further back in time) through the calendar.

Example:

if calendar is as below ("_" used to replace blanks for months after the date of interview for display here):

```
_____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
```

1) Length is 80 characters
2) Position of last birth or terminated pregnancy is position 20. Pregnancy resulted in a live birth.
```
_____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
                     ^
```
3) Century month code is 1381 (assuming interview in CMC 1386 [position 15])
4) Duration of pregnancy is 9 months and position of month before pregnancy is position 29
```
_____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
                     |12345678^
```
5) Last month with a code other than 0 before pregnancy is in position 35
```
_____00000BPPPPPPPP0000005555555500000TPP00000000000000BPPPPPPPP00000000
                           ^
```
6) Respondent was using a method, method code "5" (Condom)
7) Numeric version of the method code is 5

E2.0   Open the dataset and set up the data

The examples below assume the data are in C:\Data\DHS_model\, and that the dataset being used is ZZIR62FL.DTA. Adjust the filename and the folder name to match the file you are using and the folder it is stored in. When opening the data we keep only the variables necessary for the example.

Stata

```
* DHS Calendar Tutorial - Example 2
* Last pregnancy, duration of pregnancy and method used before pregnancy

* download the model dataset for individual women's recode: "ZZIR62FL.DTA"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
cd "C:\Data\DHS_model"

* open the dataset to use, selecting just the variables we are going to use
use vcal_1 v000 v005 v007 v008 v017 v018 v019 v208 b3_01 using "ZZIR62FL.DTA", clear
```

```
* DHS Calendar Tutorial - Example 2.
* Last pregnancy, duration of pregnancy and method used before pregnancy.

* download the model dataset for individual women's recode: "ZZIR62FL.SAV"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm .

* change to a working directory where the data are stored
* or add the full path to the 'get file' command below.
cd "C:\Data\DHS_model".

* open the dataset to use, and just keep the variables we are going to use.
get file="ZZIR62FL.SAV" / keep vcal$1 v000 v005 v007 v008 v017 v018 v019 v208 b3$01.

* set maximum number of loops high enough. Could be as many as the length of the calendar (80)
* so set it a bit higher.
set mxloops = 100.
```

SPSS by default limits any looping in the program to protect against infinite loops. The default maximum is 40 iterations, but we are likely to need up to 80 iterations (one per month of the calendar), so we need to set mxloops to a value at least as high as 80. To be on the safe side we set it to 100.

Example 2A – Find the CMC of the last birth in the calendar

E2.1   Get the length of the calendar

This example uses the functions that return the length of a string - strlen and char.length, respectively. The length will be 80 in all cases, except in surveys where information about contraceptive use is not recorded in the calendar, and only the births, terminations, and months of pregnancy are given in the calendar. In those cases it is better just to set vcal_len to 80.

Stata

```
* Example 2A
* ----------------------
* get century month code (CMC) of date of last birth or pregnancy from calendar
* using string functions


* Step 2.1
* length of full calendar string including leading blanks (80)
* actual length used according to v019 will be less
egen vcal_len = max(strlen(vcal_1))
* most calendars are 80 in length, but those without method use may be short, so use the max
label variable vcal_len "Length of calendar"
```
SPSS

```
* Example 2A.
* ----------------------.
* get century month code (CMC) of date of last birth or pregnancy from calendar
* using string functions.


* Step 2.1.
```

```
* length of full calendar string including leading blanks (80).
* actual length used according to v019 will be less.
compute vcal_len = char.length(vcal$1).
variable labels vcal_len "Length of calendar".
print formats vcal_len (f2.0).
```

E2.2   Find the position of the last birth or terminated pregnancy in the calendar

This example uses the functions that find the position of a character or substring within a string, searching for the first "B", which will be the last birth and the first "T" which will be the last terminated pregnancy. Remember that the calendar is in reverse order with the months nearest the date of interview at the beginning of the string and earlier months back to the beginning of the calendar five years before the survey at the right hand end of the string. Both of the functions `strpos` and `char.index` return 0 if the character or substring is not found in the calendar.

Having found the last birth and the last terminated pregnancy, we check to see which is the most recent, and update `lp` to refer to the most recent birth or terminated pregnancy. We do this by updating `lp` if there was (a) a birth, but no terminated pregnancy, or (b) if there was a birth and it was more recent than the last terminated pregnancy. We also save the outcome of the pregnancy – birth or terminated pregnancy – in `lp_type`.

Stata
```
* Step 2.2
* position of last birth or terminated pregnancy in calendar
gen lb = strpos(vcal_1,"B")
gen lp = strpos(vcal_1,"T")
* update lp with position of last birth if there was no terminated pregnancy,
* or if the last birth was more recent than last terminated pregnancy
replace lp = lb if lp == 0 | (lb > 0 & lb < lp)
* e.g. if calendar is as below ("_" used to replace blank for display here):
* _____00000BPPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPPP00000000
*                     ^
* lp would be 20
label variable lp "Position of last birth or terminated pregnancy in calendar"
label def lp 0 "No birth or terminated pregnancy in calendar"
label value lp lp

* get the type of birth or terminated pregnancy
* lp_type will be set to 1 if lp refers to a birth,
* and 2 if lp refers to a terminated pregnancy using the position in "BT" for the resulting code
gen lp_type = strpos("BT",substr(vcal_1,lp,1)) if lp > 0
label variable lp_type "Birth or terminated pregnancy in calendar"
label def lp_type 1 "Birth" 2 "Terminated pregnancy"
label value lp_type lp_type

list vcal_1 lp lp_type in 1/5
tab lp lp_type, m
```
SPSS
```
* Step 2.2.
* position of last birth or terminated pregnancy in calendar.
compute lb = char.index(vcal$1,"B").
compute lp = char.index(vcal$1,"T").
```

```
* update lp with position of last birth if there was no terminated pregnancy,
* or if the last birth was more recent than last terminated pregnancy.
if (lp = 0 | (lb > 0 & lb < lp)) lp = lb.
* e.g. if calendar is as below ("_" used to replace blank for display here):
* _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
*                    ^.
* lp would be 20.
variable labels lp "Position of last birth or terminated pregnancy in calendar".
value labels lp 0 "No birth or terminated pregnancy in calendar".
print formats lp (f2.0).

* get the type of birth or terminated pregnancy.
* lp_type will be set to 1 if lp refers to a birth,
* and 2 if lp refers to a terminated pregnancy using the position in "BT" for the resulting code.
if (lp > 0) lp_type = char.index("BT",char.substr(vcal$1,lp,1)).
variable labels lp_type "Birth or terminated pregnancy in calendar".
value labels lp_type 1 "Birth" 2 "Terminated pregnancy".
print formats lp_type (f1.0).

list variables = vcal$1 lp lp_type /cases from 1 to 5.
crosstabs /tables=lp by lp_type /count=asis.
```

Stata output

```
. * Step 2.2
. * position of last birth or terminated pregnancy in calendar
. gen lb = strpos(vcal_1,"B")

. gen lp = strpos(vcal_1,"T")

. * update lp with position of last birth if there was no terminated pregnancy,
. * or if the last birth was more recent than last terminated pregnancy
. replace lp = lb if lp == 0 | (lb > 0 & lb < lp)
(4,428 real changes made)

. * e.g. if calendar is as below ("_" used to replace blank for display here):
. * _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
. *                    ^
. * lp would be 20
. label variable lp "Position of last birth or terminated pregnancy in calendar"

. label def lp 0 "No birth or terminated pregnancy in calendar"

. label value lp lp

.
. * get the type of birth or terminated pregnancy
. * lp_type will be set to 1 if lp refers to a birth,
. * and 2 if lp refers to a terminated pregnancy using the position in "BT" for the resulting
code
. gen lp_type = strpos("BT",substr(vcal_1,lp,1)) if lp > 0
(3,657 missing values generated)

. label variable lp_type "Birth or terminated pregnancy in calendar"

. label def lp_type 1 "Birth" 2 "Terminated pregnancy"

. label value lp_type lp_type

.
. list vcal_1 lp lp_type in 1/5

     +--------------------------------------------------------------------------------+
  1. |                                                                         vcal_1 |
```

```
|                 00000BPPPPPPPP00000000000000000000000BPPPPPPPP00000000000000000000 |
|-----------------------------------------------------------------------------------|
|                                           lp        |        lp_type            |
|                                           20        |         Birth             |
+-----------------------------------------------------------------------------------+


    +-----------------------------------------------------------------------------------+
 2. |                                                                          vcal_1  |
    |         PPPPPP000000000000000000000000000BPPPPPPPP000000000000000000000000000000 |
    |-----------------------------------------------------------------------------------|
    |                                           lp        |        lp_type            |
    |                                           45        |         Birth             |
    +-----------------------------------------------------------------------------------+


    +-----------------------------------------------------------------------------------+
 3. |                                                                          vcal_1  |
    |         0000000000000000000000000000000000000000000000000000000000000000000000000 |
    |-----------------------------------------------------------------------------------|
    |                                           lp        |        lp_type            |
    |       No birth or terminated pregnancy in calendar  |           .               |
    +-----------------------------------------------------------------------------------+


    +-----------------------------------------------------------------------------------+
 4. |                                                                          vcal_1  |
    |         0000000000BPPPPPPPP00000000000BPPPPPPPP0000000000000000000000000000000000 |
    |-----------------------------------------------------------------------------------|
    |                                           lp        |        lp_type            |
    |                                           25        |         Birth             |
    +-----------------------------------------------------------------------------------+


    +-----------------------------------------------------------------------------------+
 5. |                                                                          vcal_1  |
    |         0BPPPPPPPP0000000000000000000000000000BPPPPPPPP000000000000000000000000000 |
    |-----------------------------------------------------------------------------------|
    |                                           lp        |        lp_type            |
    |                                           16        |         Birth             |
    +-----------------------------------------------------------------------------------+


. tab lp lp_type, m

    Position of last | Birth or terminated pregnancy in
  birth or terminated |          calendar
pregnancy in calendar |    Birth  Terminate         . |     Total
---------------------+-------------------------------+---------
No birth or terminate |        0          0      3,657 |     3,657
                 11 |        1          0          0 |         1
                 12 |       15          0          0 |        15
                 13 |       36          3          0 |        39
                 14 |       59          5          0 |        64
                 15 |      105         14          0 |       119
                 16 |      112          3          0 |       115
                 17 |      115         14          0 |       129
                 18 |      117          9          0 |       126
                 19 |      115          8          0 |       123
                 20 |      135          4          0 |       139
                 21 |       97         10          0 |       107
                 22 |       92          3          0 |        95
                 23 |      108          9          0 |       117
                 24 |       93          7          0 |       100
                 25 |       88          9          0 |        97
                 26 |      122          5          0 |       127
                 27 |      123          3          0 |       126
                 28 |      110          7          0 |       117
                 29 |      106          8          0 |       114
                 30 |      106         11          0 |       117
                 31 |       95          5          0 |       100
```

```
    32 |        101            6            0 |        107
    33 |         72            4            0 |         76
    34 |         55            2            0 |         57
    35 |         68            1            0 |         69
    36 |         55            4            0 |         59
    37 |         73            5            0 |         78
    38 |         97            2            0 |         99
    39 |         99            4            0 |        103
    40 |         99            1            0 |        100
    41 |        103            6            0 |        109
    42 |         85           10            0 |         95
    43 |         62            2            0 |         64
    44 |         56            2            0 |         58
    45 |         53            4            0 |         57
    46 |         40            0            0 |         40
    47 |         41            2            0 |         43
    48 |         47            3            0 |         50
    49 |         64            6            0 |         70
    50 |         65            2            0 |         67
    51 |         76            4            0 |         80
    52 |         73            9            0 |         82
    53 |         81            1            0 |         82
    54 |         71            3            0 |         74
    55 |         38            0            0 |         38
    56 |         46            0            0 |         46
    57 |         33            2            0 |         35
    58 |         23            3            0 |         26
    59 |         20            1            0 |         21
    60 |         37            1            0 |         38
    61 |         34            3            0 |         37
    62 |         30            1            0 |         31
    63 |         39            2            0 |         41
    64 |         47            1            0 |         48
    65 |         62            8            0 |         70
    66 |         46            5            0 |         51
    67 |         25            2            0 |         27
    68 |         26            1            0 |         27
    69 |         22            2            0 |         24
    70 |         25            0            0 |         25
    71 |         14            2            0 |         16
    72 |         19            0            0 |         19
    73 |         30            1            0 |         31
    74 |         26            3            0 |         29
    75 |         38            0            0 |         38
    76 |         55            1            0 |         56
    77 |         34            1            0 |         35
    78 |         30            2            0 |         32
    79 |         18            0            0 |         18
    80 |         25            1            0 |         26
--------------------+------------------------------+----------
 Total |      4,428          263        3,657 |      8,348
```

E2.3   Calculate the century month code (CMC) of the last pregnancy in the calendar

The century month code (CMC) of the date of the last pregnancy can be calculated by adding the length of the calendar minus the position of the last pregnancy (lp) to the century month code of the start of the calendar found in v017, providing there is a birth or terminated pregnancy in the calendar.

The logic then checks that the CMC date of the last pregnancy from the calendar (cmc_lp) matches with the CMC date of last birth from the birth history (b3_01 or B3$01) if the last pregnancy was a live birth. If

they do not match then typically there is an error in the logic[8]. In the example given, there should be no cases where the CMCs do not match.

Stata

```
* Step 2.3
* if there is a birth or terminated pregnancy in the calendar then calculate CMC
* of date of last birth or pregnancy by adding length of calendar to start CMC
* less the position of the birth or pregnancy
* calendar starts in CMC given in v017
* lp > 0 means there was a birth or terminated pregnancy in the calendar
gen cmc_lp = v017 + vcal_len - lp if lp > 0
label variable cmc_lp "Century month code of last pregnancy"
* e.g. if calendar is as below and cmc of beginning of calendar (V017) = 1321:
*                00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
* cmc_lp would be 1381, calculation as follows:
* 1321 + 80 - 20 (80 is the vcal_len, and 20 is the position of lp)
list v017 lp vcal_len cmc_lp in 1/5

* check the variables created.
tab lp
tab cmc_lp

* list cases where cmc_lp and b3_01 don't agree if the last pregnancy was a birth
list cmc_lp b3_01 if lp > 0 & lp == lb & cmc_lp != b3_01
* there shouldn't be any cases listed.
```

SPSS

```
* Step 2.3.
* if there is a birth or terminated pregnancy in the calendar then calculate CMC
* of date of last birth or pregnancy by adding length of calendar to start CMC
* less the position of the birth or pregnancy.
* calendar starts in CMC given in V017.
* lp > 0 means there was a birth or terminated pregnancy in the calendar.
if (lp > 0) cmc_lp = V017 + vcal_len - lp.
variable labels cmc_lp "Century month code of last pregnancy".
print formats cmc_lp (f4.0).
* e.g. if calendar is as below and cmc of beginning of calendar (V017) = 1321:
*                00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
* cmc_lp would be 1381, calculation as follows:
* 1321 + 80 - 20 (80 is the vcal_len, and 20 is the position of lp).
list variables = V017 lp vcal_len cmc_lp /cases from 1 to 5.

* check the variables created.
frequencies variables=lp cmc_lp.


* list cases where cmc_lp and B3$01 don't agree if the last pregnancy was a birth.
compute filter_$ = (lp > 0 & lp = lb & cmc_lp <> B3$01).
print formats filter_$ (f1.0).
filter by filter_$.
* there shouldn't be any cases listed.
list variables = lp cmc_lp B3$01.
filter off.
```

[8] In some surveys there are a small number of cases where the CMC date of birth in b3_01 does not match with the CMC date of last birth from the calendar data, but most surveys have no cases that do not match.

```
. * Step 2.3
. * if there is a birth or terminated pregnancy in the calendar then calculate CMC
. * of date of last birth or pregnancy by adding length of calendar to start CMC
. * less the position of the birth or pregnancy
. * calendar starts in CMC given in v017
. * lp > 0 means there was a birth or terminated pregnancy in the calendar
. gen cmc_lp = v017 + vcal_len - lp if lp > 0
(3,657 missing values generated)

. label variable cmc_lp "Century month code of last pregnancy"

. * e.g. if calendar is as below and cmc of beginning of calendar (V017) = 1321:
. *               00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
. * cmc_lp would be 1381, calculation as follows:
. * 1321 + 80 - 20 (80 is the vcal_len, and 20 is the position of lp)
. list v017 lp vcal_len cmc_lp in 1/5

     +---------------------------------------------------------------------------+
     | v017                                              lp   vcal_len   cmc_lp |
     |---------------------------------------------------------------------------|
  1. | 1321                                              20         80     1381 |
  2. | 1321                                              45         80     1356 |
  3. | 1321    No birth or terminated pregnancy in calendar        80        . |
  4. | 1321                                              25         80     1376 |
  5. | 1321                                              16         80     1385 |
     +---------------------------------------------------------------------------+

.
. * check the variables created.
. tab lp

  Position of last birth or terminated |
               pregnancy in calendar |      Freq.      Percent        Cum.
---------------------------------------+---------------------------------------
No birth or terminated pregnancy in cal |      3,657       43.81        43.81
                                    11 |          1        0.01        43.82
                                    12 |         15        0.18        44.00
                                    13 |         39        0.47        44.47
                                    14 |         64        0.77        45.23
                                    15 |        119        1.43        46.66
                                    16 |        115        1.38        48.04
                                    17 |        129        1.55        49.58
                                    18 |        126        1.51        51.09
                                    19 |        123        1.47        52.56
                                    20 |        139        1.67        54.23
                                    21 |        107        1.28        55.51
                                    22 |         95        1.14        56.65
                                    23 |        117        1.40        58.05
                                    24 |        100        1.20        59.25
                                    25 |         97        1.16        60.41
                                    26 |        127        1.52        61.93
                                    27 |        126        1.51        63.44
                                    28 |        117        1.40        64.84
                                    29 |        114        1.37        66.21
                                    30 |        117        1.40        67.61
                                    31 |        100        1.20        68.81
                                    32 |        107        1.28        70.09
                                    33 |         76        0.91        71.00
                                    34 |         57        0.68        71.68
                                    35 |         69        0.83        72.51
                                    36 |         59        0.71        73.22
                                    37 |         78        0.93        74.15
                                    38 |         99        1.19        75.34
                                    39 |        103        1.23        76.57
```

```
                                    40 |         100        1.20        77.77
                                    41 |         109        1.31        79.07
                                    42 |          95        1.14        80.21
                                    43 |          64        0.77        80.98
                                    44 |          58        0.69        81.67
                                    45 |          57        0.68        82.36
                                    46 |          40        0.48        82.83
                                    47 |          43        0.52        83.35
                                    48 |          50        0.60        83.95
                                    49 |          70        0.84        84.79
                                    50 |          67        0.80        85.59
                                    51 |          80        0.96        86.55
                                    52 |          82        0.98        87.53
                                    53 |          82        0.98        88.51
                                    54 |          74        0.89        89.40
                                    55 |          38        0.46        89.85
                                    56 |          46        0.55        90.40
                                    57 |          35        0.42        90.82
                                    58 |          26        0.31        91.14
                                    59 |          21        0.25        91.39
                                    60 |          38        0.46        91.84
                                    61 |          37        0.44        92.29
                                    62 |          31        0.37        92.66
                                    63 |          41        0.49        93.15
                                    64 |          48        0.57        93.72
                                    65 |          70        0.84        94.56
                                    66 |          51        0.61        95.17
                                    67 |          27        0.32        95.50
                                    68 |          27        0.32        95.82
                                    69 |          24        0.29        96.11
                                    70 |          25        0.30        96.41
                                    71 |          16        0.19        96.60
                                    72 |          19        0.23        96.83
                                    73 |          31        0.37        97.20
                                    74 |          29        0.35        97.54
                                    75 |          38        0.46        98.00
                                    76 |          56        0.67        98.67
                                    77 |          35        0.42        99.09
                                    78 |          32        0.38        99.47
                                    79 |          18        0.22        99.69
                                    80 |          26        0.31       100.00
-----------------------------------------+---------------------------------
                                 Total |       8,348      100.00

. tab cmc_lp

    Century |
 month code |
    of last |
  pregnancy |      Freq.     Percent        Cum.
------------+-----------------------------------
       1321 |         26        0.55        0.55
       1322 |         18        0.38        0.94
       1323 |         32        0.68        1.62
       1324 |         35        0.75        2.37
       1325 |         56        1.19        3.56
       1326 |         38        0.81        4.37
       1327 |         29        0.62        4.99
       1328 |         31        0.66        5.65
       1329 |         19        0.41        6.05
       1330 |         16        0.34        6.40
       1331 |         25        0.53        6.93
       1332 |         24        0.51        7.44
       1333 |         27        0.58        8.02
       1334 |         27        0.58        8.59
       1335 |         51        1.09        9.68
```

```
        1336 |         70         1.49        11.17
        1337 |         48         1.02        12.19
        1338 |         41         0.87        13.07
        1339 |         31         0.66        13.73
        1340 |         37         0.79        14.52
        1341 |         38         0.81        15.33
        1342 |         21         0.45        15.77
        1343 |         26         0.55        16.33
        1344 |         35         0.75        17.08
        1345 |         46         0.98        18.06
        1346 |         38         0.81        18.87
        1347 |         74         1.58        20.44
        1348 |         82         1.75        22.19
        1349 |         82         1.75        23.94
        1350 |         80         1.71        25.64
        1351 |         67         1.43        27.07
        1352 |         70         1.49        28.57
        1353 |         50         1.07        29.63
        1354 |         43         0.92        30.55
        1355 |         40         0.85        31.40
        1356 |         57         1.22        32.62
        1357 |         58         1.24        33.85
        1358 |         64         1.36        35.22
        1359 |         95         2.03        37.24
        1360 |        109         2.32        39.57
        1361 |        100         2.13        41.70
        1362 |        103         2.20        43.89
        1363 |         99         2.11        46.00
        1364 |         78         1.66        47.67
        1365 |         59         1.26        48.92
        1366 |         69         1.47        50.39
        1367 |         57         1.22        51.61
        1368 |         76         1.62        53.23
        1369 |        107         2.28        55.51
        1370 |        100         2.13        57.64
        1371 |        117         2.49        60.14
        1372 |        114         2.43        62.57
        1373 |        117         2.49        65.06
        1374 |        126         2.69        67.75
        1375 |        127         2.71        70.45
        1376 |         97         2.07        72.52
        1377 |        100         2.13        74.65
        1378 |        117         2.49        77.15
        1379 |         95         2.03        79.17
        1380 |        107         2.28        81.45
        1381 |        139         2.96        84.42
        1382 |        123         2.62        87.04
        1383 |        126         2.69        89.73
        1384 |        129         2.75        92.47
        1385 |        115         2.45        94.93
        1386 |        119         2.54        97.46
        1387 |         64         1.36        98.83
        1388 |         39         0.83        99.66
        1389 |         15         0.32        99.98
        1390 |          1         0.02       100.00
------------+-----------------------------------
      Total |      4,691       100.00


.
. * list cases where cmc_lp and b3_01 don't agree if the last pregnancy was a birth
. list cmc_lp b3_01 if lp > 0 & lp == lb & cmc_lp != b3_01

. * there shouldn't be any cases listed.
```

Example 2B – Find the duration of pregnancy for that birth

E2.4   Calculate the duration of the pregnancy and find the position of the month before the pregnancy for the last birth or terminated pregnancy

In the following logic we want to calculate the duration of pregnancy and find the month before the pregnancy. In Stata there is a very useful function called `indexnot` that finds the first character in a string that is <u>not</u> a particular character or substring. We use this function to find the first month prior to the birth or terminated pregnancy (`pos_bp`) that is not a month of pregnancy (a "P"). We first start from the month before the birth or termination (the character after the "B" or "T" – found at `lp+1`), and create a substring (`piece_bp`) from that position to the end of the calendar string (calculated as a substring of length `vcal_len-lp`). We then use `indexnot` to search within that substring. If this function returns 0 it means that the pregnancy was underway at the beginning of the calendar, but otherwise it returns the position in the substring where something other than a "P" was recorded.

To adjust this position to the position in the whole calendar string we add the position of the last pregnancy `lp` – providing the pregnancy did not go back to the beginning of the calendar. Below is an example to explain the calculation:

Example:

> if calendar is as below ("_" used to replace blanks for months after the date of interview for display here):
> ```
> _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
>                      ^
> ```
> lp would be 20.
> the substring to search then starts at the position after the "B" (position 21)
> ```
> _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
>                      |123456789
> ```
> dur_preg is set to 9 by the indexnot function when searching in the substring, and
> after adjusting for the position of lp
> ```
> _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
>                               ^
> ```
> pos_bp is set to 29 (=dur_preg+lp).

In SPSS there is no similar function, so we have to do all of the work ourselves. We can achieve the same thing by writing a loop that checks each month before the birth or terminated pregnancy looking for a code other than a "P". We start by setting `pos_bp` to the position after the birth or terminated pregnancy (`lp+1`), and then loop from that position until we find a character other that is not a "P" or we run out of characters (in which case the pregnancy was underway at the beginning of the calendar).

With this information calculating the duration of pregnancy is now easy. We have the position in the calendar of the last month prior to the pregnancy for the last birth or terminated pregnancy in `pos_bp`, so we just have to subtract the position of the last pregnancy (`lp`) to get the duration of the pregnancy (in months). If we cannot calculate `pos_bp` in the previous step because the pregnancy was underway at the

beginning of the calendar or there was no birth or terminated pregnancy in the calendar, then we therefore cannot calculate the duration of pregnancy.

Stata

```
* Example 2B
* ----------------------
* Find the duration of the pregnancy for the last birth or terminated pregnancy.
* (continues from Example 2A)


* Step 2.4
* get the duration of pregnancy and the position of the month prior to the pregnancy
* start from the position after the birth in the calendar string by creating a substring
* indexnot searches the substring for the first position that is not a "P" (pregnancy)
* piece is the piece of the calendar before the birth ("B") or termination ("T") code
gen piece = substr(vcal_1, lp+1, vcal_len-lp)
* find the length of the pregnancy
gen dur_preg = indexnot(piece, "P") if lp > 0
* dur_preg will be 0 if pregnant at the start of the calendar
label variable dur_preg "Duration of pregnancy"
* e.g. if calendar is as below:
* _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
*                      |12345678^
* dur_preg would be 9 for the last pregnancy (1 B plus 8 Ps)
* if we find something other than a "P" then that is the month before the pregnancy
* if it returns 0 then the pregnancy is underway in the first month of the calendar

* now get the position in the calendar to reflect the full calendar
* not just the piece before the birth, by adding lp
* _bp means 'before pregnancy'. pos_bp means position before pregnancy
gen pos_bp = dur_preg + lp if dur_preg > 0
label variable pos_bp "Position before pregnancy"
label def pos_bp 0 "Pregnant in first month of calendar"
label val pos_bp pos_bp
* e.g. if calendar is as below:
* _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
*                                        ^
* pos_bp would be 29
list vcal_1 lp dur_preg pos_bp in 1/5
tab dur_preg lp_type, m
```

SPSS

```
* Example 2B.
* ----------------------.
* Find the duration of the pregnancy for the last birth or terminated pregnancy.
* (continues from Example 2A).


* Step 2.4.
* get the position of the month prior to the pregnancy and the duration of pregnancy.
* starting in the position after the birth loop and search the substring for the
* first position that is not a "P" (pregnancy).
* _bp means 'before pregnancy'. pos_bp means position before pregnancy.
compute pos_bp = lp+1.
* note that pos_bp cannot be zero or missing as it is used in the substring command following
* it will be reset later.
* loop through each position in the calendar (going back in time) until there is no "P".
loop if (lp > 0 & pos_bp <= vcal_len & char.substr(vcal$1,pos_bp,1) = "P").
+ compute pos_bp = pos_bp+1.
end loop.
* reset pos_bp to missing if there is no birth or if the respondent was already pregnant
* in the first month of the calendar.
if (lp = 0 or pos_bp > vcal_len) pos_bp = $sysmis.
execute.
variable labels pos_bp "Position before pregnancy".
value labels pos_bp 0 "No pregnancy, or pregnant in first month of calendar".
print formats pos_bp (f2.0).
* e.g. if calendar is as below:
* _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
*                               ^.
* pos_bp would be 29.
list variables = vcal$1 pos_bp /cases from 1 to 5.


* find the length of the pregnancy.
if (pos_bp > 0) dur_preg = pos_bp - lp.
variable labels dur_preg "Duration of pregnancy".
print formats dur_preg (f2.0).
frequencies variables=dur_preg.
* note that the duration of pregnancy cannot be calculated for births or pregnancies
* where the pregnancy started in the first month of the calendar or before
* as we don't know the real month the pregnancy started.

* e.g. if calendar is as below:
* _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
*                       |12345678^
* dur_preg would be 9 for the last pregnancy (1 B plus 8 Ps).
list variables = vcal$1 lp dur_preg pos_bp /cases from 1 to 5.
crosstabs /tables=dur_preg by lp_type /count=asis.
```

Stata output

```
. * Example 2B
. * ----------------------
. * Find the duration of the pregnancy for the last birth or terminated pregnancy.
. * (continues from Example 2A)
.
.
. * Step 2.4
. * get the duration of pregnancy and the position of the month prior to the pregnancy
. * start from the position after the birth in the calendar string by creating a substring
. * indexnot searches the substring for the first position that is not a "P" (pregnancy)
. * piece is the piece of the calendar before the birth ("B") or termination ("T") code
. gen piece = substr(vcal_1, lp+1, vcal_len-lp)
```

```
(26 missing values generated)

. * find the length of the pregnancy
. gen dur_preg = indexnot(piece, "P") if lp > 0
(3,657 missing values generated)

. * dur_preg will be 0 if pregnant at the start of the calendar
. label variable dur_preg "Duration of pregnancy"

. * e.g. if calendar is as below:
. * _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
. *                      |12345678^
. * dur_preg would be 9 for the last pregnancy (1 B plus 8 Ps)
. * if we find something other than a "P" then that is the month before the pregnancy
. * if it returns 0 then the pregnancy is underway in the first month of the calendar
.
. * now get the position in the calendar to reflect the full calendar
. * not just the piece before the birth, by adding lp
. * _bp means 'before pregnancy'. pos_bp means position before pregnancy
. gen pos_bp = dur_preg + lp if dur_preg > 0
(3,939 missing values generated)

. label variable pos_bp "Position before pregnancy"

. label def pos_bp 0 "Pregnant in first month of calendar"

. label val pos_bp pos_bp

. * e.g. if calendar is as below:
. * _____00000BPPPPPPPP000000555555500000TPP00000000000000BPPPPPPPP00000000
. *                              ^
. * pos_bp would be 29
. list vcal_1 lp dur_preg pos_bp in 1/5
```

```
     +--------------------------------------------------------------------------------+
  1. |                                                                         vcal_1 |
     |           00000BPPPPPPPP000000000000000000000000BPPPPPPPP00000000000000000000000 |
     |--------------------------------------------------------------------------------|
     |                                        lp  |   dur_preg  |    pos_bp   |
     |                                        20  |         9   |        29   |
     +--------------------------------------------------------------------------------+

     +--------------------------------------------------------------------------------+
  2. |                                                                         vcal_1 |
     |           PPPPPP000000000000000000000000000BPPPPPPPP00000000000000000000000000000 |
     |--------------------------------------------------------------------------------|
     |                                        lp  |   dur_preg  |    pos_bp   |
     |                                        45  |         9   |        54   |
     +--------------------------------------------------------------------------------+

     +--------------------------------------------------------------------------------+
  3. |                                                                         vcal_1 |
     |           0000000000000000000000000000000000000000000000000000000000000000000000 |
     |--------------------------------------------------------------------------------|
     |                                        lp  |   dur_preg  |    pos_bp   |
     |   No birth or terminated pregnancy in calendar   |         .   |         .   |
     +--------------------------------------------------------------------------------+

     +--------------------------------------------------------------------------------+
  4. |                                                                         vcal_1 |
     |           0000000000BPPPPPPPP00000000000BPPPPPPPP0000000000000000000000000000000 |
     |--------------------------------------------------------------------------------|
     |                                        lp  |   dur_preg  |    pos_bp   |
     |                                        25  |         9   |        34   |
     +--------------------------------------------------------------------------------+
```

```
     +--------------------------------------------------------------------------------+
  5. |                                                                         vcal_1 |
     |          0BPPPPPPPP000000000000000000000000BPPPPPPPP000000000000000000000000 |
     |--------------------------------------------------------------------------------|
     |                                                  lp   |   dur_preg   |  pos_bp    |
     |                                                  16   |          9   |     25     |
     +--------------------------------------------------------------------------------+

. tab dur_preg lp_type, m

  Duration | Birth or terminated pregnancy in
        of |           calendar
 pregnancy |     Birth  Terminate          . |     Total
-----------+---------------------------------+----------
         0 |       277          5          0 |       282
         1 |         0          9          0 |         9
         2 |         0         43          0 |        43
         3 |         0         75          0 |        75
         4 |         0         61          0 |        61
         5 |         0         29          0 |        29
         6 |         0         15          0 |        15
         7 |         1          6          0 |         7
         8 |        70         10          0 |        80
         9 |     3,496         10          0 |     3,506
        10 |       572          0          0 |       572
        11 |        12          0          0 |        12
         . |         0          0      3,657 |     3,657
-----------+---------------------------------+----------
     Total |     4,428        263      3,657 |     8,348
```

E2.5   Find the last month before the pregnancy (within the last 5 years) in which the respondent has a code different from 0 (something other than non-use of contraception)

To find the last month before the last pregnancy in which a contraceptive method was used, we need to search for the last month in which any code except 0 is used. We are restricting the search to just the 60 months (five years) preceding the pregnancy.

In Stata we can again use the `indexnot` function to look for the last non-zero code found before the pregnancy. As before, the `indexnot` function is used with a substring of the calendar starting before the pregnancy for the last birth (position `pos_bp`), and going back to the beginning of the calendar. `lnz` (standing for "last non-zero") is the position of the last non-zero code in the calendar before the pregnancy, relative to the substring. From this the position of the last non-zero (`pos_lnz`) is then calculated by adding the month before the pregnancy of the last birth (`pos_bp`). If the month of the last non-zero code is earlier than five years before the interview we set `pos_lnz` to 0 indicating no contraceptive use in that time period preceding the last pregnancy.

Example:

> if calendar is as below ("_" used to replace blanks for months after the date of interview for display here):
> _____00000BPPPPPPPP0000000555555500000TPP00000000000000BPPPPPPPP00000000
>   ^
> pos_bp would be 29.
> the substring to search then starts at that position
> _____00000BPPPPPPPP<mark>0000000555555500000TPP00000000000000BPPPPPPPP00000000</mark>
>   ^   ^
> lnz is set to 7 by the indexnot function when searching in the substring and, after adjusting for the position of pos_bp, pos_lnz is set to 35 = (29+7-1).

In SPSS, as before we have to write our own loop to find the last non-zero code, starting from the month before the pregnancy (`pos_bp`), and then loop through each month going back to find the last month in which a code other than zero is used. The function `char.substr` is used to compare the character in the calendar with "0". In contrast to the Stata code, the SPSS code calculates pos_lnz directly, and does not need to calculate the intermediate variable `lnz`.

Stata

```
* Example 2C
* ----------------------
* Find last method used before pregnancy, but after any other pregnancy in the last 5 year
* (continues from Example 2B)



* Step 2.5
* find the last code that is not 0 before the pregnancy (using indexnot),
* searching in a substring of the calendar from the month before pregnancy and earlier,
* but not more than 5 years back
* lnz means 'last non-zero before the pregnancy'
gen lnz = indexnot(substr(vcal_1, pos_bp, vcal_len - pos_bp + 1),"0") ///
  if inrange(pos_bp, 1, vcal_len)
* get the actual position in the calendar of the last non-zero before the last birth
gen pos_lnz = pos_bp + lnz - 1 if inrange(lnz, 1, vcal_len)
* if last non-zero is more than 5 years before interview, set position to 0
replace pos_lnz = 0 if lnz == 0 | (pos_lnz != . & pos_lnz > v018+59)
label variable pos_lnz "Position in calendar of last non-zero before pregnancy"
label def pos_lnz 0 "No non-zero preceding the pregnancy in the last 5 years"
label val pos_lnz pos_lnz

* list a few cases to check
list vcal_1 lp pos_bp pos_lnz in 1/5
```

SPSS

```
* Example 2C.
* ----------------------.
* Find last method used before pregnancy in the last 5 year, even if not immediately before.
* (continues from Example 2B).



* Step 2.5.
* find the last code that is not 0 before the pregnancy,
* but not more than 5 years back.
* lnz means 'last non-zero before the pregnancy'.
compute pos_lnz = pos_bp.
do if (pos_lnz > 0).
+ loop if (pos_lnz >= 1 & pos_lnz <= vcal_len & char.substr(vcal$1,pos_lnz,1) = "0").
+    compute pos_lnz = pos_lnz+1.
+ end loop.
end if.
* if last non-zero is more than 5 years before interview, set position to 0.
if (pos_lnz > v018+59) pos_lnz = 0.
execute.
variable labels pos_lnz "Position in calendar of last non-zero before pregnancy".
value labels pos_lnz 0 "No non-zero preceding the pregnancy in the last 5 years".
print formats pos_lnz (f2.0).

* list a few cases to check.
list variables = vcal$1 lp pos_bp pos_lnz /cases from 1 to 5.
```

Stata output

```
. * Example 2C
. * ----------------------
. * Find last method used before pregnancy, but after any other pregnancy in the last 5 year
. * (continues from Example 2B)
.
.
. * Step 2.5
. * find the last code that is not 0 before the pregnancy (using indexnot),
. * searching in a substring of the calendar from the month before pregnancy and earlier,
```

```
. * but not more than 5 years back
. * lnz means 'last non-zero before the pregnancy'
. gen lnz = indexnot(substr(vcal_1, pos_bp, vcal_len - pos_bp + 1),"0") ///
>    if inrange(pos_bp, 1, vcal_len)
(3,939 missing values generated)

. * get the actual position in the calendar of the last non-zero before the last birth
. gen pos_lnz = pos_bp + lnz - 1 if inrange(lnz, 1, vcal_len)
(6,083 missing values generated)

. * if last non-zero is more than 5 years before interview, set position to 0
. replace pos_lnz = 0 if lnz == 0 | (pos_lnz != . & pos_lnz > v018+59)
(2,578 real changes made)

. label variable pos_lnz "Position in calendar of last non-zero before pregnancy"

. label def pos_lnz 0 "No non-zero preceding the pregnancy in the last 5 years"

. label val pos_lnz pos_lnz

.
. * list a few cases to check
. list vcal_1 lp pos_bp pos_lnz in 1/5


     +----------------------------------------------------------------------------------------------+
  1. |                                                                          vcal_1              |
     |            00000BPPPPPPPP000000000000000000000000BPPPPPPPP00000000000000000000               |
     |----------------------------------------------------------------------------------------------|
     |                                lp | pos_bp |                                        pos_lnz |
     |                                20 |    29 |                                             52 |
     +----------------------------------------------------------------------------------------------+


     +----------------------------------------------------------------------------------------------+
  2. |                                                                          vcal_1              |
     |            PPPPPP0000000000000000000000000BPPPPPPPP000000000000000000000000000000             |
     |----------------------------------------------------------------------------------------------|
     |                                lp | pos_bp |                                        pos_lnz |
     |                                45 |    54 | No non-zero preceding the pregnancy in the last 5 years |
     +----------------------------------------------------------------------------------------------+


     +----------------------------------------------------------------------------------------------+
  3. |                                                                          vcal_1              |
     |            0000000000000000000000000000000000000000000000000000000000000000000000             |
     |----------------------------------------------------------------------------------------------|
     |                                lp | pos_bp |                                        pos_lnz |
     | No birth or terminated pregnancy in calendar |      . |                                  . |
     +----------------------------------------------------------------------------------------------+


     +----------------------------------------------------------------------------------------------+
  4. |                                                                          vcal_1              |
     |            0000000000BPPPPPPPP00000000000BPPPPPPPP00000000000000000000000000000               |
     |----------------------------------------------------------------------------------------------|
     |                                lp | pos_bp |                                        pos_lnz |
     |                                25 |    34 |                                             45 |
     +----------------------------------------------------------------------------------------------+


     +----------------------------------------------------------------------------------------------+
  5. |                                                                          vcal_1              |
     |            0BPPPPPPPP00000000000000000000000BPPPPPPPP00000000000000000000000000               |
     |----------------------------------------------------------------------------------------------|
     |                                lp | pos_bp |                                        pos_lnz |
     |                                16 |    25 |                                             49 |
     +----------------------------------------------------------------------------------------------+
```

58

E2.6   Check if the respondent used a method at that time

Now we want to capture the non-zero code from the calendar at that time. We get the code from the calendar for the month pointed to by `pos_lnz`, using the function `substr` or `char.substr`, respectively, checking that we have a valid position in the calendar in `pos_lnz`. We also check, though, to see if this was within the five years preceding the interview using the `inrange` function in Stata, and the `do if` condition in SPSS. Note that for SPSS we have to define `code_lnz` as a string of one character prior to setting it.

Now we want to check if the respondent was using a contraceptive method in that month. As the list of codes that are contraceptive methods is mostly standard, but does include some survey-specific codes for methods, it is actually easier to check if the code is for something other than a contraceptive method. In most surveys the only other codes will be "0" (not using), "B" (birth), "P" (pregnancy), and "T" (termination/non-live birth)[9]. In Stata, we use the function `inlist` to check if the code in `code_lnz` is in the list of codes above. We set the variable `used_bp` to 0 if it is "0", "B", "P", or "T" and to 1 if it is not (meaning a method was being used). In SPSS, we achieve the same by using the function `char.index` to see if `code_lnz` is in the list of codes above.

Stata
```
* Step 2.6
* check if the respondent is using a method before the pregnancy but in the last 5 years
gen code_lnz = substr(vcal_1, pos_lnz, 1) if inrange(pos_lnz, v018, v018+59)
replace code_lnz = "0" if pos_lnz == 0

* if the code is NOT(!) a zero ("0"), a "B", "P" or "T" then the respondent was using a method
gen used_bp = !inlist(code_lnz, "0","B","P","T") if code_lnz != ""
label variable code_lnz "Last non-zero code before pregnancy"
label variable used_bp "Using a method before the last pregnancy"
label def used_bp 0 "No" 1 "Yes"
label val used_bp used_bp

* list a few cases to check
list vcal_1 lp pos_bp pos_lnz code_lnz used_bp in 1/5
```

---

[9] Note that a small number of surveys also include a code for hysterectomy, that is not generally considered a contraceptive method, and the logic should be adapted for these cases.

SPSS

```
* Step 2.6.
* check if the respondent is using a method before the pregnancy but in the last 5 years.
string code_lnz (A1).
variable labels code_lnz "Last non-zero code before pregnancy".

do if (pos_lnz >= 1 & pos_lnz <= v018+59).
+ compute code_lnz = char.substr(vcal$1, pos_lnz, 1).
* if the code is NOT(!) a zero ("0"), a "B", "P", or "T" then the respondent was using a method.
+ compute used_bp = (char.index("0BPT",code_lnz) = 0).
* char.index returns the position of code_lnz in the string 0BPT,
* or 0 if it is not in the string.
* char.index(...) = 0 will set used_bp to 1 (meaning using a method)
* if code_lnz is NOT "0","B","P","T",
* and will set used_bp to 0 (meaning NOT using a method) if the code is one of "0","B","P","T".
else if (lp > 0).
+ compute code_lnz = "0".
+ compute used_bp = 0.
end if.

variable labels used_bp "Using a method before the last pregnancy".
value labels used_bp 0 "No" 1 "Yes".
print formats used_bp (f1.0).

* list a few cases to check.
list variables = vcal$1 lp pos_bp pos_lnz code_lnz used_bp /cases from 1 to 5.
```

Stata output

```
. * Step 2.6
. * check if the respondent is using a method before the pregnancy but in the last 5 years
. gen code_lnz = substr(vcal_1, pos_lnz, 1) if inrange(pos_lnz, v018, v018+59)
(6,517 missing values generated)

. replace code_lnz = "0" if pos_lnz == 0
(2,578 real changes made)

.
. * if the code is NOT(!) a zero ("0"), a "B", "P" or "T" then the respondent was using a method
. gen used_bp = !inlist(code_lnz, "0","B","P","T") if code_lnz != ""
(3,939 missing values generated)

. label variable code_lnz "Last non-zero code before pregnancy"

. label variable used_bp "Using a method before the last pregnancy"

. label def used_bp 0 "No" 1 "Yes"

. label val used_bp used_bp

.
. * list a few cases to check
. list vcal_1 lp pos_bp pos_lnz code_lnz used_bp in 1/5

     +----------------------------------------------------------------------------------------------------------+
  1. |                                                                                         vcal_1           |
     |                    00000BPPPPPPPP00000000000000000000000BPPPPPPPP0000000000000000000000                  |
     |----------------------------------------------------------------------------------------------------------|
     |                              lp | pos_bp |                                      pos_lnz | code_lnz |
     |                              20 |     29 |                                           52 |        B |
     |----------------------------------------------------------------------------------------------------------|
     |                                              used_bp                                                      |
     |                                                 No                                                        |
     +----------------------------------------------------------------------------------------------------------+
```

60

```
      +-------------------------------------------------------------------------------------------------------+
 2. |                                                                              vcal_1                      |
      |                      PPPPPP000000000000000000000000BPPPPPPPP00000000000000000000000000000              |
      |-------------------------------------------------------------------------------------------------------|
      |                                    lp | pos_bp |                                    pos_lnz | code_lnz |
      |                                    45 |     54 | No non-zero preceding the pregnancy in the last 5 years |        0 |
      |-------------------------------------------------------------------------------------------------------|
      |                                                    used_bp                                             |
      |                                                       No                                              |
      +-------------------------------------------------------------------------------------------------------+

      +-------------------------------------------------------------------------------------------------------+
 3. |                                                                              vcal_1                      |
      |                      000000000000000000000000000000000000000000000000000000000000000000000            |
      |-------------------------------------------------------------------------------------------------------|
      |                                    lp | pos_bp |                                    pos_lnz | code_lnz |
      | No birth or terminated pregnancy in calendar |     . |                                    . |          |
      |-------------------------------------------------------------------------------------------------------|
      |                                                    used_bp                                             |
      |                                                        .                                              |
      +-------------------------------------------------------------------------------------------------------+

      +-------------------------------------------------------------------------------------------------------+
 4. |                                                                              vcal_1                      |
      |                      0000000000BPPPPPPPP00000000000BPPPPPPPP00000000000000000000000000000              |
      |-------------------------------------------------------------------------------------------------------|
      |                                    lp | pos_bp |                                    pos_lnz | code_lnz |
      |                                    25 |     34 |                                    45 |        B |
      |-------------------------------------------------------------------------------------------------------|
      |                                                    used_bp                                             |
      |                                                       No                                              |
      +-------------------------------------------------------------------------------------------------------+

      +-------------------------------------------------------------------------------------------------------+
 5. |                                                                              vcal_1                      |
      |                      0BPPPPPPPPP000000000000000000000000BPPPPPPPPP00000000000000000000000000           |
      |-------------------------------------------------------------------------------------------------------|
      |                                    lp | pos_bp |                                    pos_lnz | code_lnz |
      |                                    16 |     25 |                                    49 |        B |
      |-------------------------------------------------------------------------------------------------------|
      |                                                    used_bp                                             |
      |                                                       No                                              |
      +-------------------------------------------------------------------------------------------------------+
```

E2.7   Convert the alphanumeric string variable for the method to a numeric code

Now we want to use the code for the method (if she was using a contraceptive method), and convert that code to a numeric code. We could do this with a complicated recode or a long series of 'if' conditions, but it is actually easier to do this by searching for the method code in a string of codes and returning the position of the code in that string as the numeric equivalent. For example, if we had codes "A", "B", "C", and "D" and we wanted to recode them to 1, 2, 3, and 4. We could use:

Stata: `gen num = strpos("ABCD",code)`

or

SPSS: `compute num = char.index("ABCD",code).`

and this would assign 1 to `num` if `code` was "A", 2 if "B", 3 if "C", and 4 if "D". We use a slightly longer version of this approach to recode the alpha[10] string version of the method code to a number, and set `method_bp` to the numeric method code.

---

[10] "Alpha" means an alphanumeric character value or variable. An alphanumeric value is a letter or a digit (or in some cases another printable character, e.g. $ or %) that is stored as a string.

As an alternative, there is survey-specific recoding of the contraceptive method codes that can be found in Calendar recoding.do and Calendar recoding.sps, respectively. This code handles all of the survey-specific alpha method and reasons codes that have been used in past surveys, and recodes them to a set of standardized numeric method and reasons codes. These logic also add the value labels for the methods and the reasons. If you use the Calendar recoding, comment out recoding for method_bp before, and the labeling of the values (but not the variable label) in step 2.8.

Now we want to check if the respondent was actually using a contraceptive method at that time, because a "B", "P", or "T" would have been included in the code above. If used_bp is 0 (respondent not using a method) then we can set method_bp to 0.

Stata

```
* Step 2.7
* last method used before pregnancy, but may have been followed by a period of non-use
* converting the string variable to numeric, although it isn't really necessary for most analyses

* set up a list of codes used in the calendar, with each position matching the coding in V312
* use a tilde (~) to mark gaps in the coding that are not used for this survey
* e.g. Emergency contraception and Standard days method do not exist in this calendar
* note that some of the codes are survey specific so this list may need adjusting
scalar methodlist = "123456789WNALCF~M~"
gen method_bp = strpos(methodlist,code_lnz) if code_lnz != ""
* convert the missing code to 99
replace method_bp = 99 if code_lnz == "?"
* now check if there are any method codes that were not converted, and change these to -1
replace method_bp = -1 if method_bp == 0 & used_bp == 1

* alternatively,
* use the do file below to set up survey specific coding using scalar methodlist and label method
* and recode the method and/or reasons for discontinuation
* include the path to the do file if needed
*run "Calendar recoding.do" code_lnz method_bp
* and skip the value labeling in step 2.8 as the do file above includes the value labeling

* if no method was used, set method_bp to 0
replace method_bp =  0 if used_bp == 0
```

```
* Step 2.7.
* last method used before pregnancy, but may have been followed by a period of non-use.
* converting the string variable to numeric if desired, although it isn't really necessary for
most analyses.
* set up a list of codes used in the calendar, with each position matching the coding in V312.
* use a tilde (~) to mark gaps in the coding that are not used for this survey
* e.g. Emergency contraception and Standard days method do not exist in this calendar.
* note that some of the codes are survey specific so this list may need adjusting.
if (code_lnz <> " ") method_bp = char.index("123456789WNALCF~M~",code_lnz).
* convert the missing code to 99.
if (code_lnz = "?") method_bp = 99.
* now check if there are any codes that were not converted, and change these to -1.
if (method_bp = 0 & used_bp) method_bp = -1.

* alternatively,
* use the commands below to set up survey specific coding and recode
* the method and/or reasons for discontinuation.
* include the path to the insert file if needed.
* load the macro for the recoding.
*insert file="Calendar recoding.sps".
* now recode the method and/or reason for discontinuation.
*!Calendar_recoding code_lnz method_bp.
* and skip the value labeling in step 2.8 as the insert file above includes the value labeling.

* if no method was used, set method_bp to 0.
if (used_bp = 0) method_bp =  0.
```

E2.8   Label the method variable and codes

Having created the variable `method_bp` we now want to label the variable and its categories and check the variable that we have created. If the calendar recoding routines are used in step 2.7 (they are commented out by default), then it is only necessary to label the variable, and the labeling of the values should be commented out in the code below. The logic below also lists a few cases of method use to check that the variable has been correctly created.

Stata

```
* Step 2.8
* label the method variable and codes
label variable method_bp "Method used before the last pregnancy (numeric)"
label def method ///
  0 "No method used" ///
  1 "Pill" ///
  2 "IUD" ///
  3 "Injectable" ///
  4 "Diaphragm" ///
  5 "Condom" ///
  6 "Female sterilization" ///
  7 "Male sterilization" ///
  8 "Periodic abstinence/Rhythm" ///
  9 "Withdrawal" ///
 10 "Other traditional method" ///
 11 "Norplant" ///
 12 "Abstinence" ///
 13 "Lactational amenorrhea method" ///
 14 "Female condom" ///
```

```
  15 "Foam and Jelly" ///
  16 "Emergency contraception" ///
  17 "Other modern method" ///
  18 "Standard days method" ///
  99 "Missing" ///
  -1 "***Unknown code not recoded***"


label val method_bp method
tab method_bp

* list all cases in the first 500 that used before the pregnancy
* anytime in the 5 years before interview
list vcal_1 lp pos_lnz code_lnz method_bp if used_bp==1 in 1/500
```

SPSS

```
* Step 2.8.
* label the method variable and codes.
variable labels method_bp "Method used before the last pregnancy (numeric)".
value labels method_bp
   0 "No method used"
   1 "Pill"
   2 "IUD"
   3 "Injectable"
   4 "Diaphragm"
   5 "Condom"
   6 "Female sterilization"
   7 "Male sterilization"
   8 "Periodic abstinence/Rhythm"
   9 "Withdrawal"
  10 "Other traditional method"
  11 "Norplant"
  12 "Abstinence"
  13 "Lactational amenorrhea method"
  14 "Female condom"
  15 "Foam and Jelly"
  16 "Emergency contraception"
  17 "Other modern method"
  18 "Standard days method"
  99 "Missing"
  -1 "***Unknown code not recoded***".
print formats method_bp (f2.0).
frequencies variables=method_bp.

* list the first 15 cases that used before the pregnancy
* anytime in the 5 years before interview.
filter off.
filter by used_bp.
list variables = vcal$1 lp pos_lnz code_lnz method_bp /cases from 1 to 15.
filter off.
```

Stata output

```
. * Step 2.8
. * label the method variable and codes
. label variable method_bp "Method used before the last pregnancy (numeric)"

. label def method ///
>    0 "No method used" ///
>    1 "Pill" ///
>    2 "IUD" ///
>    3 "Injectable" ///
>    4 "Diaphragm" ///
>    5 "Condom" ///
```

```
>    6 "Female sterilization" ///
>    7 "Male sterilization" ///
>    8 "Periodic abstinence/Rhythm" ///
>    9 "Withdrawal" ///
>   10 "Other traditional method" ///
>   11 "Norplant" ///
>   12 "Abstinence" ///
>   13 "Lactational amenorrhea method" ///
>   14 "Female condom" ///
>   15 "Foam and Jelly" ///
>   16 "Emergency contraception" ///
>   17 "Other modern method" ///
>   18 "Standard days method" ///
>   99 "Missing" ///
>   -1 "***Unknown code not recoded***"


.
. label val method_bp method

. tab method_bp

   Method used before the last |
          pregnancy (numeric) |      Freq.     Percent        Cum.
-------------------------------+-----------------------------------
              No method used |      4,090       92.76       92.76
                        Pill |        117        2.65       95.42
                         IUD |          4        0.09       95.51
                  Injectable |        122        2.77       98.28
                      Condom |          8        0.18       98.46
     Periodic abstinence/Rhythm |       3        0.07       98.53
                  Withdrawal |          1        0.02       98.55
        Other traditional method |     14        0.32       98.87
                    Norplant |         17        0.39       99.25
   Lactational amenorrhea method |     33        0.75      100.00
-------------------------------+-----------------------------------
                       Total |      4,409      100.00


.
. * list all cases in the first 500 that used before the pregnancy
. * anytime in the 5 years before interview
. list vcal_1 lp pos_lnz code_lnz method_bp if used_bp==1 in 1/500


    +-----------------------------------------------------------------------------------------------------------------+
    |                                                              vcal_1   lp   pos_lnz   code_lnz   method_bp |
    |-----------------------------------------------------------------------------------------------------------------|
 35. |          1111111000000000000000000000BPPPPPPPP0011111111111111000000000000000000   39     50        1        Pill |
254. |          3333333333333311111111111111111111000000000000000BPPPPPPPPP000001111111   61     74        1        Pill |
257. |          11TPPP111111111111111111111111111111111111111111111111111110000000BPPP   17     21        1        Pill |
265. |          000000000000BPPPPPPPPP0003333333333333333330000000000BPPPPPPPPP00000000   25     37        3   Injectable |
283. |          00BPPPPPPPPPP000NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN000000000000000   15     28        N    Norplant |
    |-----------------------------------------------------------------------------------------------------------------|
285. |          NNN000000000000000000000000000000BPPPPPPPPPP00001111111111111111111111   44     58        1        Pill |
290. |          0000000BPPPPPPPP003333333333333333300000000000000000000000000000000000   20     31        3   Injectable |
310. |          000000000BPPPPPPPPPP0011111111111111111111111111111111111111111100000000   21     33        1        Pill |
359. |          3333300TPPPPPP0000111111110BPPPPPPPPP00000000000000000000000000000000   21     32        1        Pill |
394. |          00000000000000000BPPPPPPPPP000000000000003333333333333333333333333333   31     52        3   Injectable |
    |-----------------------------------------------------------------------------------------------------------------|
409. |          00000000BPPPPPPPPP033333333333333333333330000000000000000000000BPPPPPP   23     33        3   Injectable |
416. |          0000000000000BPPPPPPPPP1111111111111000000000000000BPPPPPPPPP000000   29     38        1        Pill |
426. |          00BPPPPPPPPP11111111111NNNNNNNNNNNNNNNNNNNNNN0000000000000000000000   17     26        1        Pill |
428. |          00000BPPPPPPPPPNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN   20     31        N    Norplant |
429. |          0000000000BPPPPPPPPP0NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN000000BPPP   25     35        N    Norplant |
    +-----------------------------------------------------------------------------------------------------------------+
```

E2.9   Weight and tabulate the method used by type of pregnancy outcome

Finally, we compute the weight and tabulate the data. It is important to use the correct weights when analyzing DHS data. When analyzing the calendar data the correct weight to use is the women's weight given in `v005`. The weights in DHS datasets are stored with 6 implied decimal places and so should be divided by 1000000 (one million). For more information on weighting data, see the [DHS Program tutorial videos on sampling and weighting](#).

In this example we are producing a simple cross-tabulation of the last method used prior to the last pregnancy but in the five years preceding the survey by the pregnancy outcome.

Stata
```
* Step 2.9
* compute the weight variable and weight the data.
gen wt = v005/1000000
* tab the last method used prior to the pregnancy by the type of pregnancy outcome
tab method_bp lp_type [iw=wt], col
```
SPSS
```
* Step 2.9.
* compute the weight variable and weight the data.
compute wt = v005/1000000.
weight by wt.
* crosstab the last method used prior to the pregnancy by the type of pregnancy outcome.
crosstabs /tables=method_bp by lp_type /count=asis /cell=column count.
```

Stata output
```
. * Step 2.9
. * compute the weight variable and weight the data.
. gen wt = v005/1000000

. * tab the last method used prior to the pregnancy by the type of pregnancy outcome
. tab method_bp lp_type [iw=wt], col

+-------------------+
| Key               |
|-------------------|
|      frequency    |
| column percentage |
+-------------------+

   Method used before |  Birth or terminated
   the last pregnancy | pregnancy in calendar
            (numeric) |    Birth  Terminate |     Total
---------------------+---------------------+----------
      No method used | 3,726.587  227.25559 |3,953.8428
                     |     91.71      84.24 |     91.24
---------------------+---------------------+----------
                 Pill | 116.92239  17.927922 | 134.85031
                     |      2.88       6.65 |      3.11
---------------------+---------------------+----------
                 IUD |3.08249402    .206567 |  3.289061
                     |      0.08       0.08 |      0.08
---------------------+---------------------+----------
           Injectable | 140.84152  14.973971 | 155.81549
```

```
                       |      3.47         5.55 |      3.60
-----------------------+--------------------+---------
             Condom | 8.8306651    4.903457 |13.7341221
                       |      0.22         1.82 |      0.32
-----------------------+--------------------+---------
Periodic abstinence/R |  3.022521           0 |  3.022521
                       |      0.07         0.00 |      0.07
-----------------------+--------------------+---------
         Withdrawal | .80930901           0 | .80930901
                       |      0.02         0.00 |      0.02
-----------------------+--------------------+---------
Other traditional met |13.7197451  .69064802 | 14.410393
                       |      0.34         0.26 |      0.33
-----------------------+--------------------+---------
           Norplant | 21.725411    1.271946 | 22.997357
                       |      0.53         0.47 |      0.53
-----------------------+--------------------+---------
Lactational amenorrhea | 27.987985    2.548405 |  30.53639
                       |      0.69         0.94 |      0.70
-----------------------+--------------------+---------
              Total | 4,063.529   269.77851 | 4,333.308
                       |    100.00      100.00 |    100.00
```

Example 3 – Postpartum family planning

For this example we are going to look at postpartum family planning. Specifically, we will calculate the proportion of women using a traditional or modern method of family planning within 12 months of their most recent birth in the period one to five years (12-59 months) preceding the survey.

This example produces a simple frequency of whether the respondent used either a traditional method or a modern method within 12 months postpartum following a birth. We will limit the analysis to births that took place in the period one to five years (12-59 months) prior to the date of interview to ensure that there are at least 12 months of data following the birth.

This example demonstrates alternative ways to process the calendar, including trimming the calendar string, splitting out a substring, and reversing the substring. In Example 2, the logic found the last birth or terminated pregnancy, then located the month before the pregnancy, and then the last month of use of contraception progressing from left to right through the calendar. In Example 3, the logic initially finds the last birth searching from left to right, but then splits out the substring of the time period since that birth, and reverses that substring to facilitate moving forwards in time from the birth. While this is not the only way to process the calendar, it is often useful to think of reversing a substring of the calendar when searching forward in time.

Logic for example 3 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example3.do	Stata\Example3.log
SPSS	SPSS\Example3.sps	SPSS\Example3.txt

E3.0   Open the datasets, keeping just the data needed

First, the dataset is opened, selecting the variables to use. In this example we are only using the calendar data on births, pregnancies and contraceptive use (`vcal_1`/`VCAL$1`) and the sample weight (`v005`).

We will create a variable for postpartum family planning (`ppfp`) and a variable for selecting the denominator for those women with a birth in the period one to five years (12-59 months) preceding the survey (`birth1_5`).

Stata

```
* DHS Calendar Tutorial - Example 3
* whether woman used family planning at any point in first year after most recent birth

* variable ppfp (post-partum family planning) will be
* 0 = No method used in first 12 months after birth
* 1 = Traditional method used in first 12 months after birth
* 2 = Modern method used in first 12 months after birth
* restricted to women whose most recent birth is at least 12 months before interview
* back to five years before interview
* birth1_5=1 if the woman meets these criteria

* download the model dataset for individual women's recode: "ZZIR62FL.DTA"
```

```
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
cd "C:\Data\DHS_model"

* open the dataset to use, selecting just the variables we are going to use
use vcal_1 v000 v005 v007 using "ZZIR62FL.DTA", clear
```

SPSS

```
* DHS Calendar Tutorial - Example 3.
* whether woman used family planning at any point in first year after most recent birth.

* variable ppfp (post-partum family planning) will be
* 0 = No method used in first 12 months after birth
* 1 = Traditional method used in first 12 months after birth
* 2 = Modern method used in first 12 months after birth.
* restricted to women whose most recent birth is at least 12 months before interview
* back to five years before interview.
* birth1_5=1 if the woman meets these criteria.

* download the model dataset for individual women's recode: "ZZIR62FL.SAV"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm .

* change to a working directory where the data are stored
* or add the full path to the 'get file' command below.
cd "C:\Data\DHS_model".

* open the dataset to use, and just keep the variables we are going to use.
get file="ZZIR62FL.SAV" / keep vcal$1 v000 v005 v007.
```

E3.1   Find the last birth in the period 12-59 months before the survey, and split out the postpartum
        period after the birth

First we trim the calendar so that the first month in the string is the date of interview. We then look for
the last birth in the calendar (at position `lb`), and if we find one then we check to see if it was in the period
12-59 months before the interview (positions 13-60 if the month of interview [month 0 before interview]
is in position 1). We then extract the postpartum period (`pp1`) since the last birth. In Stata the code
demonstrates the use of the split command to split the string into separate sub strings following each
birth, even though we could more simply just create a substring. SPSS does not have an equivalent
command, so the code simply extracts the substring.

Stata

```
* Step 3.1
* remove the leading blanks for the months after the interview
gen trim_cal=trim(vcal_1)

* search for the last birth in the calendar
gen lb=strpos(trim_cal,"B")
* eligible if most recent birth is between 13 months ago and 60 months ago
* equivalent to months 12-59 preceding the survey when month of interview is month 0
gen birth1_5=inrange(lb,13,60)

* split into strings separated by births ("B") for each postpartum period
split trim_cal, p("B") gen(pp)
* we only want pp1, following the most recent birth, drop all the others
foreach x of varlist pp* {
```

```
  if "`x'" != "pp1" {
    drop `x'
  }
}
```

SPSS

```
* Step 3.1.
* remove the leading blanks for the months after the interview.
string trim_cal (a80).
compute trim_cal=ltrim(vcal$1).

* search for the last birth in the calendar.
compute lb=char.index(trim_cal,"B").
* eligible if most recent birth is between 13 months ago and 60 months ago
* equivalent to months 12-59 preceding the survey when month of interview is month 0.
compute birth1_5=(lb >= 13 & lb <= 60).

* extract the postpartum period after the birth.
string pp1 (a80).
if (birth1_5 = 1) pp1 = char.substr(trim_cal,1,lb-1).
execute.
```

E3.2   Extract the first 12 months since the birth

To look just at the 12 months since the most recent birth it is simplest to reverse the substring following the birth, and extract the first 12 months. In Stata this can be achieved with the reverse() function, but in SPSS we use a user-defined macro (!ReverseStr) to reverse the string. We also need to define the string variables to be created before they are computed. In SPSS pp1_rev is defined as an 80 character string, although the actual contents will be shorter than that. In Stata postbirth is defined as a 12 character string as that is the maximum length we will extract. The 12 month period following the birth is only extracted into postbirth if the respondent's last birth was in the period one to five years before the survey.

Stata

```
* Step 3.2
* reverse the string for the period after the birth
* so we are going forward in time from the birth
* limit to women whose most recent birth is at least 12 months before interview
gen postbirth=reverse(pp1) if birth1_5 == 1
* and then extract the first 12 months
replace postbirth=substr(postbirth,1,12)
```

SPSS

```
* Step 3.2.
* Macro to reverse a string.
define !ReverseStr(!positional !tokens(1) /!positional !tokens(1))
* first parameter is old variable, second is new variable.
compute !2 = !1.
string #a (A1).
compute #l = length(rtrim(!2)).
loop #i = 1 to #l/2.
+ compute #j = #l - #i + 1.
+ compute #a = char.substr(!2,#i,1).
+ compute substr(!2,#i,1) = char.substr(!2,#j,1).
+ compute substr(!2,#j,1) = #a.
end loop.
execute.
```

```
!enddefine.

string pp1_rev (a80).
* reverse the string for the period after the birth
* so we are going forward in time from the birth.
* limit to women whose most recent birth is at least 12 months before interview.
!ReverseStr pp1 pp1_rev.
* and then extract the first 12 months.
* limit to women whose most recent birth is at least 12 months before interview.
string postbirth (a12).
if (birth1_5 = 1) postbirth=char.substr(pp1_rev,1,12).
```

E3.3   Check for method use in the postpartum period

Next we search to see if the respondent used a method in the 12-month postpartum period. In Stata we can use the `indexnot` function to search for any code other than "0". In SPSS, we achieve the same by looping through the 12 month period looking for something other than a "0". If nothing was found, or there was no last birth in the period 12-59 months before the survey, we set `used_month` to 0, otherwise it points to the month following the birth in which use of a method started, or possibly in which another pregnancy started. After filtering out a "P" or a "T" in that month, by setting `used_month` to 0 we capture the code from the calendar for the method that was used (in `method_used`).

Stata
```
* Step 3.3
* see if anything happened in this 12 month period other than non-use of contraception
gen used_month = indexnot(postbirth,"0")
* if no birth in the period 12-59 months preceding the survey (birth1_5 != 1) then
* reset used_month to 0 to facilitate later steps
replace used_month = 0 if birth1_5 != 1
* get the method code for the method used following the pregnancy
gen method_used = substr(postbirth,used_month,1) if used_month > 0
* something was found, but it might be a pregnancy (or possibly a termination),
* if so don't count this. Births are always preceded by pregnancy,
* but a termination in month 1 would not have a P preceding it
replace used_month = 0 if used_month > 0 & inlist(method_used,"P","T")
replace method_used = "" if used_month == 0
```

SPSS
```
* Step 3.3.
* see if anything happened in this 12 month period other than non-use of contraception.
do if (birth1_5 = 1).
+ compute used_month = 1.
+ loop if (used_month <= 12 & char.substr(postbirth,used_month,1) = "0").
+   compute used_month = used_month+1.
+ end loop.
end if.
* if no birth in the period 12-59 months preceding the survey (birth1_5 <> 1) then
* reset used_month to 0 to facilitate later steps.
if (birth1_5 = 0 | used_month > 12) used_month = 0.

* get the method code for the method used following the pregnancy.
string method_used (a1).
if (used_month > 0) method_used = char.substr(postbirth,used_month,1).
* something was found, but it might be a pregnancy (or possibly a termination),
* if so don't count this. Births are always preceded by pregnancy,
* but a termination in month 1 would not have a P preceding it.
do if (used_month > 0).
```

```
+ if (char.index("PT",method_used) > 0) used_month = 0.
+ if (used_month = 0) method_used = " ".
end if.
```

E3.4   Generate the analysis variable

Now we can generate our analysis variable for whether the respondent used a family planning method in
the first 12 months following the birth of her last child (born in the period 12-59 months prior to the
interview). We initialize the variable ppfp to 0 for not using a method, and update it to 1 if she used any
type of method (used_month > 0). We then check to see if the method used was a modern method, and
if so update the code in ppfp to 2 (modern method used). This last step is survey-specific and the list of
codes that are modern methods needs to be verified for each survey by checking the corresponding
recode file. In particular there are codes that from DHSVI onwards are treated as standard codes for
modern contraceptive methods, including Emergency contraception "E", Other modern methods "M",
and Standard Days method "S", but which may have been used for other methods that were traditional
in earlier DHS surveys, and so would be removed from the lists below for those earlier surveys.
Additionally, surveys may have other method codes for survey-specific modern methods.

Stata
```
* Step 3.4
* generate postpartum family planning variable, initially set to 0
gen ppfp=0 if birth1_5 == 1
* update ppfp if used a method
replace ppfp = 1 if used_month > 0
* search the 12 months after birth for one of the modern methods
* the list of codes below (in the 'strpos' function) are survey specific
* and should be adapted for each survey
* in particular codes "E", "M", and "S" may have been traditional methods in older surveys,
* but are now standard codes for Emergency contraception, Other modern methods,
* and Standard days method
* also note that "L" (LAM) could be excluded because it is only valid within 6 months after birth
replace ppfp = 2 if used_month > 0 & strpos("1234567LNCFEMS",method_used) > 0

* label the ppfp variable
label variable ppfp "Used modern method within 12 months of birth"
label def used 0 "no method used" 1 "traditional method used" 2 "modern method used"
label val ppfp used
```
SPSS
```
* Step 3.4.
* generate postpartum family planning variable, initially set to 0.
if (birth1_5 = 1) ppfp=0.
* update ppfp if used a method.
if (used_month > 0) ppfp = 1.
* search the 12 months after birth for one of the modern methods.
* the list of codes below (in the 'strpos' function) are survey specific
* and should be adapted for each survey.
* in particular codes "E", "M", and "S" may have been traditional methods in older surveys,
* but are now standard codes for Emergency contraception, Other modern methods,
* and Standard days method.
* also note that "L" (LAM) could be excluded because it is only valid within 6 months after birth.
do if (used_month > 0).
+ if (char.index("1234567LNCFEMS",method_used) > 0) ppfp = 2.
end if.
execute.
```

```
* label the ppfp variable.
variable labels ppfp "Used modern method within 12 months of birth".
value labels ppfp 0 "no method used" 1 "traditional method used" 2 "modern method used".
```

E3.5   Weight and tabulate the data

Finally, we will weight the data and produce our tabulation. The weight is stored without decimals and there are 6 implied decimal places, so we divide the v005 by 1000000 to produce the weight variable wt. Then we can use a simple tab or frequency command to tabulate the data.

Stata
```
* Step 3.5
* weight the data and tabulate
gen wt=v005/1000000
tab ppfp [iw=wt] if birth1_5==1
```
SPSS
```
* Step 3.5.
* weight the data and tabulate.
compute wt=v005/1000000.
weight by wt.
filter by birth1_5.
frequencies variables=ppfp.
filter off.
```


Stata output
```
. * Step 3.5
. * weight the data and tabulate
. gen wt=v005/1000000

. tab ppfp [iw=wt] if birth1_5==1

    Used modern method |
    within 12 months of |
                 birth |      Freq.      Percent       Cum.
-----------------------+-----------------------------------
        no method used | 2,633.8549        89.88       89.88
traditional method used |24.82437107        0.85       90.73
     modern method used | 271.633399         9.27      100.00
-----------------------+-----------------------------------
                 Total | 2,930.3127       100.00
```

Example 4 – Stillbirths and perinatal mortality

For this example, we will be replicating the results from DHS-7 table 8.4[11] (Perinatal mortality). For this table, a stillbirth is defined as a terminated pregnancy of 7 or more months of pregnancy. An early neonatal death is defined as a death in the first seven days (days 0-6) of a child born alive. The perinatal mortality rate is defined as stillbirths plus early neonatal deaths in the five years preceding the survey divided by all births (including stillbirths) that had a pregnancy duration of 7 or more months.

To calculate the stillbirths, we will use the information in the calendar. For the live births we could also look at the calendar, but this has a limitation in that twins or triplets are recorded with a single code B in the calendar, so instead we will look at the birth history variables to calculate live births including twins. Information for early neonatal deaths is also retrieved from the birth history. For the total births and pregnancies of 7 months or more, we just add the count of stillbirths to the count of live births, assuming that all live births are of 7 months pregnancy duration or more.

Logic for example 4 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example4.do	Stata\Example4.log
SPSS	SPSS\Example4.sps	SPSS\Example4.txt

E4.0   Open the datasets, keeping just the data needed

As in prior examples, we open the dataset keeping column 1 of the calendar, the other variables we will need for the analysis such as the sample weight, CMC date of interview, survey design variables, region of residence, and in addition keeping the birth history variables we will need – the b3 (CMC date of birth) and b6 (age at death) series of variables.

Stata
```
* DHS Calendar Tutorial - Example 4
* Stillbirths and perinatal mortality

* download the model dataset for individual women's recode: "ZZIR62FL.DTA"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
cd "C:\Data\DHS_model\"

* open the dataset to use, selecting just the variables we are going to use
use vcal_1 v000 v005 v007 v008 v018 v021 v023 v024 b3* b6* using "ZZIR62FL.DTA", clear
```

SPSS
```
* DHS Calendar Tutorial - Example 4.
* Stillbirths and perinatal mortality.

* download the model dataset for individual women's recode: "ZZIR62FL.SAV"
```

---

[11] An example of this table based on the model dataset can be found in table 8.4 in "8. Infant and Child Mortality.pdf" in zzfulltables.zip found at http://dhsprogram.com/data/Download-Model-Datasets.cfm.

```
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm .

* change to a working directory where the data are stored
* or add the full path to the 'get file' command below.
cd "C:\Data\DHS_model".

* open the dataset to use, and just keep the variables we are going to use.
get file="ZZIR62FL.SAV" / keep vcal$1 v000 v005 v007 v008 v018 v021 v023 v024 b3$01 to b3$20
  b6$01 to b6$20.

* set maximum number of loops high enough. Could be as many as the length of the calendar (80)
* so set it a bit higher.
set mxloops = 100.
```

E4.1   Initialize counter variables for stillbirths, early neonatal deaths and all live births

The approach we will take in this example is tallying the number of stillbirths, early neonatal deaths, and all births (including twins) for each woman, and then calculate a ratio statistic to produce the perinatal mortality rate. Below we'll initialize a set of variables that we will use to count stillbirths, early neonatal deaths and live births.

Stata
```
* Step 4.1
* Stillbirths
gen stillbirths = 0
label variable stillbirths "Stillbirths"
* Births in calendar
gen births = 0
label variable births "Births in calendar (excludes twins)"
* Births in birth history including twins in the five years preceding the survey
gen births2 = 0
label variable births2 "Births in birth history (including twins)"
* Early neonatal deaths in the five years preceding the survey
gen earlyneo = 0
label variable earlyneo "Early neonatal deaths"
```

SPSS
```
* Step 4.1.
* Stillbirths.
compute stillbirths = 0.
variable labels stillbirths "Stillbirths".
* Births in calendar.
compute births = 0.
variable labels births "Births in calendar (excludes twins)".
* Births in birth history including twins in the five years preceding the survey.
compute births2 = 0.
variable labels births2 "Births in birth history (including twins)".
* Early neonatal deaths in the five years preceding the survey.
compute earlyneo = 0.
variable labels earlyneo "Early neonatal deaths".
```

E4.2   Count the stillbirths in the calendar

First, we set a range of values for the period of interest in the calendar. We set two variables, `beg` and `end` to the start and end positions in the calendar that we are interested in looking at. The variable `beg` points

to the month of interview and `end` points to the last month to include five years before the interview. Remember that the calendar is in reverse chronological order and `beg` is the earlier position in the strong and `end` is the later position in the string.

We then loop through the calendar checking for any stillbirths in that period. The loop works differently in Stata than in SPSS: In Stata, the loop control variable `(i)` is a local macro and applies to all cases, whereas in SPSS the loop control variable (`#i`) is case specific and can take different values for different cases. This means that the logic needs to be slightly different for the two programs. In Stata, we loop over the whole of the calendar (all 80 characters) but select just the period of interest with the `inrange` function, whereas in SPSS we can just loop over the specific 60 months that apply for each case.

We count the number of births in the period in the calendar by checking if any character is a "B". We are not actually going to use this variable as it excludes twins, but we have left this assignment in the program as an example of how to count them in the calendar.

We count the number of stillbirths in the selected period in a similar manner, except that we look for a "T" followed by six "P"s (meaning a total of 7 months of pregnancy).

Stata

```
* Step 4.2
* Set the start and end positions to use for the five year windows
gen beg = v018
gen end = v018+59

* Loop through calendar summing births, non-live pregnancies and stillbirths
* total length of calendar to loop over including leading blanks (80)
local vcal_len = strlen(vcal_1[1])
forvalues i = 1/`vcal_len' {
  * count the births, but restricting to just the 60 months preceding survey
  replace births = births+1 if inrange(`i',beg,end) & substr(vcal_1,`i',1) == "B"
  * count the stillbirths, also restricting to just the 60 months preceding survey
  replace stillbirths = stillbirths+1 if inrange(`i',beg,end) & ///
    substr(vcal_1,`i',7) == "TPPPPPP"
}
```

SPSS

```
* Step 4.2.
* Set the start and end positions to use for the five year windows.
compute beg = v018.
compute end = v018 + 59.

* Loop through calendar summing births and stillbirths (a termination of 7+ months).
* restrict to just the 60 months preceding survey.
loop #i = beg to end.
* count the births.
+ if (char.substr(vcal$1,#i,1) = "B") births = births+1.
* count the stillbirths.
+ if (char.substr(vcal$1,#i,7) = "TPPPPPP") stillbirths = stillbirths+1.
end loop.
execute.
```

Stata output

```
. * Step 4.2
. * Set the start and end positions to use for the five year windows
. gen beg = v018

. gen end = v018+59
```

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```
.
. * Loop through calendar summing births, non-live pregnancies and stillbirths
. * total length of calendar to loop over including leading blanks (80)
. local vcal_len = strlen(vcal_1[1])

. forvalues i = 1/`vcal_len' {
  2.    * count the births, but restricting to just the 60 months preceding survey
.    replace births = births+1 if inrange(`i',beg,end) & substr(vcal_1,`i',1) == "B"
  3.    * count the stillbirths, also restricting to just the 60 months preceding survey
.    replace stillbirths = stillbirths+1 if inrange(`i',beg,end) & ///
>      substr(vcal_1,`i',7) == "TPPPPPP"
  4. }
(0 real changes made)
(0 real changes made)
…
(15 real changes made)
(0 real changes made)
(36 real changes made)
(0 real changes made)
…
(37 real changes made)
(1 real change made)
(15 real changes made)
(0 real changes made)
…
(0 real changes made)
(0 real changes made)
```

Note: In the above output many lines reporting some changes made were omitted for brevity.

E4.3   Count the early neonatal deaths and all live births in the birth history

To get the count of early neonatal deaths and all live births (including twins), we can, in a similar way to counting the stillbirths, loop through the birth history variables. We need to set the range of dates to use to limit to the five years preceding the survey, and so we reuse the variables beg and end, this time to specify the beginning and ending century month codes for the period of interest.

To facilitate the looping through the birth history, we need to set up the variables needed for that loop. In Stata, we must rename the b3 and b6 series variables to drop the leading zeros on the indexes. For example, b3_01 and b3_02 become b3_1 and b3_2, etc. In SPSS, we declare vectors (similar to arrays) for the B3 series and the B6 series for use with the loop control variable.

We then loop through the 20 possible entries in the birth history and check if the birth was within the period of interest and, if so, count it in births2. We also check to see if there was an early neonatal death in the period of interest by checking b3 and b6. We are checking b6 to see if it is between 100 and 106. The coding of the age at death in b6 has a three digit number composed of a single digit unit (1 = days) followed a two digit number in that unit. Thus, 100 means an age at death of 0 days and 106 means an age at death of 6 days.

Stata

```
* Step 4.3
* reuse beg and end for CMCs range for the birth history
replace end = v008
replace beg = v008-59

* rename b3 and b6 variables to facilitate use in the for loop
```

```
rename b3_0* b3_*
rename b6_0* b6_*

* Loop through birth history summing births and early neonatal deaths
* in the five years preceding the survey
forvalues i = 1/20 {
* restrict to 60 months preceding survey
  replace births2 = births2+1 if inrange(b3_`i',beg,end)
  replace earlyneo = earlyneo+1 if inrange(b3_`i',beg,end) & inrange(b6_`i',100,106)
}
```

SPSS

```
* Step 4.3.
* reuse beg and end for CMCs range for the birth history.
compute end = v008.
compute beg = v008-59.

* convert b3 and b6 variables into vectors to facilitate use in the loop.
vector B3 = B3$01 to B3$20.
vector B6 = B6$01 to B6$20.

* Loop through birth history summing births and early neonatal deaths
* in the five years preceding the survey.
loop #i = 1 to 20.
*  Restrict to 60 months preceding survey.
+ if (B3(#i) >= beg & B3(#i) <= end) births2 = births2+1.
+ if (B3(#i) >= beg & B3(#i) <= end & B6(#i) >= 100 & B6(#i) <= 106)
  earlyneo = earlyneo+1.
end loop.
execute.
```

Stata output

```
. * Step 4.3
. * reuse beg and end for CMCs range for the birth history
. replace end = v008
(8,348 real changes made)

. replace beg = v008-59
(8,348 real changes made)

.
. * rename b3 and b6 variables to facilitate use in the for loop
. rename b3_0* b3_*

. rename b6_0* b6_*

.
. * Loop through birth history summing births and early neonatal deaths
. * in the five years preceding the survey
. forvalues i = 1/20 {
  2. * restrict to 60 months preceding survey
.    replace births2 = births2+1 if inrange(b3_`i',beg,end)
  3.    replace earlyneo = earlyneo+1 if inrange(b3_`i',beg,end) & inrange(b6_`i',100,106)
  4. }
(4,260 real changes made)
(106 real changes made)
(1,531 real changes made)
(49 real changes made)
(169 real changes made)
(7 real changes made)
(8 real changes made)
(0 real changes made)
…
```

```
(0 real changes made)
```
Note: In the above output many lines reporting 0 real changes made were omitted for brevity.

E4.4   Sum the total number of pregnancies of 7 or more months and the number of perinatal deaths

In this step we add the births from the birth history (`births2`) and the stillbirths to give the total number of pregnancies of 7 or more months in the last 5 years in `totpreg7m`. Similarly, we add the stillbirths and the early neonatal deaths in the last 5 years to calculate all perinatal mortality.

Stata
```
* Step 4.4
* total pregnancies of 7+ months in last 5 years (all live births (including twins),
* plus the stillbirths)
gen totpreg7m = births2+stillbirths
label variable totpreg7m "Number of pregnancies of 7+ months duration"

* total perinatal mortality = early neonatal deaths plus stillbirths
gen perinatal = earlyneo+stillbirths
label variable perinatal "Perinatal mortality"
```
SPSS
```
* Step 4.4.
* total pregnancies of 7+ months in last 5 years (all live births (including twins),
* plus the stillbirths).
compute totpreg7m = births2+stillbirths.
variable labels totpreg7m "Number of pregnancies of 7+ months duration".

* total perinatal mortality = early neonatal deaths plus stillbirths.
compute perinatal = earlyneo+stillbirths.
variable labels perinatal "Perinatal mortality".
```


E4.5   Weight the data and tabulate the results

In the last step we first calculate the sampling weight by dividing `v005` by one million (1000000). In the Stata example, we also set up the complex sample parameters using the `svyset` command, while in SPSS we turn on the weighting using the `weight by` command. Later we will use complex samples in SPSS to calculate the ratio of perinatal deaths to all pregnancies of 7+ months.

We want to tabulate the counts for `stillbirths`, `earlyneo`, and `totpreg7m`. However, currently we have counts for each respondent, so to get a total (weighted) count for the survey, we can multiply the weight by the counts of still births, early neonatal deaths, and total pregnancies of 7+ months, respectively and then produce counts by any of the women's-level characteristics. In this example, the results are disaggregated by region of residence, but could equally have been presented by education, wealth index, or other characteristics of the respondent.

We then want to calculate the perinatal mortality rate as the ratio of the perinatal deaths to all pregnancies of 7 or more months. Before doing the calculation, though, we must restore the weight variable to be just the women's sample weight. To calculate the perinatal mortality rate, in the Stata example, we first produce a national estimate using the `svy: ratio` command, and then disaggregate by the region of residence.

In the SPSS logic, we can use the complex samples command `csdescriptives` to produce the ratio of perinatal mortality to all pregnancies of 7+ months duration, disaggregated by region of residence. In the below logic, the complex samples plan for use with the DHS data is created. The complex sample plan can be constructed once and used in many analyses, and does not need to be re-created in each run. In the example given we turn off the weight command in SPSS before running `csdescriptives` to avoid receiving a warning message about the weight being ignored[12].

If we do not want to or cannot use the `csdescriptives`[13] command in SPSS, then we need to do things a little differently, using the `ratio statistics` command. The `ratio statistics` command does not permit non-integer weights. To get around this limitation we can re-compute our weight variable, this time without dividing by one million and weight by that, and then use the `ratio statistics` command, but remembering to print the weighted mean (`wgtmean`) as our indicator estimate.

Stata

```
* Step 4.5
* create weight variable
gen wt = v005/1000000

* set up svyset parameters for complex samples
svyset v021 [pweight=wt], strata(v023)

* number of stillbirths
* weight the number of women by the number of stillbirths for the correct count
replace wt = stillbirths*v005/1000000
svy: tab v024, cell count
* early neonatal deaths
* weight the number of women by the number of early neonatal deaths
replace wt = earlyneo*v005/1000000
svy: tab v024, cell count
* number of pregnancies of 7+ months
* weight the number of women by the total number of pregnancies of 7+ months
replace wt = totpreg7m*v005/1000000
svy: tab v024, cell count

* reset the weight variable
replace wt = v005/1000000
* perinatal mortality ratio
svy: ratio perinatal/totpreg7m
svy: ratio perinatal/totpreg7m, over(v024)
```

SPSS

```
* Step 4.5.
* create weight variable.
compute wt = v005/1000000.
weight by wt.

* number of stillbirths.
* weight the number of women by the number of stillbirths for the correct count.
compute wt = stillbirths*v005/1000000.
frequencies variables=v024.
* number of early neonatal deaths.
* weight the number of women by the number of early neonatal deaths.
```

---

[12] The weight is not ignored, but csdescriptives uses the weight specified in the csplan instead, not the weight specified in the weight by command.

[13] csdescriptives is part of the Complex Samples module in SPSS and is purchased as a separate module. If you do not see Complex Samples under the Analyze menu in SPSS, then Complex Samples is not installed for your current version.

```
compute wt = earlyneo*v005/1000000.
frequencies variables=v024.
* number of pregnancies of 7+ months.
* weight the number of women by the total number of pregnancies of 7+ months.
compute wt = totpreg7m*v005/1000000.
frequencies variables=v024.

* reset the weight variable.
compute wt = v005/1000000.
* turn off weighting as the complex samples procedures don't use the weight
* from the 'weight by' command, but use it from the csplan instead.
* this eliminates a confusing warning message about the weight being ignored.
weight off.

* complex sample for use with DHS calendar data.
csplan analysis /plan file='Calendar.csaplan'
  /planvars analysisweight=wt
  /srsestimator type=wor
  /design strata=v023 cluster=v021
  /estimator type=wr.

* complex samples ratio for the perinatal mortality rate.
csdescriptives
  /plan file='Calendar.csaplan'
  /ratio numerator=perinatal denominator=totpreg7m
  /statistics se
  /subpop table=v024.

* Ratio doesn't permit the use of non-integer weights,
* so use the weight without dividing by a million.
compute wt = v005.
weight by wt.
* perinatal mortality rate.
ratio statistics perinatal with totpreg7m by v024 /print wgtmean.
```

Note re stratification: The examples here use $v021$ for the primary sampling unit and $v023$ for the sample strata; however, attention should be paid to the correct variables to use. In some datasets $v001$ should be used for the primary sampling unit (or cluster), and either $v022$ or a constructed variable creating separate strata for urban and rural areas in each region (based on $v024$ and $v025$) should be used for the sample strata. This is survey-specific and information on the stratification can usually be found in the DHS final report for each survey, either in Chapter 1 or the Appendix on the sample design.

Stata output

```
. * Step 4.5
. * create weight variable
. gen wt = v005/1000000


.
. * set up svyset parameters for complex samples
. svyset v021 [pweight=wt], strata(v023)

      pweight: wt
          VCE: linearized
  Single unit: missing
     Strata 1: v023
         SU 1: v021
        FPC 1: <zero>
```

```
.
. * number of stillbirths
. * weight the number of women by the number of stillbirths for the correct count
. replace wt = stillbirths*v005/1000000
(8,306 real changes made)

. svy: tab v024, cell count
(running tabulate on estimation sample)

Number of strata   =           7              Number of obs     =      7,172
Number of PSUs     =         190              Population size   = 33.6578372
                                              Design df         =        183


----------------------------------
   region |     count  proportion
----------+-----------------------
 region 1 |      15.8       .4695
 region 2 |     5.365       .1594
 region 3 |     1.384       .0411
 region 4 |     11.11         .33
          |
    Total |     33.66           1
----------------------------------
  Key:  count    =  weighted count
        propor~n =  cell proportion

Note: 1 stratum omitted because it contains no population members.

. * early neonatal deaths
. * weight the number of women by the number of early neonatal deaths
. replace wt = earlyneo*v005/1000000
(194 real changes made)

. svy: tab v024, cell count
(running tabulate on estimation sample)

Number of strata   =           8              Number of obs     =      8,348
Number of PSUs     =         217              Population size   = 176.571694
                                              Design df         =        209


----------------------------------
   region |     count  proportion
----------+-----------------------
 region 1 |     38.27       .2167
 region 2 |     40.21       .2277
 region 3 |     54.73         .31
 region 4 |     43.36       .2456
          |
    Total |     176.6           1
----------------------------------
  Key:  count    =  weighted count
        propor~n =  cell proportion

. * number of pregnancies of 7+ months
. * weight the number of women by the total number of pregnancies of 7+ months
. replace wt = totpreg7m*v005/1000000
(4,216 real changes made)

. svy: tab v024, cell count
(running tabulate on estimation sample)
```

```
Number of strata    =          8                 Number of obs    =      8,348
Number of PSUs      =        217                 Population size  = 5,906.0759
                                                 Design df        =        209


----------------------------------
   region |     count  proportion
----------+-----------------------
 region 1 |      2178       .3688
 region 2 |      1315       .2226
 region 3 |      1101       .1863
 region 4 |      1313       .2223
          |
    Total |      5906           1
----------------------------------
  Key:  count    =  weighted count
        propor~n =  cell proportion


.
. * reset the weight variable
. replace wt = v005/1000000
(5,625 real changes made)

. * perinatal mortality ratio
. svy: ratio perinatal/totpreg7m
(running ratio on estimation sample)

Survey: Ratio estimation

Number of strata =        8       Number of obs    =      8,348
Number of PSUs   =      217       Population size  = 8,347.9996
                                  Design df        =        209

    _ratio_1: perinatal/totpreg7m


---------------------------------------------------------------
            |               Linearized
            |      Ratio   Std. Err.    [95% Conf. Interval]
------------+--------------------------------------------------
    _ratio_1 |  .0355955   .0031781       .0293303    .0418606
---------------------------------------------------------------

. svy: ratio perinatal/totpreg7m, over(v024)
(running ratio on estimation sample)

Survey: Ratio estimation

Number of strata =        8       Number of obs    =      8,348
Number of PSUs   =      217       Population size  = 8,347.9996
                                  Design df        =        209

    _ratio_1: perinatal/totpreg7m

    _subpop_1: v024 = region 1
    _subpop_2: v024 = region 2
    _subpop_3: v024 = region 3
    _subpop_4: v024 = region 4


---------------------------------------------------------------
            |               Linearized
       Over |      Ratio   Std. Err.    [95% Conf. Interval]
------------+--------------------------------------------------
_ratio_1    |
```

```
  _subpop_1 |    .024825    .0039607       .0170169      .0326331
  _subpop_2 |   .0346693    .0062962       .0222571      .0470815
  _subpop_3 |   .0509912    .0113263       .0286628      .0733197
  _subpop_4 |    .041484    .0056726       .0303011      .0526669
------------------------------------------------------------
```

The approach used above works to produce an estimate of perinatal mortality, but it has some limitations, principally that we can only disaggregate the results by women's-level variables and not by variables pertaining to each separate pregnancy, such as the previous pregnancy interval or the age of the respondent at the end of the pregnancy. To be able to disaggregate by those characteristics we would need to create a file where the unit of analysis was a pregnancy. In fact, for perinatal mortality to be able to disaggregate by pregnancy-specific characteristics, it would be necessary to produce two files: one based from the calendar with stillbirths as the unit of analysis, and a second one from the birth history with live births (including twins) as the unit of analysis, and then to append the two files together.

The next section presents methods for constructing a file with a different unit of analysis – months.

Module 4: Restructuring the calendar into a file of single months

<u>Goal of the module:</u> For analysts to understand how to restructure the calendar into a file of single months, and use that file in analysis.

So far examples 1 through 4 used the women's individual recode (IR) file. The IR contains one case per woman, meaning that these examples are based on having just variables at the woman's level – for example, postpartum contraceptive use following the **last** birth rather than following all births in the calendar.

Similarly in the perinatal mortality example the denominator for the perinatal mortality is actually pregnancies (of 7 months or longer duration), not a denominator based on women. The example works around this by looking at the ratio of the count of perinatal deaths to the count of pregnancies of 7 months or more in the five years preceding the survey. This works provided that any disaggregation of the ratio only uses women's level variables. For example, we can disaggregate the perinatal mortality rate by the mother's education and by place of residence and region, but we cannot disaggregate by the prior pregnancy interval or by the mother's age at the time of the birth. To do that we would need to construct a file with the pregnancy as the unit of analysis.

One of the easiest ways of constructing a file that has an appropriate unit of analysis is to convert the calendar into a file where the unit of analysis is each single month in the calendar. This can be done fairly simply by constructing a separate variable for each month for each column of the calendar, and then converting this file using Stata's `reshape long` command or SPSS's `varstocases` command.

Example 5 below looks at the reason for discontinuation for all episodes of contraceptive use in the calendar. This can be performed using a single month analysis or an episode based analysis. We approach this by restructuring the data into a file of single months to be able to produce a more useful analysis than would be achieved with an analysis purely at the woman's level.

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Example 5 – Reasons for discontinuation in the last five years by method

This example produces a percent distribution of the reason for discontinuation of each method discontinued in the five years preceding the survey, disaggregated by the type of method used. This is DHS-7 standard table 7.12[14] (table number may vary in final reports) and should match the results shown for the equivalent table in the final reports.

The approach used here is to restructure the calendar data into a file where the unit of analysis is a single month, from that extract only the records in which there was a discontinuation, and then tabulate the reason for the discontinuation by the method used. This example introduces the use of Stata's `reshape long` and SPSS's `varstocases` commands.

Logic for example 5 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example5.do	Stata\Example5.log
SPSS	SPSS\Example5.sps	SPSS\Example5.txt

E5.0 Open the datasets, keeping just the data needed

First, the dataset is opened, selecting the variables to use. We want to include `vcal_2`/`VCAL$2` for the reasons for discontinuation in addition to `vcal_1`/`VCAL$1`, `v005` (sample weight), `v018` (position in calendar of month of interview), `v021` (PSU), and `v023` (stratum). The last two variables and the weight variable are used in the complex sample tabulation at the end of this example. Additionally, we include the case identification variable (`caseid`), which will be used in the restructuring of the data.

Stata
```
* DHS Calendar Tutorial - Example 5
* Percent distribution of discontinuations of contraceptive methods in the five years
* preceding the survey by main reason stated for discontinuation, according to specific method

* download the model dataset for individual women's recode: "ZZIR62FL.DTA"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
cd "C:\Data\DHS_model"

* open the dataset to use, selecting just the variables we are going to use
use caseid vcal_1 vcal_2 v000 v005 v007 v018 v021 v023 using "ZZIR62FL.DTA", clear
```

SPSS
```
* DHS Calendar Tutorial - Example 5.
* Percent distribution of discontinuations of contraceptive methods in the five years
* preceding the survey by main reason stated for discontinuation, according to specific method.

* download the model dataset for individual women's recode: "ZZIR62FL.SAV"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm .
```

---

[14] An example of this table based on the model dataset can be found in table 7.10 in "7. Family Planning.pdf" in zzfulltables.zip found at http://dhsprogram.com/data/Download-Model-Datasets.cfm.

```
* change to a working directory where the data are stored
* or add the full path to the 'get file' command below.
cd "C:\Data\DHS_model".

* open the dataset to use, and just keep the variables we are going to use.
get file="ZZIR62FL.SAV" / keep caseid vcal$1 vcal$2 v000 v005 v007 v018 v021 v023.

* set maximum number of loops high enough. Could be as many as the length of the calendar (80),
so set it a bit higher.
set mxloops = 100.

* set length of calendar in a macro.
define !vcal_len() 80 !enddefine.
```

E5.1   Convert the calendar into separate variables per month

In this step we create 80 separate single character string variables for each of the 80 months of the calendar for column 1 (called `method`) and column 2 (called `reason`), using the `substr` functions in each language. The SPSS logic contains a macro for the length of the calendar (`!vcal_len`) rather than using the constant of 80 for the full length of the calendar string. In the Stata logic, `vcal_len` is set as a local macro automatically later on.

In Stata, we drop `vcal_1` and `vcal_2` after creating the single month variables as we do not want to duplicate the calendar variables on each record in the next step. In SPSS, they are excluded from the restructured file in the next step.

Stata
```
* Step 5.1
* loop through calendar creating separate variables for each month
* total length of calendar to loop over including leading blanks (80)
local vcal_len = strlen(vcal_1[1])
forvalues i = 1/`vcal_len' {
  gen str1 method`i' = substr(vcal_1,`i',1)
  gen str1 reason`i' = substr(vcal_2,`i',1)
}
```
SPSS
```
* Step 5.1.
* create separate variables for each month of the calendar.
vector method(!vcal_len A1).
vector reason(!vcal_len A1).
* loop through calendar creating separate variables for each month.
loop #i = 1 to !vcal_len.
+ compute method(#i) = char.substr(vcal$1,#i,1).
+ compute reason(#i) = char.substr(vcal$2,#i,1).
end loop.
```

E5.2   Restructure the data into a file with one record per month of the calendar

In this step, we take the 80 separate pairs of variables (`method1` and `reason1` to `method80` and `reason80`) and convert them into 80 cases, each with one variable pair for each case in the original file. In Stata the command is `reshape long`, while in SPSS it is `varstocases`. In Stata we provide the prefixes of the variables we want to convert into cases (`method` and `reason`), followed by the case identification variable

caseid in the `i()` parameter, and a new index variable we will call `i` in the `j()` parameter. The output dataset will have a case for each of the 80 variable pairs, each with the `caseid`, the variables `method` and `reason`, and the index number `i` (numbered from 1 to 80 within `caseid`).

SPSS works in a similar manner and we specify the variables we are going to make from the 80 separate variable pairs (`method` and `reason`) we currently have. Additionally, we specify the index variable `i` to create and the list of other variables to keep on each case.

Stata

```
* Step 5.2
* drop calendar string variables as we don't need them further
drop vcal_1 vcal_2

* reshape the data file into a file where the month is the unit of analysis
reshape long method reason, i(caseid) j(i)
```

SPSS

```
* Step 5.2.
* restructure the new month by month variables into a long format where
* the month is the unit of analysis, keeping just the variables that we need.
varstocases
  /make method from method1 to method!vcal_len
  /make reason from reason1 to reason!vcal_len
  /index=i(!vcal_len)
  /keep=caseid v000 v005 v007 v018 v021 v023
  /null=keep.
```

Stata output

```
. * Step 5.2
. * drop calendar string variables as we don't need them further
. drop vcal_1 vcal_2

.
. * reshape the data file into a file where the month is the unit of analysis
. reshape long method reason, i(caseid) j(i)
(note: j = 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
32 33 34 35 36 37 38 39 40 41 42 43 44
> 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80)

Data                            wide   ->   long
-----------------------------------------------------------------------------
Number of obs.                  8348   ->   667840
Number of variables              167   ->       10
j variable (80 values)                 ->   i
xij variables:
        method1 method2 ... method80   ->   method
        reason1 reason2 ... reason80   ->   reason
-----------------------------------------------------------------------------
```

In the Stata example this will convert the file from having 165 variables into a file with 8 variables, but 80 times as many cases. For SPSS, the file goes from 167 variables (it still includes VCAL$1 and VCAL$2) to 8 variables.

E5.3   Keep only the months with discontinuations in the five years preceding the survey

After constructing the file where each month of the calendar is the unit of analysis, we then select only those months in which use of a contraceptive method was discontinued in the five years preceding the survey. We can achieve this by keeping only the cases that were in the five-year period and where the code for the reason was not blank. Note that for Stata we actually have to check for a single space character and for an empty string. The variable will have a single space character if the original calendar variable (`vcal_2`) had a non-blank character further to the right in the string than the current month and will have an empty string if there was no non-blank character further to the right in the string than the current month. This is not an issue for the SPSS code, however, and we can just test for a character other than a single space character.

Stata
```
* Step 5.3
* keep only the cases of discontinuations (reason is not blank)
* in the five years preceding the survey
* checks for both a single blank and the null string in reason
* string can be null if position i is beyond the last non-blank in the original string
keep if reason != " " & reason != "" & inrange(i,v018,v018+59)
```
SPSS
```
* Step 5.3.
* keep only the cases of discontinuations (reason is not blank)
* in the five years preceding the survey.
select if reason <> " " & i >= v018 & i <= v018+59.
```


E5.4   Convert the reason code and method code from strings to numbers

Next we convert the reason and method variables from alpha strings to numeric variables. We can use the string position approach used in Example 2D (using `strpos` or `char.index`, respectively) to convert from a string to a number. Be sure to check the codes that are used in the calendar for the survey you are working with. Contraceptive method codes "E", "M", and "S" are relatively new standard codes and may have been used for other methods in surveys before DHSVI. Additionally, other survey-specific codes may have been used. Similarly, check if there are additional codes used for reasons for discontinuation that are not included in the list.

Stata
```
* Step 5.4
* list of codes of methods
local methodlist = "123456789WNALCFEMS"
* convert the contraceptive methods to numeric codes, using the position in the string
gen method_num = strpos("`methodlist'",method)
* convert the missing code to 99
replace method_num = 99 if method == "?"
* now check if there are any codes that were not converted, and change these to -1
replace method_num = -1 if method_num == 0 & method != " "

* list of codes of reasons for discontinuation. ~ represents other survey specific codes
local reasonlist = "123456789CFAD~~~~"
* convert the reasons for discontinuation to numeric codes, using the position in the string
gen reason_num = strpos("`reasonlist'",reason)
* now convert the special codes for other, don't know and missing to 96, 98, 99 respectively
```

```
gen special = strpos("W~K?",reason)
replace reason_num = special+95 if special > 0
drop special
* now check if there are any codes that were not converted, and change these to -1
replace reason_num = -1 if reason_num == 0 & reason != " "
```

SPSS

```
* Step 5.4.
* convert the contraceptive methods to numeric codes, using the position in the string.
compute method_num = char.index("123456789WNALCFEMS",method).
* convert the missing code to 99.
if (method = "?") method_num = 99.
* now check if there are any codes that were not converted, and change these to -1.
if (method_num = 0 & method <> " ") method_num = -1.

* convert the reasons for discontinuation to numeric codes, using the position in the string.
* ~ represents other survey specific codes.
compute reason_num = char.index("123456789CFAD~~~~",reason).
* now convert the special codes for other, don't know and missing to 96, 98, 99 respectively.
compute special = char.index("W~K?",reason).
if (special > 0) reason_num = special+95.
* now check if there are any codes that were not converted, and change these to -1.
if (reason_num = 0 & reason <> " ") reason_num = -1.

execute.
* clean up unneeded variable.
delete variables special.
```

E5.5   Label the variables

Now we should label the variables we have produced in preparation for tabulating the data. Where you see an ellipsis (…) in the logic below, this indicates that a long list of value labels has been excluded; however, these can be found in the Example 5 logic files (the `.do` and `.sps` files).

Stata

```
* Step 5.5
* label the method variables and codes
label variable method "Contraceptive method (alpha)"
label variable method_num "Contraceptive method"
label def method_codes ///
 0 "No method used" ///
 1 "Pill" ///
 2 "IUD" ///
 …
 99 "Missing" ///
 -1 "***Unknown code not recoded***"
label val method_num method_codes

* label the reason variables and codes
label variable reason "Discontinuation code (alpha)"
label variable reason_num "Discontinuation code"
label def reason_codes ///
 0 "No discontinuation" ///
 1 "Became pregnant while using" ///
 2 "Wanted to become pregnant" ///
 …
 96 "Other" ///
 98 "Don't know" ///
 99 "Missing" ///
```

```
 -1 "***Unknown code not recoded***"
label val reason_num reason_codes
```

```
* Step 5.5.
* label the method variables and codes.
variable labels method "Contraceptive method (alpha)".
variable labels method_num "Contraceptive method".
value labels method_num
 0 "No method used"
 1 "Pill"
 2 "IUD"
 …
 99 "Missing"
 -1 "***Unknown code not recoded***".

* label the reason variables and codes.
variable labels reason "Discontinuation code (alpha)".
variable labels reason_num "Discontinuation code".
value labels reason_num
 0 "No discontinuation"
 1 "Became pregnant while using"
 2 "Wanted to become pregnant"
 …
 96 "Other"
 98 "Don't know"
 99 "Missing"
 -1 "***Unknown code not recoded***".
```

E5.6   Weight and tabulate the data

Finally, we will weight the data and produce our tabulation. The weight is stored without decimals and there are 6 implied decimal places, so we divide the v005 by 1000000 to produce the weight variable `wt`. Then we can use a simple tab or crosstab command to tabulate the data, or we can setup the design for a complex sample (`svyset` and `csplan`, respectively) and use the complex sample commands (`svy: tab` and `cstabulate`).

Stata

```
* Step 5.6
* Compute weight variable
gen wt=v005/1000000

* crosstab reason and method, either using a simple tab:
tab reason_num method_num [iweight=wt], col

* or better, using svy tab:
svyset v021 [pweight=wt], strata(v023)
svy: tab reason_num method_num, col per
```

SPSS

```
* Step 5.6.
* Weight the data.
compute wt = v005/1000000.
weight by wt.

* crosstab reason and method, either using a simple crosstab:.
crosstabs tables = reason_num by method_num /cells=count column /count=asis.
```

```
* or better, using the complex samples crosstab:.

* turn off weighting as the complex samples procedures don't use the weight
* from the 'weight by' command, but use it from the csplan instead.
* this eliminates a confusing warning message about the weight being ignored.
weight off.

csplan analysis /plan file='Calendar.csaplan'
  /planvars analysisweight=wt
  /srsestimator type=wor
  /design strata=v023 cluster=v021
  /estimator type=wr.

cstabulate /plan file='Calendar.csaplan'
  /tables variables = reason_num by method_num
  /cells colpct.
```

Stata output

```
. * Step 5.6
. * Compute weight variable
. gen wt=v005/1000000

.
. * crosstab reason and method, either using a simple tab:
. tab reason_num method_num [iweight=wt], col

+-------------------+
| Key               |
|-------------------|
|      frequency    |
| column percentage |
+-------------------+

                     |                    Contraceptive method
Discontinuation code |     Pill       IUD Injectabl    Condom  Periodic  Withdrawa |    Total
---------------------+-----------------------------------------------------------------+----------
Became pregnant while| 36.963059        0 23.518104  5.482217        0 .80930901 | 82.95496
                     |      9.14     0.00      4.88      4.46      0.00     11.53 |     6.56
---------------------+-----------------------------------------------------------------+----------
Wanted to become preg| 119.70253 5.4144591 131.53668 34.493693  3.022521 1.9204611 | 339.56439
                     |     29.61    19.48     27.29     28.08     13.95     27.37 |    26.84
---------------------+-----------------------------------------------------------------+----------
  Husband disapproved| 14.03721 .88217503  6.508606 9.5084161        0        0 | 65.61936
                     |      3.47     3.17      1.35      7.74      0.00      0.00 |     5.19
---------------------+-----------------------------------------------------------------+----------
         Side effects| 97.680173 20.23361 233.75634 6.1060832 6.6836791   1.25802 | 424.18264
                     |     24.16    72.81     48.50      4.97     30.85     17.93 |    33.53
---------------------+-----------------------------------------------------------------+----------
  Access/availability| 21.212403        0 5.54250896 2.688849        0        0 | 29.995631
                     |      5.25     0.00      1.15      2.19      0.00      0.00 |     2.37
---------------------+-----------------------------------------------------------------+----------
Wanted more effective|80.5512978        0  35.99295 26.714048 4.4645391 2.2203889 | 160.10621
                     |     19.93     0.00      7.47     21.75     20.61     31.64 |    12.65
---------------------+-----------------------------------------------------------------+----------
  Inconvenient to use| 8.344504  1.25802  6.075892 18.158897 .80930901        0 | 39.626623
                     |      2.06     4.53      1.26     14.78      3.74      0.00 |     3.13
---------------------+-----------------------------------------------------------------+----------
Infrequent sex/husban| 5.2058952        0  14.48474 1.208572 6.6836791        0 | 34.790794
                     |      1.29     0.00      3.01      0.98     30.85      0.00 |     2.75
---------------------+-----------------------------------------------------------------+----------
                 Cost| .286632         0  5.827325 4.8573129        0        0 | 13.682149
                     |      0.07     0.00      1.21      3.95      0.00      0.00 |     1.08
---------------------+-----------------------------------------------------------------+----------
           Fatalistic|        0         0 .73194402        0        0        0 | 11.10523
                     |      0.00     0.00      0.15      0.00      0.00      0.00 |     0.88
---------------------+-----------------------------------------------------------------+----------
Difficult to get preg| .53772801        0 1.14783597        0        0        0 | 2.248672
                     |      0.13     0.00      0.24      0.00      0.00      0.00 |     0.18
```

```
---------------------+-----------------------------------------------------------------------------+----------
             Other | .56567502          0   5.295249           0           0          0 | 7.6272251
                   |      0.14       0.00       1.10        0.00        0.00       0.00 |      0.60
---------------------+-----------------------------------------------------------------------------+----------
           Missing | 19.161202          0  11.523261  13.622675           0  .80930901 | 53.686628
                   |      4.74       0.00       2.39       11.09        0.00      11.53 |      4.24
---------------------+-----------------------------------------------------------------------------+----------
             Total | 404.24831  27.788264  481.94143  122.84076  21.663727   7.017488 | 1,265.191
                   |    100.00     100.00     100.00      100.00     100.00     100.00 |    100.00


                   |            Contraceptive method
 Discontinuation code | Other tra   Norplant  Lactation  Other mod |     Total
---------------------+------------------------------------------------+----------
Became pregnant while | 11.989206          0   4.193065          0 | 82.95496
                   |     40.34       0.00       6.12       0.00 |      6.56
---------------------+------------------------------------------------+----------
Wanted to become preg | 8.867199  22.7654323   9.621027  2.2203889 | 339.56439
                   |     29.83      25.05      14.05      20.93 |     26.84
---------------------+------------------------------------------------+----------
  Husband disapproved |  2.05095   4.665788  27.966215          0 | 65.61936
                   |      6.90       5.13      40.85       0.00 |      5.19
---------------------+------------------------------------------------+----------
         Side effects | 1.452412  54.539657   2.472669          0 | 424.18264
                   |      4.89      60.00       3.61       0.00 |     33.53
---------------------+------------------------------------------------+----------
   Access/availability | .55186999          0          0          0 | 29.995631
                   |      1.86       0.00       0.00       0.00 |      2.37
---------------------+------------------------------------------------+----------
Wanted more effective | .69064802   .418383   1.731912  7.3220382 | 160.10621
                   |      2.32       0.46       2.53      69.02 |     12.65
---------------------+------------------------------------------------+----------
   Inconvenient to use | .74744798  3.9752231          0    .25733 | 39.626623
                   |      2.51       4.37       0.00       2.43 |      3.13
---------------------+------------------------------------------------+----------
Infrequent sex/husban | .86752599          0   6.3403819          0 | 34.790794
                   |      2.92       0.00       9.26       0.00 |      2.75
---------------------+------------------------------------------------+----------
                Cost |         0  2.7108791          0          0 | 13.682149
                   |      0.00       2.98       0.00       0.00 |      1.08
---------------------+------------------------------------------------+----------
          Fatalistic |         0          0  10.373286          0 | 11.10523
                   |      0.00       0.00      15.15       0.00 |      0.88
---------------------+------------------------------------------------+----------
Difficult to get preg |         0 .563108027          0          0 | 2.248672
                   |      0.00       0.62       0.00       0.00 |      0.18
---------------------+------------------------------------------------+----------
               Other | 1.766301          0          0          0 | 7.6272251
                   |      5.94       0.00       0.00       0.00 |      0.60
---------------------+------------------------------------------------+----------
             Missing |    .7378    1.25802  5.76505208  .80930901 | 53.686628
                   |      2.48       1.38       8.42       7.63 |      4.24
---------------------+------------------------------------------------+----------
               Total | 29.72136  90.8964901  68.463608  10.609066 | 1,265.191
                   |    100.00     100.00     100.00     100.00 |    100.00


.
. * or better, using svy tab:
. svyset v021 [pweight=wt], strata(v023)

      pweight: wt
          VCE: linearized
  Single unit: missing
     Strata 1: v023
        SU 1: v021
       FPC 1: <zero>

. svy: tab reason_num method_num, col per
(running tabulate on estimation sample)

Number of strata   =          8              Number of obs      =         946
Number of PSUs     =        165              Population size    = 1,265.1905
```

```
                                              Design df         =           157


--------------------------------------------------------------------------------------------------------
Discontin |
uation    |                                   Contraceptive method
code      |    Pill      IUD Injectab   Condom Periodic Withdraw Other tr Norplant Lactatio Other mo    Total
----------+---------------------------------------------------------------------------------------------
 Became p |   9.144        0     4.88    4.463        0    11.53    40.34        0    6.125        0    6.557
 Wanted t |   29.61    19.48    27.29    28.08    13.95    27.37    29.83    25.05    14.05    20.93    26.84
  Husband |   3.472    3.175     1.35     7.74        0        0    6.901    5.133    40.85        0    5.187
 Side eff |   24.16    72.81     48.5    4.971    30.85    17.93    4.887       60    3.612        0    33.53
 Access/a |   5.247        0     1.15    2.189        0        0    1.857        0        0        0    2.371
 Wanted m |   19.93        0    7.468    21.75    20.61    31.64    2.324    .4603     2.53    69.02    12.65
 Inconven |   2.064    4.527    1.261    14.78    3.736        0    2.515    4.373        0    2.426    3.132
 Infreque |   1.288        0    3.005    .9839    30.85        0    2.919        0    9.261        0     2.75
     Cost |   .0709        0    1.209    3.954        0        0        0    2.982        0        0    1.081
 Fatalist |       0        0    .1519        0        0        0        0        0    15.15        0    .8778
 Difficul |    .133        0    .2382        0        0        0        0    .6195        0        0    .1777
    Other |   .1399        0    1.099        0        0        0    5.943        0        0        0    .6029
  Missing |    4.74        0    2.391    11.09        0    11.53    2.482    1.384    8.421    7.628    4.243
          |
    Total |     100      100      100      100      100      100      100      100      100      100      100
--------------------------------------------------------------------------------------------------------
  Key:   column percentage

  Pearson:
    Uncorrected   chi2(108)      =  662.2600
    Design-based  F(10.15, 1593.43)=    4.7692      P = 0.0000
```

The results from this example should match the results for the reason for discontinuation table in the DHS reports.

Example 6 – Contraceptive prevalence over time

This example calculates the proportion of women age 15-44 who were using any method of contraception in a five-year period prior to the first survey interview. For a reasonable analysis two restrictions apply here: 1) limit to women age 15-44 throughout the table as the oldest woman would only be 44 years old five years before the survey, and 2) only include data for months on or before the earliest month of interview as there may be biases for later months in which only a limited set of women provided data.

As in Example 5, we restructure the calendar data into a file where the unit of analysis is a single month, using Stata's `reshape long` and SPSS's `varstocases` commands. We then generate a constant variable for the earliest month of interview based on the maximum value of `v018` (`v018_max`), and select data in a 60 month window preceding that month.

Logic for example 6 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example6.do	Stata\Example6.log
SPSS	SPSS\Example6.sps	SPSS\Example6.txt

E6.0   Open the datasets, keeping just the data needed

As in other examples, the dataset is opened, selecting the variables to use. From the calendar this example only needs the contraceptive method information in `vcal_1`/`VCAL$1`. We also include `caseid` (case identification), `v005` (sample weight), `v008` (CMC date of interview), `v011` (CMC date of respondent's birth), `v018` (position in calendar of month of interview), `v021` (PSU) and `v023` (stratum).

Stata
```
* DHS Calendar Tutorial - Example 6
* Contraceptive prevalence rate (CPR) month by month over time

* download the model dataset for individual women's recode: "ZZIR62FL.DTA"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
cd "C:\Data\DHS_model"

* open the dataset to use, selecting just the variables we are going to use
use caseid vcal_1 v000 v005 v007 v008 v011 v017 v018 v021 v023 using "ZZIR62FL.DTA", clear
```
SPSS
```
* DHS Calendar Tutorial - Example 6.
* Contraceptive prevalence rate (CPR) month by month over time.

* download the model dataset for individual women's recode: "ZZIR62FL.SAV"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm .

* change to a working directory where the data are stored
* or add the full path to the 'get file' command below.
cd "C:\Data\DHS_model".
```

```
* open the dataset to use, and just keep the variables we are going to use.
get file="ZZIR62FL.SAV" / keep caseid vcal$1 v000 v005 v007 v008 v011 v018 v021 v023.

* set maximum number of loops high enough. Could be as many as the length of the calendar (80),
* so set it a bit higher.
set mxloops = 100.

* set length of calendar in a macro.
define !vcal_len() 80 !enddefine.
```

E6.1   Convert the calendar into separate variables per month

This step is virtually identical to step 5.1 in Example 5, where we created 80 separate single character
string variables for the 80 months of the calendar for column 1 (called `method`), using the `substr` functions
in each language. The SPSS logic contains a macro for the length of the calendar (`!vcal_len`) rather than
using the constant of 80 for the full length of the calendar string. In the Stata logic, `vcal_len` is set as a
local macro automatically later on.

Stata
```
* Step 6.1
* loop through calendar creating separate variables for each month
* total length of calendar to loop over including leading blanks (80)
local vcal_len = strlen(vcal_1[1])
forvalues i = 1/`vcal_len' {
  gen str1 method`i' = substr(vcal_1,`i',1)
}
```
SPSS
```
* Step 6.1.
* create separate variables for each month of the calendar.
vector method(!vcal_len A1).
* loop through calendar creating separate variables for each month.
loop #i = 1 to !vcal_len.
+ compute method(#i) = char.substr(vcal$1,#i,1).
end loop.
```

E6.2   Restructure the data into a file with one record per month of the calendar

In Stata we drop `vcal_1` after creating the single month variables as we do not want to duplicate the
calendar variable on each record. In SPSS, it is excluded from the `keep` parameter of the `varstocases`
command.

Similar to step 5.2 in Example 5 we convert the 80 separate variables for the calendar and into 80 cases
each with one variable for each case in the original file. In Stata we use `reshape long` and provide the
prefixes of the variable we want to convert into cases (`method`), followed by the case identification variable
`caseid` in the `i()` parameter, and a new sequential index variable we will call `i` in the `j()` parameter.
SPSS works in a similar manner and we use `varstocases` and specify the variable we are going to make
from the 80 variables we currently have, and we specify the index variable to create and the list of other
variables to keep for each case.

Stata

```
* Step 6.2
* drop calendar string variable as we don't need it further
drop vcal_1

* reshape the data file into a file where the month is the unit of analysis
reshape long method, i(caseid) j(i)
```

SPSS

```
* Step 6.2.
* restructure the new month by month variables into a long format where
* the month is the unit of analysis, keeping just the variables that we need.
varstocases
 /make method from method1 to method!vcal_len
 /index=i(!vcal_len)
 /drop=vcal$1
 /null=keep.
```

Stata output

```
. * Step 6.2
. * drop calendar string variable as we don't need it further
. drop vcal_1

.
. * reshape the data file into a file where the month is the unit of analysis
. reshape long method, i(caseid) j(i)
(note: j = 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37
> 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69
70 71 72 73
>  74 75 76 77 78 79 80)

Data                              wide   ->   long
-----------------------------------------------------------------------------
Number of obs.                    8348   ->   667840
Number of variables                 89   ->       11
j variable (80 values)                   ->    i
xij variables:
        method1 method2 ... method80   ->    method
-----------------------------------------------------------------------------
```

E6.3   Keep only the months of the calendar that will contribute to the analysis

After constructing the file where each month of the calendar is the unit of analysis, we now need to select only those months in the five year period preceding the earliest month of interview in the survey. We calculate the earliest month of interview by summarizing the month of interview position variable ($v018$) to calculate its maximum (the maximum value of $v018$ will be the earliest month of interview in the calendar). Using Stata's egen and SPSS's aggregate commands we can add the maximum value of $v018$ as a constant to all cases.

Once we have the position of the earliest month of interview in $v018\_max$, we can simply select only those cases in the range $v018\_max$ to $v018\_max+59$ to keep only the cases in that five year period.

Stata

```
* Step 6.3
* find the position of the earliest date of interview (the maximum value of v018)
egen v018_max = max(v018)

* drop cases outside of the five years preceding the earliest interview
* months 0-59 before the earliest interview date
keep if inrange(i,v018_max,v018_max+59)
```

SPSS

```
* Step 6.3.
* find the position of the earliest date of interview (the maximum value of v018).
aggregate /outfile=* mode=addvariables /v018_max=max(v018).

* keep only cases inside of the five years preceding the earliest interview
* months 0-59 before the earliest interview date.
select if i >= v018_max & i <= v018_max+59.
```

Stata output

```
. * Step 6.3
. * find the position of the earliest date of interview (the maximum value of v018)
. egen v018_max = max(v018)

.
. * drop cases outside of the five years preceding the earliest interview
. * months 0-59 before the earliest interview date
. keep if inrange(i,v018_max,v018_max+59)
(166,960 observations deleted)
```

E6.4   Create analysis variables

Next, we construct the variables that are going to be used in the analysis. Here we calculate the age of the respondent in months (agem) for every month, which will be used to select women age 15-44 (actually 180-539 months, which is equivalent to 15 years 0 months through 44 years 11 months). We also calculate the century month code (CMC) of the date of use for our continuous time variable (cmctime). The results will be presented by cmctime. To help understand the results, CMC 1333 is January 2011, CMC 1345 is January 2012, CMC 1357 is January 2013, etc.

We then construct our variable for the contraceptive prevalence rate (CPR) based on any contraceptive use (usingany). The method variable contains the code for the contraceptive method being used, or "0" if not using a method, or "B", "T", or "P" if the respondent was pregnant in that month. To construct usingany we check if the code in method is anything other than "0", "B", "T", and "P". In Stata we use the inlist function, while in SPSS we use the char.index function. We construct usingany as a variable coded 0/100, rather than the more traditional 0/1 variable. This will enable us to calculate the mean of usingany and to display the result as a percentage.

Stata

```
* Step 6.4
* calculate age in months for each month in the calendar
gen agem = (v008 - v011) - (i - v018)

* calculate century month code for each month
gen cmctime = v008 - (i - v018)
```

```
label variable cmctime "Century month code"

* create variable for use of any method as a 0/100 variable
gen usingany = !inlist(method, "0","B","P","T") * 100
label variable usingany "Using any method"
label def usingany 0 "Not using" 100 "Using a method"
label val usingany usingany
```

SPSS

```
* Step 6.4.
* calculate age in months for each month in the calendar.
compute agem = (v008 - v011) - (i - v018).

* calculate century month code for each month.
compute c = v008 - (i - v018).
variable labels c "Century month code".
print formats c (f2.0).

* create variable for use of any method as a 0/100 variable.
compute usingany = (char.index("0BPT", method) = 0) * 100.
variable labels usingany "Using any method".
value labels usingany 0 "Not using" 100 "Using a method".
print formats usingany (f1.0).
```

E6.5   Weight the data and tabulate

Lastly, we compute the weight variable to be used, and in the case of SPSS, apply the weight, before tabulating the results. In SPSS we need to filter the cases for women age 15-44 before the tabulation, while in Stata this condition is built into the tabulation commands. The examples below give two options for tabulating the data:

- a simple cross-tabulation with the century month code in the row and the CPR variable (which gives the proportion not using a method and the proportion using a method), and
- a method taking into account the complex sample design using svy in Stata and csdescriptives in SPSS

Both options produce a mean of the 0/100 variable usingany by century month code, which is the proportion of women age 15-44 using any contraceptive method. In the second option, together with the contraceptive prevalence rate for each month, we also calculate the standard error and the confidence interval.

Stata

```
* Step 6.5
* compute weight variable
gen wt=v005/1000000

* simply tabulate CPR for each month
tab cmctime usingany [iw=wt] if inrange(agem,180,539), row nofreq

* set up the svy paramters and calculate the mean of usingany (which is the CPR)
svyset v021 [pweight=wt], strata(v023)

* tabulate CPR for women 15-44
svy, subpop(if inrange(agem,180,539)): mean usingany, over(cmctime) nolegend
```

SPSS

```
* Step 6.5.
* Compute weight variable and weight the data.
compute wt = v005/1000000.
weight by wt.


* age range restricted to 15-44.
compute agerange=(agem >= 180 & agem <= 539).
filter by agerange.


* simply tabulate CPR for each month.
crosstabs tables=cmctime by usingany /cells row.


* or better, using the complex samples descriptives.


* turn off weighting as the complex samples procedures don't use the weight
* from the 'weight by' command, but use it from the csplan instead.
* this eliminates a confusing warning message about the weight being ignored.
weight off.


csplan analysis /plan file='Calendar.csaplan'
  /planvars analysisweight=wt
  /srsestimator type=wor
  /design strata=v023 cluster=v021
  /estimator type=wr.

* tabulate CPR for women 15-44 at the time.
csdescriptives /plan file='Calendar.csaplan'
  /summary variables = usingany
  /subpop table=cmctime
  /mean
  /statistics se cin.
```

Stata output

```
. * Step 6.5
. * compute weight variable
. gen wt=v005/1000000


.
. * simply tabulate CPR for each month
. tab cmctime usingany [iw=wt] if inrange(agem,180,539), row nofreq

   Century |   Using any method
month code | Not using  Using a m |     Total
-----------+----------------------+----------
      1327 |     93.17       6.83 |    100.00
      1328 |     93.09       6.91 |    100.00
      1329 |     93.00       7.00 |    100.00
      1330 |     92.84       7.16 |    100.00
      1331 |     92.75       7.25 |    100.00
      1332 |     92.43       7.57 |    100.00
      1333 |     92.21       7.79 |    100.00
      1334 |     92.08       7.92 |    100.00
      1335 |     92.00       8.00 |    100.00
      1336 |     91.70       8.30 |    100.00
      1337 |     91.64       8.36 |    100.00
      1338 |     91.29       8.71 |    100.00
      1339 |     90.71       9.29 |    100.00
      1340 |     90.45       9.55 |    100.00
      1341 |     90.38       9.62 |    100.00
```

```
      1342 |      90.34       9.66 |     100.00
      1343 |      90.31       9.69 |     100.00
      1344 |      90.18       9.82 |     100.00
      1345 |      89.86      10.14 |     100.00
      1346 |      89.53      10.47 |     100.00
      1347 |      89.27      10.73 |     100.00
      1348 |      89.02      10.98 |     100.00
      1349 |      88.56      11.44 |     100.00
      1350 |      88.11      11.89 |     100.00
      1351 |      87.85      12.15 |     100.00
      1352 |      87.60      12.40 |     100.00
      1353 |      87.47      12.53 |     100.00
      1354 |      87.38      12.62 |     100.00
      1355 |      87.41      12.59 |     100.00
      1356 |      87.28      12.72 |     100.00
      1357 |      86.97      13.03 |     100.00
      1358 |      86.70      13.30 |     100.00
      1359 |      86.25      13.75 |     100.00
      1360 |      85.69      14.31 |     100.00
      1361 |      85.46      14.54 |     100.00
      1362 |      85.02      14.98 |     100.00
      1363 |      84.74      15.26 |     100.00
      1364 |      84.51      15.49 |     100.00
      1365 |      84.33      15.67 |     100.00
      1366 |      84.21      15.79 |     100.00
      1367 |      84.24      15.76 |     100.00
      1368 |      84.23      15.77 |     100.00
      1369 |      83.57      16.43 |     100.00
      1370 |      82.95      17.05 |     100.00
      1371 |      82.43      17.57 |     100.00
      1372 |      81.94      18.06 |     100.00
      1373 |      81.81      18.19 |     100.00
      1374 |      81.22      18.78 |     100.00
      1375 |      81.18      18.82 |     100.00
      1376 |      80.74      19.26 |     100.00
      1377 |      80.42      19.58 |     100.00
      1378 |      80.25      19.75 |     100.00
      1379 |      79.71      20.29 |     100.00
      1380 |      79.18      20.82 |     100.00
      1381 |      78.48      21.52 |     100.00
      1382 |      78.23      21.77 |     100.00
      1383 |      77.76      22.24 |     100.00
      1384 |      77.08      22.92 |     100.00
      1385 |      76.37      23.63 |     100.00
      1386 |      75.77      24.23 |     100.00
-----------+---------------------+----------
     Total |      85.94      14.06 |     100.00


.
. * set up the svy paramters and calculate the mean of usingany (which is the CPR)
. svyset v021 [pweight=wt], strata(v023)

      pweight: wt
          VCE: linearized
  Single unit: missing
     Strata 1: v023
         SU 1: v021
        FPC 1: <zero>


.
. * tabulate CPR for women 15-44
```

```
. svy, subpop(if inrange(agem,180,539)): mean usingany, over(cmctime) nolegend
(running mean on estimation sample)


Survey: Mean estimation

Number of strata =        8       Number of obs   =    500,880
Number of PSUs   =      217       Population size = 500,879.98
                                  Subpop. no. obs =    415,066
                                  Subpop. size    = 419,215.66
                                  Design df       =        209


-----------------------------------------------------------------
             |              Linearized
        Over |      Mean   Std. Err.     [95% Conf. Interval]
-------------+---------------------------------------------------
usingany     |
        1327 |  6.826301   1.394903      4.076417    9.576184
        1328 |  6.907226    1.39015      4.166713     9.64774
        1329 |  7.003087   1.384522      4.273668    9.732506
        1330 |  7.162718   1.362503      4.476707    9.848729
        1331 |  7.250781   1.354845      4.579868    9.921695
        1332 |   7.57439   1.433646       4.74813    10.40065
        1333 |  7.791406   1.518362      4.798139    10.78467
        1334 |  7.918431   1.523505      4.915023    10.92184
        1335 |  7.995632    1.42497      5.186475    10.80479
        1336 |  8.304927   1.505767      5.336489    11.27336
        1337 |  8.360027    1.47329      5.455613    11.26444
        1338 |  8.705975   1.619501      5.513323    11.89863
        1339 |  9.293078   1.772632      5.798547    12.78761
        1340 |  9.548267   1.855908      5.889567    13.20697
        1341 |  9.616516   1.757516      6.151786    13.08125
        1342 |  9.659246   1.742195      6.224719    13.09377
        1343 |  9.688056   1.727471      6.282555    13.09356
        1344 |  9.818077   1.722848       6.42169    13.21446
        1345 |  10.14429   1.797486      6.600764    13.68782
        1346 |  10.47487   1.689904       7.14343    13.80632
        1347 |  10.73104    1.72581      7.328816    14.13327
        1348 |  10.97644   1.682512      7.659574    14.29331
        1349 |  11.44304   1.654197      8.181986    14.70409
        1350 |  11.88802   1.647213      8.640737     15.1353
        1351 |  12.15204   1.712481      8.776091    15.52799
        1352 |  12.40302   1.781062      8.891871    15.91417
        1353 |  12.52892   1.784517      9.010963    16.04688
        1354 |   12.6182   1.778422      9.112258    16.12415
        1355 |  12.58572   1.778742      9.079139    16.09229
        1356 |  12.71764   1.765487      9.237193    16.19808
        1357 |  13.03124   1.666866      9.745213    16.31726
        1358 |  13.29739   1.752256      9.843025    16.75175
        1359 |  13.74868    1.80117      10.19788    17.29947
        1360 |  14.31233   1.855829      10.65378    17.97087
        1361 |   14.5398    1.84365      10.90527    18.17433
        1362 |  14.97648   1.899527      11.23179    18.72117
        1363 |  15.25645   1.865809      11.57823    18.93466
        1364 |  15.49366   1.745618      12.05238    18.93493
        1365 |  15.66688   1.722182      12.27181    19.06196
        1366 |  15.78676   1.711957      12.41184    19.16168
        1367 |   15.7607   1.705844      12.39784    19.12357
        1368 |  15.76813    1.70541      12.40612    19.13014
        1369 |  16.43327   1.772216      12.93956    19.92698
        1370 |  17.04896    2.00703      13.09234    21.00558
        1371 |  17.57024   2.224489      13.18493    21.95555
        1372 |  18.06329   2.285629      13.55745    22.56913
```

```
1373 |    18.1907    2.190652    13.87209    22.50931
1374 |    18.7826     2.14883    14.54644    23.01876
1375 |   18.82163     2.14552      14.592    23.05127
1376 |   19.26218    2.130525    15.06211    23.46226
1377 |   19.58263    2.042189     15.5567    23.60856
1378 |    19.7548     2.11941    15.57664    23.93296
1379 |   20.29312    2.085764    16.18129    24.40496
1380 |   20.82156    2.132107    16.61836    25.02475
1381 |   21.52466    2.016138    17.55009    25.49923
1382 |   21.76771    2.016651    17.79212    25.74329
1383 |   22.24158     1.91256     18.4712    26.01196
1384 |   22.91808    1.886763    19.19855     26.6376
1385 |   23.63029     1.83193    20.01886    27.24172
1386 |   24.22737     1.80001    20.67887    27.77588
-----------------------------------------------------------
```

Note: CMC 1333 is January 2011, CMC 1345 is January 2012, CMC 1357 is January 2013, CMC 1369 is January 2014, CMC 1381 is January 2015. Thus CMC 1327 is July 2010 and CMC 1386 is June 2015.

The data tabulated with this example using the model dataset highlight one of the potential issues with data quality in DHS calendar data. The results from the model dataset show a much lower contraceptive prevalence rate further back in time that is not likely to be accurate, but more likely due to poor reporting. This pattern is seen in some DHS surveys, while others demonstrate expected patterns of contraceptive prevalence over time. This data quality issue is discussed in depth in Contraceptive use and perinatal mortality in the DHS: an assessment of the quality and consistency of calendars and histories (Bradley, Winfrey, and Croft 2015).

Module 5: Introduction to event files and how to use them

Goal of the module: For analysts to understand how to convert the data into event files, and how to use the event files in analysis.

5.1. Introduction to event files

In DHS data analysis we have different files for different units of analysis – households, women, children, etc. In the prior Module 4 we saw how to create files where the unit of analysis was the month. Now we want to change the unit of analysis to the event. This is particularly useful for life table analysis.

The examples in the previous modules demonstrated two main approaches to working with the calendar data: 1) string manipulation of the calendar string variables, and 2) converting the calendar data into a file of single month entries. In this module, we will discuss the third approach: constructing event files. Event files are also known as episode files or, as described by Curtis and Hammerslough (1995) in FA59: Model Further Analysis Plan: Contraceptive Use Dynamics, as segment files. These files, rather than having a record for each single month in the calendar, have a record for an event of some duration, or an episode or segment of use or non-use. The terms "event", "episode", and "segment" tend to be used interchangeably when referring to these files, but you can think of an event as being a change to a new state that continues throughout an episode or segment. For example, an event might be becoming pregnant or starting use of a contraceptive method, and the episode or segment is the time for which that pregnancy continued or the method was used.

Event files are constructed in a similar manner to the files of single month entries, but with several important differences:

1) The event files only contain a single record for each continuous episode or segment of use, non-use, pregnancy, birth or termination.
2) The event files, in addition to the information about the type of the event, also include information on when the episode started, when it stopped, the duration of the episode, and what event preceded or followed the event.
3) Events are defined only when there is a change in the code in the first column of the calendar (vcal_1/VCAL$1). It would be possible to extend the idea of event files to include changes in other columns of the calendar, but as most surveys now only include the first two columns of the calendar, the definition above is sufficient for most purposes.

Event files are useful in analysis as they can contain information not only about the event or episode itself, but about the duration of that event or episode, and the events that immediately preceded or followed the specific event. This permits a number of other analyses that either require information about the duration of an event or episode, such as twelve-month contraceptive discontinuation rates, or that require information about events that precede or follow a specific event, such as an analysis of contraceptive switching.

Let's look at an example case, using the calendar data given below:

```
Year      <-2015-><---2014---><---2013---><---2012---><---2011---><---2010---><---2009--->
Month     AJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJDNOSAJJMAMFJ
vcal_1            11111111000BPPPPPPPP888880000000001111111100000000033333300TPP00000000
vcal_2                              1              4              5
vcal_3            XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX0000
vcal_4            000000000000000000000000000000X1111111111111111111111111111X33333333333
vcal_5                    2              F              2              3
Position  ....5...10...15...20...25...30...35...40...45...50...55...60...65...70...75...80
```

where:

vcal_1 Births, terminated pregnancies, months of pregnancy and contraceptive use
vcal_2 Reason for discontinuation of use of a contraceptive method
vcal_3 Marriage
vcal_4 Types of place of residence and change in residence
vcal_5 Source of contraceptive method

Note that the position and year and month rows have been added for illustration. Users will see only the data shown in vcal_1 through vcal_5 in their dataset.

This case would be converted into an event file containing the following variables:

ev004   Index for the event
ev900   CMC start of the event
ev901   CMC end of the event
ev901a Duration of the event
ev902a Alphanumeric code for the event from the calendar column 1 (vcal_1/VCAL$1)
ev902   Numeric code for the event
ev903a Alphanumeric code for the reason for discontinuation from calendar column 2 (vcal_2/VCAL$2)
ev903   Numeric code for the reason for discontinuation
ev904   Numeric code for the previous event
ev905   Numeric code for the following event
ev906a Alphanumeric code for the marital status at the end of the segment from calendar column 3 (vcal_3/VCAL$3)
ev906   Numeric code for the marital status

The event file is created by reading the calendar data for vcal_1 starting from the right hand end in position 80. For example, position 80 (January 2009) is CMC 1309 (ev900 = 1309). From the right hand end of vcal_1 there are 8 codes "0" (ev901a = 8, ev902a = "0", and ev902 = 0) going up to position 73 (September 2009) which is CMC 1316 (ev901 = 1316). This is followed by two codes "P" (ev901a = 2, ev902a = "P", and ev902 = 83) in positions 71 and 72 (ev900 = 1317 and ev901 = 1318). In total there are 13 separate events in this calendar, up to the date of interview where the respondent is using method

105

code "1" (`ev902a = 1, ev902 = 1`), and has been using it for 8 months (`ev901a = 8`) from position 19 (February 2014 – `ev900` = CMC 1370) to position 12 (September 2014 – `ev901` = CMC 1377).

The resulting data for the event file for this case would look like the following:

ev004	ev900	ev901	ev901a	ev902a	ev902	ev903a	ev903	ev904	ev905	ev906a	ev906
1	1309	1316	8	"0"	0				83	"X"	1
2	1317	1318	2	"P"	83			0	82	"X"	1
3	1319	1319	1	"T"	82			83	0	"X"	1
4	1320	1321	2	"0"	0			82	3	"X"	1
5	1322	1327	6	"3"	3	"5"	5	0	0	"X"	1
6	1328	1335	8	"0"	0			3	1	"X"	1
7	1336	1343	8	"1"	1	"4"	4	0	0	"X"	1
8	1344	1352	9	"0"	0			1	8	"X"	1
9	1353	1357	5	"8"	8	"1"	1	0	83	"X"	1
10	1358	1365	8	"P"	83			8	81	"X"	1
11	1366	1366	1	"B"	81			83	0	"X"	1
12	1367	1369	3	"0"	0			81	1	"X"	1
13	1370	1377	8	"1"	1			0		"X"	1

In the above example, there are 13 separate cases produced from the calendar data for the respondent – one for each different consecutive code in the first column of the calendar from `vcal_1/VCAL$1`.

In the above:

`ev901a` is the duration calculated as `ev901-ev900+1`.

`ev902` is a numerical conversion of `ev902a` (contraceptive method, non-use, or months of pregnancy) but with letter codes for methods converted to numerical codes 10-19, and with births coded 81, terminated pregnancies coded 82, and months of pregnancy coded 83.

`ev903` is a numerical conversion of `ev903a` (reason for discontinuation), but with letter codes converted to codes 10+, and with Other ("W") coded 96, Don't know ("K") coded 98, and missing ("?") coded 99 (not shown in the above example).

`ev904` is the code for the preceding event, copied from `ev902` for the preceding row with the same case identification.

`ev905` is the code for the following event, copied from `ev902` for the following row with the same case identification.

`ev906` is a numerical conversion of `ev906a` (marital status at the end of the episode), converting "X" to 1, "0" to 0, and "?" to 9. If any other code is found, or the marriage column is not used, then code 7 is assigned.

Additionally, in the example provided, the following standard variables are carried across from the individual recode (IR) dataset into the event file:

`caseid` Case identification

`v001`   Cluster number

`v002`   Household number

`v003`   Woman's line number

`v005`   Women's sample weight

`v007`   Year of interview

`v008`   Century month code (CMC) of date of interview

`v011`   Century month code (CMC) of date of birth of respondent

`v017`   Century month code (CMC) of date of start of calendar

`v018`   Position of month of interview in calendar

`v019`   Length of calendar used

`v021`   Primary sampling unit

`v023`   Sample design stratification

`v101`   Region of residence

`v102`   Type of place of residence

`v106`   Level of education

`v190`   Wealth quintile

5.2. How to create an events file

Events files are created in a similar process to the construction of the single month files, but with an added step of combining consecutive months that have the same code in column 1 of the calendar into a single record with a count of the number of months that the same code appeared. The combining of the separate records for the consecutive months into a single record is achieved using the `collapse` command in Stata or the `aggregate` command in SPSS. Example 7 found in Create events file.do or Create events file.sps provides an example of how to prepare these files.

Example 7 – Create events file

Example 7 does not carry out any analysis, but prepares an events file that can be used in an analysis. It builds on the approaches used in the prior examples to construct the events file.

Logic for example 7 can be found in the following files:

Software	Commands	Output
Stata	Stata\Create events file.do	Stata\Create events file.log
SPSS	SPSS\Create events file.sps	SPSS\Create events file.txt

E7.0   Open the datasets, keeping just the data needed

As in other examples, the dataset is opened, selecting the variables to use. From the calendar this example uses the contraceptive use, births, terminations and pregnancies (column 1), the reasons for discontinuation (usually column 2), and, where it exists, marriage (usually column 3). Note that for DHSII surveys the columns might be different from the current standard. We also include the main variables that we might want to use for analysis, typically keeping this file to a relatively small number of variables (it is straightforward to merge additional variables in from the individual recode file if other variables are needed). The list of variables that we are keeping is given above.

We use a set of macros for each of the three columns to permit easy adaptation of the logic if the column numbers are different from the standard (typically only for older surveys). In Stata we check if the marriage column exists and if so whether it is empty or not, and use that automatically in the logic. In SPSS we do not have quite the same level of control over existence of variables, so some adaptation will be necessary related to the marriage column in the next step.

Stata
```
* DHS Calendar Tutorial - Example 7
* Create events file

* download the model dataset for individual women's recode: "ZZIR62FL.DTA"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
```

```
cd "C:\Data\DHS_model"

* open the dataset to use
use caseid v000 v001 v002 v003 v005 v007 v008 v011 v017 v018 v019 v021 v023 v101 v102 v106 ///
  v190 vcal_* using "ZZIR62FL.DTA", clear

* set up which calendar columns to look at - column numbers can vary across phases of DHS
local col1 1 // method use and pregnancies - always column 1
local col2 2 // reasons for discontinuation - usually column 2
local col3 3 // marriage - when it exists it is usually column 3
local marr_col vcal_`col3'
* check if marriage column exists
capture confirm variable vcal_`col3'
if _rc { // variable does not exist
  di "Marriage column does not exist"
  local marr_col
  local col3
}
else { // variable exists, but is it empty?
  assert vcal_`col3'==""
  if !_rc { // variable is empty
    di "Marriage column exists but is empty"
    local marr_col
    local col3
  }
  else {
    di "Marriage column exists and contains data"
  }
}
```

SPSS

```
* DHS Calendar Tutorial - Example 7.
* Create events file.

* download the model dataset for individual women's recode: "ZZIR62FL.SAV"
* the model datasets are available at http://dhsprogram.com/data/download-model-datasets.cfm .

* change to a working directory where the data are stored
* or add the full path to the 'get file' command below.
cd "C:\Data\DHS_model".

* set up which calendar columns to look at - column numbers can vary across phases of DHS.
* method use and pregnancies - always column 1.
define !cal1() VCAL$1 !enddefine.
* reasons for discontinuation - usually column 2.
define !cal2() VCAL$2 !enddefine.
* marriage - when it exists it is usually column 3 - adapt if it is a different column.
define !cal3() VCAL$3 !enddefine.
*define !cal3()        !enddefine.  * leave it blank if vcal$3 does not exist.
* set length of calendar in a macro.
define !vcal_len() 80 !enddefine.

* open the dataset to use.
get file="ZZIR62FL.SAV" / keep CASEID V000 V001 V002 V003 V005 V007 V008 V011 V017 V018 V019
  V021 V023 V101 V102 V106 V190 !cal1 !cal2 !cal3.

* set maximum number of loops high enough.
* could be as many as the length of the calendar (typically 80), so set it a bit higher.
set mxloops = 100.
```

E7.1   Convert the calendar into separate variables per month

We follow a similar approach to Examples 5 and 6 to create 80 separate single character string variables for the 80 months of the calendar for each column, using the `substr` functions in each language. The logic is set up to create three sets of variables for columns 1, 2 and 3. In the SPSS logic if the marriage column does not exist in the dataset, there is one line that should be commented out.

We will also create a set of 80 variables (`ev004*`) to indicate which episode each single month contributes to. To construct this set we will use two working variables to remember the current episode number (`eps`) and the previous month's code from `vcal_1` (`prev_vcal1`). Additionally we will create the episodes in chronological order, so the loop through the calendar starts from the end of the calendar string and works towards the beginning. We use `j` as our index into the calendar strings going from 80 to 1, and `i` as our index for the constructed variables going from 1 to 80.

The variable eps is initialized to 0 before the loop, and is updated any time there is a change in event, including at the beginning of the calendar. Thus the first episode at the beginning of the calendar will be episode 1, and when the code in the calendar column 1 changes to a different code that will signal the start of episode 2, and this repeats for each change in event. Lastly `prev_vcal1` is set to the code in `vcal1_` for the month to use in testing for a change in the next iteration of the loop.

Stata

```
* Step 7.1
* set length of calendar in a local macro
local vcal_len = strlen(vcal_`col1'[1])
* set episode number - initialized to 0
gen eps = 0
* set previous calendar column 1 variable to anything that won't be in the calendar
gen prev_vcal1 = "_"
* create separate variables for each month of the calendar
forvalues j = `vcal_len'(-1)1 {
  local i = `vcal_len' - `j' + 1
  * contraceptive method, non-use, or birth, pregnancy, or termination
  gen vcal1_`i' = substr(vcal_`col1',`j',1)
  * reason for discontinuation
  gen vcal2_`i' = substr(vcal_`col2',`j',1)

  * check if we have marriage info
  if "`marr_col'"!="" { // we have a marriage column
    gen vcal3_`i' = substr(vcal_`col3',`j',1)
    * set up parameter to add into reshape below, and collapse further below
    local vcal3_ vcal3_
    local ev906 ev906a=vcal3_
  }
  * increase the episode number if there is a change in vcal_1
  replace eps = eps+1 if vcal1_`i' != prev_vcal1
  * set the episode number
  gen int ev004`i' = eps
  * save the vcal1 value for the next time through the loop
  replace prev_vcal1 = vcal1_`i'
}
```

SPSS

```
* Step 7.1.
* set episode number - initialized to 0.
compute eps = 0.
* set previous calendar column 1 variable to anything that won't be in the calendar.
string prev_vcal1 (a1).
compute prev_vcal1 = "_".
```

```
* create separate variables for each month of the calendar.
vector vcal1_(!vcal_len A1).
vector vcal2_(!vcal_len A1).
vector vcal3_(!vcal_len A1).
vector EV004_(!vcal_len F2.0).

loop #i = 1 to !vcal_len.

  compute #j = !vcal_len-#i+1.
  * contraceptive method, non-use, or birth, pregnancy, or termination.
  compute vcal1_(#i) = char.substr(!cal1,#j,1).
  * reason for discontinuation.
  compute vcal2_(#i) = char.substr(!cal2,#j,1).
  * marriage. initialize to blank in case it does not exist.
  compute vcal3_(#i) = " ".
  * comment out the line below if the marriage column does not exist.
  compute vcal3_(#i) = char.substr(!cal3,#j,1).

  * set up parameter to add into reshape below, and collapse further below.
  * increase the episode number if there is a change in vcal$1.
  if (vcal1_(#i) <> prev_vcal1) eps = eps+1.
  * set the episode number.
  compute EV004_(#i) = eps.
  * save the vcal1 value for the next time through the loop.
  compute prev_vcal1 = vcal1_(#i).

end loop.
execute.
```

E7.2   Restructure the data into a file with one record per month of the calendar

In Stata we drop `vcal_*` after creating the single month variables as we do not want to duplicate the calendar variables on each record when reshaping the file. In SPSS, they are explicitly excluded in the restructuring.

As in Examples 5 and 6 we convert the 80 separate variables for the calendar into 80 cases each with one set of variables for each case in the original file. In Stata the discontinuation code can sometimes be an empty string, so we replace this with a single blank character for consistency.

Stata
```
* Step 7.2
* drop the calendar variables now we have the separate month by month variables
drop vcal_* eps prev_vcal1

* reshape the new month by month variables into a long format
reshape long ev004 vcal1_ vcal2_ `vcal3_', i(caseid) j(i)

* update the discontinuation code to a blank if it is empty
replace vcal2_ = " " if vcal2_ == ""

* label the event number variable
label variable ev004 "Event number"
```
SPSS
```
* Step 7.2.
* reshape the new month by month variables into a long format.
varstocases
  /make vcal1 from vcal1_1 to vcal1_!vcal_len
  /make vcal2 from vcal2_1 to vcal2_!vcal_len
  /make vcal3 from vcal3_1 to vcal3_!vcal_len
```

```
   /make EV004 from EV004_1 to EV004_!vcal_len
   /index=i(!vcal_len)
   /drop=!cal1 !cal2 !cal3 eps prev_vcal1
   /null=keep.

* label the event number variable.
variable labels EV004 "Event number".
```

Stata output

```
. * Step 7.2
. * drop the calendar variables now we have the separate month by month variables
. drop vcal_* eps prev_vcal1

.
. * reshape the new month by month variables into a long format
. reshape long ev004 vcal1_ vcal2_ `vcal3_', i(caseid) j(i)
(note: j = 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37
> 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69
70 71 72 73
>  74 75 76 77 78 79 80)

Data                              wide   ->   long
-----------------------------------------------------------------------------
Number of obs.                    8348   ->   667840
Number of variables                258   ->       22
j variable (80 values)                   ->   i
xij variables:
            ev0041 ev0042 ... ev00480   ->   ev004
        vcal1_1 vcal1_2 ... vcal1_80    ->   vcal1_
        vcal2_1 vcal2_2 ... vcal2_80    ->   vcal2_
-----------------------------------------------------------------------------

.
. * update the discontinuation code to a blank if it is empty
. replace vcal2_ = " " if vcal2_ == ""
(637,662 real changes made)

.
. * label the event number variable
. label variable ev004 "Event number"
```

E7.3   Calculate CMC for each month and drop months beyond the month of interview

We next calculate the century month code (CMC) for each month as $v017 + i - 1$, and we drop any month after the month of interview ($i > v019$).

Additionally, in Stata, we want to capture the variable and value labels for many of the variables we want in the events file as they would otherwise be dropped in the next step. In SPSS, the variable and value labels are carried through automatically in the next step. This uses a set of local macros to hold the variable and value labels for each variable.

Stata

```
* Step 7.3
* create the century month code (CMC) for each month
gen cmc=v017+i-1

* drop the blank episode after the date of interview
```

```
drop if i > v019

* capture the variable labels for the v variables
foreach v of varlist v* {
  local l`v' : variable label `v'
}
* and the value labels for v101 v102 v106 v190
foreach v of varlist v1* {
  local `v'lbl : value label `v'
}
```

SPSS

```
* Step 7.3.
* create the century month code (CMC) for each month.
compute cmc=V017+i-1.
print formats cmc (f2.0).

* drop the blank episode after the date of interview.
select if (i <= V019).
```

E7.4   Convert from a single month per record to an episode per record

The next step is to summarize the data from a single month per record to an episode per record, and this can be achieved with the `collapse` command in Stata and the `aggregate` command in SPSS. Both of these commands are typically used to produce datasets of summary data such as counts and means, but we can also use them for constructing our events file.

The commands are used to aggregate or collapse the data into events for each respondent, and so they are aggregating over `caseid` and the event number (`ev004`), using the `by` option in Stata and the `break` parameter in SPSS.

For the variables that will be in our resulting dataset, many are from the respondent and are being copied across. We could use any of the functions such as `first`, `last`, `min`, `max`, or even `mean` (each of these would give the same result) with these variables as they are constants within the case and event.

We are also constructing the start and end dates (`ev900` and `ev901`, respectively), as CMCs, and for these we use the function `first` for the start and `last` for the end date with the CMC. To get the duration of the event (`ev901a`) we can count the number of records (`count` in Stata, `Nu` in SPSS). For this count, we can count the cases for any variable that is not missing – it does not matter which variable, and here we choose to use the CMC.

We also want the event code (`ev902a`) in our dataset and for this we could use `first` or `last` as it will be constant. We also need the reason for discontinuation (`ev903a`) and for this we need to use `last` as the code is only given at the end of the episode of use. Similarly for marriage, we want the marriage code (`ev906a`) at the end of the episode, so again we use `last`. These last three variables will all be alphabetic codes directly from the calendar, but we produced numeric versions for analysis in later steps.

In Stata we are also re-labeling all of the variables that are copied across from the respondent and adding labels for the newly created variables.

Stata

```
* Step 7.4
* collapse the episodes within each case, keeping start and end, the event code,
* and other useful information
collapse (first) v001 v002 v003 v005 v007 v008 v011 v017 v018 v019 v101 v102 v106 v190 ///
  (first) ev900=cmc (last) ev901=cmc (count) ev901a=cmc ///
  (last) ev902a=vcal1_ ev903a=vcal2_ `ev906', by(caseid ev004)

* replace the variable label for all of the v* variables
foreach v of varlist v* {
  label variable `v' `"`l`v''"'
}
* and the value labels for v101 v102 v106 v190
foreach v of varlist v1* {
  label val `v' ``v'lbl'
}

* label the variables created in the collapse statement
label variable ev900  "CMC event begins"
label variable ev901  "CMC event ends"
label variable ev901a "Duration of event"
label variable ev902a "Event code (alpha)"
label variable ev903a "Discontinuation code (alpha)"
format ev004 %2.0f
format ev900 ev901 %4.0f
```

SPSS

```
* Step 7.4.
* aggregate the episodes within each case, keeping start and end, the code, and other useful
information.
dataset declare Events.
aggregate
  /outfile="Events"
  /break=CASEID EV004
  /V001 =first(V001)
  /V002 =first(V002)
  /V003 =first(V003)
  /V005 =first(V005)
  /V007 =first(V007)
  /V008 =first(V008)
  /V011 =first(V011)
  /V017 =first(V017)
  /V018 =first(V018)
  /V019 =first(V019)
  /V021 =first(V021)
  /V023 =first(V023)
  /V101 =first(V101)
  /V102 =first(V102)
  /V106 =first(V106)
  /V190 =first(V190)
  /EV900 "CMC event begins"=first(cmc)
  /EV901 "CMC event ends"=last(cmc)
  /EV901A "Duration of event"=Nu(cmc)
  /EV902A "Event code (alpha)"=last(vcal1)
  /EV903A "Discontinuation code (alpha)"=last(vcal2)
  /EV906A "Married at end of episode (alpha)"=last(vcal3).

dataset activate Events.
```

E7.5   Convert the event code to numeric

In this step we convert the alphanumeric event code (`ev902a`) to a numeric code (`ev902`). The coding used here uses codes 1-20 for contraceptive methods, code 0 for non-use of contraception, and codes 81-83 for births, terminations and pregnancies, respectively, and code 99 for missing data. Note that this code may need adaptation for the survey-specific codes used in any particular survey. In particular codes "E" (Emergency contraception), "M" (Other modern methods), and code "S" (Standard days method) are relatively recent additions as standard codes, and these codes have been used in some earlier surveys to indicate other survey-specific methods.

The logic includes a check that all alphanumeric method codes are recoded to numeric codes, but this check does not verify that all methods are correctly classified.

Stata

```
* Step 7.5
* convert the event string variable for the episode (ev902a) to numeric (ev902)

* set up a list of codes used in the calendar,
* with the position in the string of codes being the code that will be assigned
* use a tilde (~) to mark gaps in the coding that are not used for this survey
* Emergency contraception (E), Other modern method (M) and Standard days method (S)
* are recent additions as standard codes and may mean something different in earlier surveys
* note that some of the codes are survey specific so this will need adjusting
* tab vcal1_ to see the full list of codes to handle for the survey you are using
local methodlist = "123456789WNALCFEMS~"
* convert the contraceptive methods to numeric codes, using the position in the string
gen ev902 = strpos("`methodlist'",ev902a)
* now convert the birth, termination and pregnancy codes to 81, 82, 83 respectively
gen preg = strpos("BTP",ev902a)
replace ev902 = preg+80 if preg>0
drop preg
* convert the missing code to 99
replace ev902 = 99 if ev902a == "?"
* now check if there are any codes that were not converted, and change these to -1
replace ev902 = -1 if ev902 == 0 & ev902a != "0"

* list cases where the event code was not recoded
list caseid ev004 ev902 ev902a if ev902==-1
```

SPSS

```
* Step 7.5.
* convert the event string variable for the episode (EV902a) to numeric (EV902).


* set up a list of codes used in the calendar,
* with the position in the string of codes being the code that will be assigned.
* use a tilde (~) to mark gaps in the coding that are not used for this survey.
* Emergency contraception (E), Other modern method (M) and Standard days method (S)
* are recent additions as standard codes and may mean something different in earlier surveys.
* note that some of the codes are survey specific so this will need adjusting.
* do a frequency of vcal1_ to see the full list of codes to handle for the survey you are using.
* convert the contraceptive methods to numeric codes, using the position in the string.
compute EV902 = char.index("123456789WNALCFEMS~",EV902A).
* now convert the birth, termination and pregnancy codes to 81, 82, 83 respectively.
compute preg = char.index("BTP",EV902A).
if (preg > 0) EV902 = preg+80.
* convert the missing code to 99.
if (EV902A = "?") EV902 = 99.
* now check if there are any codes that were not converted, and change these to -1.
if (EV902 = 0 & EV902A <> "0") EV902 = -1.
execute.
delete variables preg.

* list cases where the event code was not recoded.
compute filter_$ = (EV902 = -1).
filter by filter_$.
* there shouldn't be any cases listed.
list variables = CASEID EV004 EV902 EV902A.
filter off.
```

E7.6   Convert the reason for discontinuation code to numeric

Similar to the preceding step her we convert the alphanumeric reason for discontinuation code (`ev903a`) to a numeric code (`ev903`). As for the event code, there may be survey-specific discontinuation codes that should be handled in the coding.

Stata

```
* Step 7.6
* convert the discontinuation string variable for the episode (ev903a) to numeric (ev903)
* set up a list of codes used in the calendar
* use a tilde (~) to mark gaps in the coding that are not used for this survey
local reasonlist = "123456789CFAD~~~~"
* convert the reasons for discontinuation to numeric codes, using the position in the string
gen ev903 = strpos("`reasonlist'",ev903a) if ev903a != " "
* now convert the special codes for other, don't know and missing to 96, 98, 99 respectively
gen special = strpos("W~K?",ev903a)
replace ev903 = special + 95 if special > 0
drop special
* now check if there are any codes that were not converted, and change these to -1.
replace ev903 = -1 if ev903 == 0 & ev903a != " "

* list cases where the reason for discontinuation code was not recoded
list caseid ev004 ev903 ev903a if ev903==-1
```

```
* Step 7.6.
* convert the discontinuation string variable for the episode (EV903a) to numeric (EV903).
* set up a list of codes used in the calendar.
* use a tilde (~) to mark gaps in the coding that are not used for this survey.
* convert the reasons for discontinuation to numeric codes, using the position in the string.
if (EV903A <> " ") EV903 = char.index("123456789CFAD~~~~",EV903A).
* now convert the special codes for other, don't know and missing to 96, 98, 99 respectively.
if (EV903A <> " ") special = char.index("W~K?",EV903A).
if (special > 0) EV903 = special+95.
* now check if there are any codes that were not converted, and change these to -1.
if (EV903 = 0 & EV903A <> " ") EV903 = -1.
execute.
delete variables special.

* list cases where the reason for discontinuation code was not recoded.
compute filter_$ = (EV903 = -1).
filter by filter_$.
list variables=CASEID EV004 EV903 EV903A.
filter off.
delete variables filter_$.
```

E7.7   Capturing the prior and next events and their durations

It is also useful to include the prior and following events and their durations in each record of the events file. For example, perhaps to know the gestation length of a birth or terminated pregnancy. The duration for a birth or a terminated pregnancy would only be 1 as there is a single "B" or "T". We would need to know the duration of the preceding event – the months of pregnancy – and add those to the one month for the birth or terminated pregnancy to get the total duration.

In Stata we just copy the values for the event code and duration from the previous record and the following record for the respondent. We achieve this by processing the cases with `by caseid:` to only look at events for the same respondent, and using `[_n-1]` for the prior event and `[_n+1]` for the following event, where `_n` is the current event. `_N` is the total number of events for this woman. Note that the `[_n-1]` and `[_n+1]` must immediately follow the variable names with no spaces.

In SPSS we first capture the event code and duration for the prior event using the lag function to look at the prior record, making sure that the prior event is also for this same respondent. There is no function in SPSS directly accessing the next record, but we can achieve the same result by sorting the events in reverse (descending) order and then using the lag function to look at the prior record which will now be the following event. We then re-sort the dataset back into ascending order of events.

Stata

```
* Step 7.7
* capture the previous event and its duration for this respondent
by caseid: gen ev904  = ev902[_n-1]  if _n > 1
by caseid: gen ev904x = ev901a[_n-1] if _n > 1
* capture the following event and its duration for this respondent
by caseid: gen ev905  = ev902[_n+1]  if _n < _N
by caseid: gen ev905x = ev901a[_n+1] if _n < _N
```

SPSS

```
* Step 7.7.
* capture the previous event by looking at the event for the previous episode for this woman.
if (CASEID = lag(CASEID)) EV904  = lag(EV902).
if (CASEID = lag(CASEID)) EV904X = lag(EV901a).
* need to sort the data in reverse order of the episode to be able to use the lag function.
sort cases by CASEID EV004(D).
* capture the following event by looking at the event for the next episode for this woman.
if (CASEID = lag(CASEID)) EV905  = lag(EV902).
if (CASEID = lag(CASEID)) EV905X = lag(EV901a).
* re sort back into order.
sort cases by CASEID EV004(A).
execute.
```

E7.8   Labeling the events file variables

As is good practice, we label the variables according to the coding schemes we have used for the events file variables, and set the print formats appropriately for the variables.

Stata

```
* Step 7.8
* label the event file variables and values
label variable ev902  "Event code"
label variable ev903  "Discontinuation code"
label variable ev904  "Prior event code"
label variable ev904x "Duration of prior event"
label variable ev905  "Next event code"
label variable ev905x "Duration of next event"
label def event ///
  0 "No method used" ///
  1 "Pill" ///
  2 "IUD" ///
  3 "Injectable" ///
  4 "Diaphragm" ///
  5 "Condom" ///
  6 "Female sterilization" ///
  7 "Male sterilization" ///
  8 "Periodic abstinence/Rhythm" ///
  9 "Withdrawal" ///
 10 "Other traditional methods" ///
 11 "Norplant" ///
 12 "Abstinence" ///
 13 "Lactational amenorrhea method" ///
 14 "Female condom" ///
 15 "Foam and Jelly" ///
 16 "Emergency contraception" ///
 17 "Other modern method" ///
 18 "Standard days method" ///
 81 "Birth" ///
```

```
 82 "Termination" ///
 83 "Pregnancy" ///
 99 "Missing" ///
 -1 "***Unknown code not recoded***"
label def reason ///
  0 "No discontinuation" ///
  1 "Became pregnant while using" ///
  2 "Wanted to become pregnant" ///
  3 "Husband disapproved" ///
  4 "Side effects" ///
  5 "Health concerns" ///
  6 "Access/availability" ///
  7 "Wanted more effective method" ///
  8 "Inconvenient to use" ///
  9 "Infrequent sex/husband away" ///
 10 "Cost" ///
 11 "Fatalistic" ///
 12 "Difficult to get pregnant/menopause" ///
 13 "Marital dissolution" ///
 96 "Other" ///
 98 "Don't know" ///
 99 "Missing" ///
 -1 "***Unknown code not recoded***"
label val ev902 event
label val ev903 reason
label val ev904 event
label val ev905 event
format ev901a ev902 ev903 ev904 ev904x ev905 ev905x %2.0f
```

SPSS

```
* Step 7.8.
* label the event file variables and values.
variable labels EV902  "Event code".
variable labels EV903  "Discontinuation code".
variable labels EV904  "Prior event code".
variable labels EV904X "Duration of prior event".
variable labels EV905  "Next event code".
variable labels EV905X "Duration of next event".
print formats EV004 EV901A EV902 EV903 EV904 EV904X EV905 EV905X (F2.0).

value labels
  EV902 EV904 EV905
    0 "No method used"
    1 "Pill"
    2 "IUD"
    3 "Injectable"
    4 "Diaphragm"
    5 "Condom"
    6 "Female sterilization"
    7 "Male sterilization"
    8 "Periodic abstinence/Rhythm"
    9 "Withdrawal"
   10 "Other traditional methods"
   11 "Norplant"
   12 "Abstinence"
   13 "Lactational amenorrhea method"
   14 "Female condom"
   15 "Foam and Jelly"
   16 "Emergency contraception"
   17 "Other modern method"
   18 "Standard days method"
   81 "Birth"
```

```
   82 "Termination"
   83 "Pregnancy"
   99 "Missing"
   -1 "***Unknown code not recoded***".
value labels
  EV903
   0 "No discontinuation"
   1 "Became pregnant while using"
   2 "Wanted to become pregnant"
   3 "Husband disapproved"
   4 "Side effects"
   5 "Health concerns"
   6 "Access/availability"
   7 "Wanted more effective method"
   8 "Inconvenient to use"
   9 "Infrequent sex/husband away"
  10 "Cost"
  11 "Fatalistic"
  12 "Difficult to get pregnant/menopause"
  13 "Marital dissolution"
  96 "Other"
  98 "Don't know"
  99 "Missing"
  -1 "***Unknown code not recoded***".
```

E7.9   Convert marriage codes to numeric

If the data on marriage was available in the survey, we convert the alphanumeric marriage codes to
numeric codes, and label the variables. In Stata the logic confirms that the alphanumeric variable `ev906a`
exists and if so it applies the recoding and labeling. In SPSS, if the marriage column does not exist in the
calendar, then this step can be skipped.

Stata

```
* Step 7.9
* convert marriage codes to numeric, if it exists
capture confirm variable ev906a
if !_rc { // variable exists
  gen ev906 = 7
  replace ev906=0 if ev906a=="0"
  replace ev906=1 if ev906a=="X"
  replace ev906=9 if ev906a=="?"
  label variable ev906a "Married at end of episode (alpha)"
  label variable ev906  "Married at end of episode"
  label def marriage 0 "Not married" 1 "Married" 7 "Unknown code" 9 "Missing"
  label val ev906 marriage
  format ev906 %1.0f
}
```

SPSS

```
* Step 7.9.
* convert marriage codes to numeric, if it exists.
compute EV906 = 7.
if (EV906A = "0") EV906=0.
if (EV906A = "X") EV906=1.
if (EV906A = "?") EV906=9.
variable labels EV906 "Married at end of episode".
value labels EV906 0 "Not married" 1 "Married" 7 "Unknown code" 9 "Missing".
print formats EV906 (f1.0).
```

E7.10   Saving the events file

The only thing remaining is to save the events file for use in future analyses.

Stata
```
* Step 7.10
* save the events file
save eventsfile.dta, replace
```
SPSS
```
* Step 7.10.
* save the events file.
save outfile="eventsfile.sav".
```

The resulting dataset contains the following data for the generated variables (ignoring the standard variables passed directly from the individual recode file to the events file).

Resulting events file data:

caseid	ev004	ev900	ev901	ev901a	ev902a	ev903a	ev902	ev903	ev904	ev904x	ev905	ev905x
1 1 2	1	1321	1340	20	0		0				83	8
1 1 2	2	1341	1348	8	P		83		0	20	81	1
1 1 2	3	1349	1349	1	B		81		83	8	0	23
1 1 2	4	1350	1372	23	0		0		81	1	83	8
1 1 2	5	1373	1380	8	P		83		0	23	81	1
1 1 2	6	1381	1381	1	B		81		83	8	0	5
1 1 2	7	1382	1386	5	0		0		81	1		
1 3 2	1	1321	1347	27	0		0				83	8
1 3 2	2	1348	1355	8	P		83		0	27	81	1
1 3 2	3	1356	1356	1	B		81		83	8	0	24
1 3 2	4	1357	1380	24	0		0		81	1	83	6
1 3 2	5	1381	1386	6	P		83		0	24		
…	…	…	…	…	…		…		…	…	…	…

These are based on the calendar data for the first two cases in the model dataset (shown below). From the first case seven event records are created, and from the second case five are created.

Model dataset input:

caseid	vcal_1
1 1 2	00000BPPPPPPPPP0000000000000000000000000BPPPPPPPPP00000000000000000000000
1 3 2	PPPPPP0000000000000000000000000BPPPPPPPPP00000000000000000000000000000000

The following section includes some ideas for analyses that can be conducted with events files.

5.3. Using events files in analysis

Events files provide a useful way in which to address many analyses. Some of the prior examples shown in this tutorial can be produced in a simpler manner using the events file, obviously with the proviso that the events file has already been produced for the survey. A few examples of analyses that can be conducted using events files:

- Reasons for discontinuation (e.g. to replicate DHS-7 final report table 7.12)
- Average duration of contraceptive use
- Average time to pregnancy after stopping use of a method
- Average time postpartum to starting use of contraception
- Contraceptive discontinuation rates
- Contraceptive switching rates
- Contraceptive failure rates
- Impact of contraceptive failure on unintended pregnancies

This tutorial is not designed to teach the analysis of the DHS calendar data, which is covered in other literature, including FA59: Model Further Analysis Plan: Contraceptive Use Dynamics (Curtis and Hammerslough, 1995), but to provide ideas and guidance in approaches to manipulating the DHS calendar data. For some of the types of analysis mentioned above there are significant analysis challenges to be taken into consideration in the analysis. These include issues such as bias, truncation, and censoring to name a few. These issues are beyond the scope of this tutorial.

The tutorial will provide two examples of the use of the events files. Example 8 will present a simple program to tabulate the reasons for discontinuation of contraception in the five year preceding the survey, similar to Example 5, but using an events file. Example 9 will introduce the calculation of twelve-month contraceptive discontinuation, switching and failure rates.

Example 8 – Reasons for discontinuation from an events file

This example reproduces Example 5, but using the events file and presents a percent distribution of the reason for discontinuation of each method discontinued in the five years preceding the survey, disaggregated by the type of method used. This is DHS-7 standard table 7.12 (DHS-VI model dataset table 7.10[15] - table number may vary in final reports). In this example the methods are grouped together, while in Example 5 they are used ungrouped, but otherwise the results are the same.

Logic for example 8 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example8.do	Stata\Example8.log
SPSS	SPSS\Example8.sps	SPSS\Example8.txt

Using the events file this table becomes quite straightforward and requires only the recoding of the methods into the groups desired for the table, and then the selection of the cases to include in the tabulation. For the selection we select all discontinuations (`ev903` not equal to 0), and restrict it to all episodes that ended in the five years preceding the interview (`v008-ev901 < 60`).

Stata

```
* DHS Calendar Tutorial - Example 8
* Reason for discontinuation in the last five years by method.

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
cd "C:\Data\DHS_model"

* open the events file dataset created by the 'create events file.do'
use "eventsfile.dta", clear

* weight variable
gen wt = v005/1000000

* recode the methods to group methods together
recode ev902                                ///
        (1=1 "Pill")                        ///
        (2=2 "IUD")                         ///
        (3=3 "Injection")                   ///
        (11=4 "Implants")                   ///
        (5=5 "Male condom")                 ///
        (13=6 "LAM")                        ///
        (nonmissing = 10 "Other")           ///
        (missing=.), g(method)
* Other includes: Female Sterilization, Male sterilization, Other Traditional, Female Condom,
*                 Emergency contraception, Other Modern, Standard Days Method,
*                 Periodic Abstinence and Withdrawal
label var method "Contraceptive method"

* tabulate all discontinuations that occurred within the last five years
tab ev903 method [iw=wt] if ev903 != 0 & v008-ev901 < 60, col
```

---

[15] An example of this table based on the model dataset can be found in table 7.10 in "7. Family Planning.pdf" in zzfulltables.zip found at http://dhsprogram.com/data/Download-Model-Datasets.cfm.

SPSS

```
* DHS Calendar Tutorial - Example 8.
* Reason for discontinuation in the last five years by method.


* change to a working directory where the data are stored
* or add the full path to the 'use' command below.
cd "C:\Data\DHS_model".


* open the events file dataset created by the 'create events file.sps'.
get file="eventsfile.sav".


* weight variable.
compute wt=v005/1000000.
weight by wt.


* recode the methods to group methods together.
recode ev902
  (sysmis=sysmis)
  (1=1  /* Pill */)
  (2=2  /* IUD */)
  (3=3  /* Injection */)
  (11=4 /* Implants */)
  (5=5  /* Male condom */)
  (13=6 /* LAM */)
  (else=10 /* Other  */)
  into method.
variable labels method "Contraceptive method".
print formats method (f2.0).
value labels method
  1 "Pill"
  2 "IUD"
  3 "Injection"
  4 "Implants"
  5 "Male condom"
  6 "LAM"
  8 "Periodic abstinence"
  9 "Withdrawal"
  10 "Other".
* Other includes: Female Sterilization, Male sterilization, Other Traditional, Female Condom,
*                 Emergency contraception, Other Modern, Standard Days Method,
*                 Periodic Abstinence and Withdrawal

* tabulate all discontinuations that occurred within the last five years.
compute filter$ = (ev903 <> 0 & v008-ev901 < 60).
filter by filter$.
crosstabs tables=ev903 by method /cells=count column /count=asis.
filter off.
```

Stata output

```
. * DHS Calendar Tutorial - Example 8
. * Reason for discontinuation in the last five years by method.
.
. * change to a working directory where the data are stored
. * or add the full path to the 'use' command below
. cd "C:\Data\DHS_model"
C:\Data\DHS_model


.
. * open the events file dataset created by the 'create events file.do'
. use "eventsfile.dta", clear
```

```
.
. * weight variable
. gen wt = v005/1000000


.
. * recode the methods to group methods together
. recode ev902                                     ///
>       (1=1 "Pill")                               ///
>       (2=2 "IUD")                                ///
>       (3=3 "Injection")                          ///
>       (11=4 "Implants")                          ///
>       (5=5 "Male condom")                        ///
>       (13=6 "LAM")                               ///
>       (nonmissing = 10 "Other")                  ///
>       (missing=.), g(method)
(30112 differences between ev902 and method)

. * Other includes: Female Sterilization, Male sterilization, Other Traditional, Female Condom,
. *                 Emergency contraception, Other Modern, Standard Days Method,
. *                 Periodic Abstinence and Withdrawal
. label var method "Contraceptive method"


.
. * tabulate all discontinuations that occurred within the last five years
. tab ev903 method [iw=wt] if ev903 != 0 & v008-ev901 < 60, col

+-------------------+
| Key               |
|-------------------|
|     frequency     |
| column percentage |
+-------------------+


                     |                              Contraceptive method
Discontinuation code |     Pill      IUD Injection  Implants Male cond       LAM      Other |     Total
---------------------+------------------------------------------------------------------------------+----------
Became pregnant while| 36.963059        0 23.518104         0  5.482217  4.193065 12.798515 |  82.95496
                     |     9.14     0.00      4.88      0.00      4.46      6.12     18.55 |      6.56
---------------------+------------------------------------------------------------------------------+----------
Wanted to become preg| 119.70253 5.4144591 131.53668 22.7654323 34.493693  9.621027 16.03057 | 339.56439
                     |    29.61    19.48     27.29     25.05     28.08     14.05     23.23 |     26.84
---------------------+------------------------------------------------------------------------------+----------
  Husband disapproved| 14.03721 .88217503  6.508606  4.665788 9.5084161 27.966215  2.05095 |  65.61936
                     |     3.47     3.17      1.35      5.13      7.74     40.85      2.97 |      5.19
---------------------+------------------------------------------------------------------------------+----------
         Side effects| 97.680173 20.23361 233.75634 54.539657 6.1060832  2.472669 9.3941112 | 424.18264
                     |    24.16    72.81     48.50     60.00      4.97      3.61     13.61 |     33.53
---------------------+------------------------------------------------------------------------------+----------
  Access/availability| 21.212403        0 5.54250896         0  2.688849         0 .55186999 | 29.995631
                     |     5.25     0.00      1.15      0.00      2.19      0.00      0.80 |      2.37
---------------------+------------------------------------------------------------------------------+----------
Wanted more effective|80.5512978        0  35.99295  .418383 26.714048  1.731912 14.697614 | 160.10621
                     |    19.93     0.00      7.47      0.46     21.75      2.53     21.30 |     12.65
---------------------+------------------------------------------------------------------------------+----------
  Inconvenient to use|  8.344504  1.25802  6.075892 3.9752231 18.158897         0  1.814087 | 39.626623
                     |     2.06     4.53      1.26      4.37     14.78      0.00      2.63 |      3.13
---------------------+------------------------------------------------------------------------------+----------
Infrequent sex/husban| 5.2058952        0  14.48474         0  1.208572 6.3403819 7.5512051 | 34.790794
                     |     1.29     0.00      3.01      0.00      0.98      9.26     10.94 |      2.75
---------------------+------------------------------------------------------------------------------+----------
                 Cost|  .286632        0  5.827325 2.7108791 4.8573129         0         0 | 13.682149
                     |     0.07     0.00      1.21      2.98      3.95      0.00      0.00 |      1.08
---------------------+------------------------------------------------------------------------------+----------
           Fatalistic|        0        0 .73194402         0         0 10.373286         0 |  11.10523
                     |     0.00     0.00      0.15      0.00      0.00     15.15      0.00 |      0.88
---------------------+------------------------------------------------------------------------------+----------
Difficult to get preg| .53772801        0 1.14783597 .563108027         0         0         0 |  2.248672
                     |     0.13     0.00      0.24      0.62      0.00      0.00      0.00 |      0.18
---------------------+------------------------------------------------------------------------------+----------
                Other| .56567502        0  5.295249         0         0         0  1.766301 | 7.6272251
```

	0.14	0.00	1.10	0.00	0.00	0.00	2.56	0.60
Missing	19.161202	0	11.523261	1.25802	13.622675	5.76505208	2.356418	53.686628
	4.74	0.00	2.39	1.38	11.09	8.42	3.41	4.24
Total	404.24831	27.788264	481.94143	90.8964901	122.84076	68.463608	69.011642	1,265.191
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Module 6: Contraceptive discontinuation and switching rates

Goal of the module: For analysts to understand how contraceptive discontinuation rates and switching rates are calculated, and how to use the event files to produce the rates. Though this model has detailed example and offers code on Stata and SPSS, it is recommended to first review the Guide to DHS Statistics to understand how contraceptive discontinuation rates are calculated.

6.1. Introduction to contraceptive discontinuation rates, failure rates and switching rates

Using the events files created in Module 5 – files that have a record for each event or episode of use or non-use – we can do further analyses of calendar data such as examining rates. The terms "event", "episode", and "segment" are used interchangeably when referring to these files, but you can think of an event as being a change to a new state that continues throughout an episode or segment. For contraceptive discontinuation and switching rates, the units of analysis are the episodes of use. One woman may contribute more than one episode to the calculation.

Twelve-month contraceptive discontinuation rates are the cumulative proportion of episodes that are discontinued for any reason by the twelfth month of use. These discontinuation rates are categorized by reason for discontinuation. Seven categories of reason for discontinuation are constructed, of which failure is one of the reasons. Additionally, a separate category for switching to a different method is constructed.

Failure rates are the cumulative proportion of episodes of contraceptive use that failed – or resulted in a pregnancy ("P" in the calendar) or a pregnancy termination ("T" in the calendar) in the month directly following a month of contraceptive use.

Switching rates are the cumulative proportion of episodes of contraceptive use that ended, but were directly followed by another method of contraception. Also, switching also occurs when a woman specifies that her reason for discontinuation was that she wanted a more effective method and then a new method was used within two months of discontinuation (i.e., only one month with a '0', indicating no contraceptive use, between episodes of use). The discontinuation rates for switching to another method are calculated separately and are not exclusive of other reasons.

Below are examples of failures and switching (note these analyses use events files and below are original column string variables *before* they are converted to events files). Reading vcal_1 from right to left, we can see that this respondent first method switched methods (from method 3 to method 1), then later experienced a failure (code 1 in vcal_2 when method 1 changed to a P for pregnancy).

Model dataset input:

vcal_1	PPP**P1**1111111111111111111111111111111**13**3333300000000000000000000000BPPPPPPP
vcal_2	**1** 7

The life table calculated for the contraceptive discontinuation rates is a multiple decrement life table producing net discontinuation rates. Because episodes can be discontinued due to one of multiple reasons, these reasons for discontinuation can be considered as competing risks, which is how we will deal with them in the statistical software. The reasons for discontinuation are mutually exclusive categories, and as the discontinuation rates are net rates the discontinuation rates by reason sum to the total discontinuation rates for any reason. As stated above, the discontinuation rates for switching to another method are calculated separately and are not exclusive of other reasons.

It is also possible to calculate associate single decrement rates which are gross rates representing discontinuation rates in the absence of other competing risks, and are often used for comparison of discontinuation rates across countries. The calculation of the multiple decrement rates is presented below.

In formulas, the monthly rate of discontinuation, q_{ij}, where i is the number of months since the start of the episode and j is the reason for discontinuation, is calculated by dividing the number of episodes discontinued in month i, d_{ij}, by the total number of episodes that reached duration, e_i:

$$q_{i,j} = \frac{d_{i,j}}{e_i} \text{ (and } q_{i,any} = \frac{d_i}{e_i} \text{ for "any reasons" combined).}$$

and the cumulative probability of not discontinuing at each month i for reason j is:

$$l_{i,j} = l_{i-1\,j} - \left(l_{i-1,any} * q_{i,j}\right)$$

where any is "any reasons" combined, and $l_{0j} = 1$ and $l_{0,any} = 1$.

The cumulative probability of discontinuing by 12 months duration for reason j is:

$$Q_{12,j} = 1 - l_{12,j}$$

Note that this is mathematically equivalent to the cumulative probability of discontinuing by 12 months duration for any reasons given as:

$$Q_{12,any} = 1 - \prod_{i=1}^{12} (1 - q_{i,any})$$

Before understanding the example below, it is important to note a few key components that will influence how we manipulate the data file:

Exposure: The exposure period is the duration of use of a specific method within one episode of use. Exposure begins with initial month of use and ends with discontinuation or with the month of interview if method was still being used at the time of the interview. For methods that are not followed by another method or a pregnancy, it is assumed that the method episode started on average in the middle of the first month of use and ended in the middle of the month after the last noted month of use. If the month following the last noted method indicates a pregnancy or a different method, then it is assumed that the

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episode ended on average in the middle of that following month. Thus, the duration of exposure is taken as the difference between the month of first use and the month of last use (i.e., equal to the number of months during that episode with a notation for the method).

Censoring: We will censor the calendar episodes to be between 3-62 months. The calendar is censored to 62 months before the interview for five complete years of data. In the DHS tables, only episodes that began within the calendar period and ended three months before the interview are included. Episodes that began before the beginning of the calendar are excluded (this does not exclude episodes that started within the calendar, but outside of the censored period of interest – see *late entries* below). Episodes that ended in the month of interview or the two months prior are censored at three months before the interview to avoid bias due to unrecognized pregnancies.

Late entries: Late entries occur when a respondent started, but did not end, an episode of contraceptive use outside of the censored period (>62 months before the interview). Late entries will first enter the life table at the duration of use when they entered the period of interest. If an episode started on the 65th month before the interview, it will first enter the table with three months of duration.

The diagram below shows the types of episodes included or excluded from the analysis:
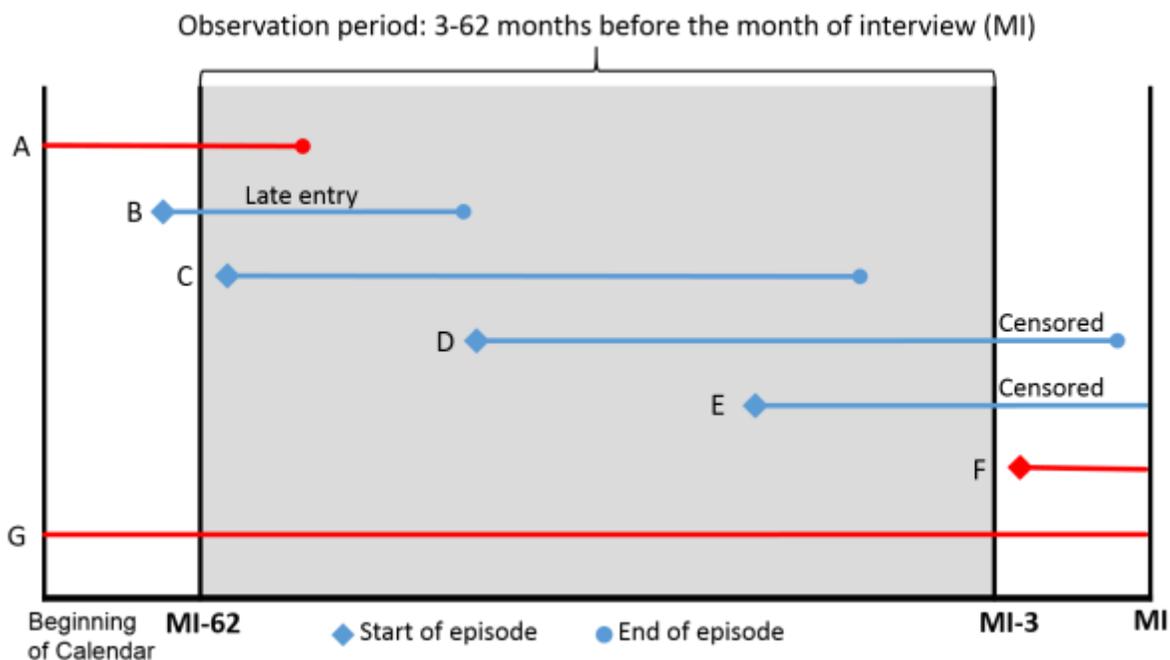
Episodes A and G are excluded as they started before the calendar and we do not have information on the duration of use prior to the calendar. Episode B is included, but as a late entry, as the episode started within the calendar, but outside of the period of interest. Episode C is included as a fully observed episode in the period of interest. Both episodes D and E are included but are censored 3 months before the month of interview. Episode F is excluded as the episode starts outside the period of interest.

E9.0   Introductory example

Using the DHS-6 Model Datasets, we first sum each month of exposure in the period of interest (3 to 62 months preceding the survey) according to the duration of use of the method in that month. Late entries will first enter the table at the duration of use when they entered the period of interest. In the month of discontinuation of the method, the discontinuations are tallied according to the reason for discontinuation. The "Any reason" column is the sum of the individual reasons for discontinuation. The "Switched to another method" column is tallied separately from the reasons for discontinuation.

Duration of use	Method failure	Desire to become pregnant	Other fertility related reasons	Side effects/ health concerns	Wanted more effective method	Other method related reasons	Other reasons	**Any reason**	Switched to another method	**Exposure**
1	0.887530	2.329931	0.000000	18.885184	7.936933	1.547109	10.400709	41.987396	3.789610	2,631.94
2	1.041063	1.140181	0.291982	9.595957	0.737800	1.203585	0.809309	14.819877	1.475600	2,534.74
3	6.722316	9.828108	0.399263	59.663155	8.163438	3.252900	3.729920	91.759100	15.687751	2,496.58
4	1.584460	0.000000	1.982117	21.353032	1.219110	7.822816	2.456574	36.418109	5.191382	2,331.74
5	5.999001	1.686366	1.172808	4.998823	3.576653	0.799367	0.809309	19.042327	4.672285	2,205.84
6	6.367820	19.024693	0.000000	43.431689	6.550592	11.890163	8.981334	96.246291	25.541805	2,119.36
7	0.903114	10.711671	0.000000	10.925789	3.527042	0.000000	0.394817	26.462433	5.166854	1,954.98
8	3.610944	4.739678	0.000000	9.301247	0.000000	1.202538	16.878426	35.732833	3.565578	1,883.74
9	0.000000	14.390345	1.092375	28.412269	8.904068	0.257330	11.521093	64.577480	31.959763	1,802.60
10	1.315005	9.698899	1.147836	17.394270	1.827615	0.903114	2.339794	34.626533	9.736157	1,697.47
11	4.868782	7.380097	2.320644	5.824226	1.827615	1.547109	3.353669	27.122142	2.636924	1,613.89
12	2.672211	15.977691	2.616564	12.536034	6.412058	6.683679	13.131727	60.029964	17.138133	1,545.51

We now convert the counts of discontinuations and the months of exposure into monthly rates of discontinuation (q_{ij}) by dividing the discontinuation columns by the exposure column, as below:

Duration of use	Method failure	Desire to become pregnant	Other fertility related reasons	Side effects/ health concerns	Wanted more effective method	Other method related reasons	Other reasons	**Any reason**	Switched to another method
1	0.000337	0.000885	0.000000	0.007175	0.003016	0.000588	0.003952	0.015953	0.001440
2	0.000411	0.000450	0.000115	0.003786	0.000291	0.000475	0.000319	0.005847	0.000582
3	0.002693	0.003937	0.000160	0.023898	0.003270	0.001303	0.001494	0.036754	0.006284
4	0.000680	0.000000	0.000850	0.009158	0.000523	0.003355	0.001054	0.015618	0.002226
5	0.002720	0.000765	0.000532	0.002266	0.001621	0.000362	0.000367	0.008633	0.002118
6	0.003005	0.008977	0.000000	0.020493	0.003091	0.005610	0.004238	0.045413	0.012052
7	0.000462	0.005479	0.000000	0.005589	0.001804	0.000000	0.000202	0.013536	0.002643
8	0.001917	0.002516	0.000000	0.004938	0.000000	0.000638	0.008960	0.018969	0.001893
9	0.000000	0.007983	0.000606	0.015762	0.004940	0.000143	0.006391	0.035825	0.017730
10	0.000775	0.005714	0.000676	0.010247	0.001077	0.000532	0.001378	0.020399	0.005736
11	0.003017	0.004573	0.001438	0.003609	0.001132	0.000959	0.002078	0.016805	0.001634
12	0.001729	0.010338	0.001693	0.008111	0.004149	0.004325	0.008497	0.038841	0.011089

Next we convert the monthly discontinuation rates into the cumulative probabilities of not discontinuing at each month, using the formula $l_{i,j} = l_{i-1,j} - (l_{i-1,any} * q_{i,j})$, where $l_{0,j} = 1$ and $l_{0,any} = 1$. To carry out these calculations, first calculate $l_{1,any}$, then $l_{2,any}$, etc. for "any reason", and then calculate $l_{1,j}, l_{2,j}$, etc. for each separate reason for discontinuation j.

Duration of use	Method failure	Desire to become pregnant	Other fertility related reasons	Side effects/ health concerns	Wanted more effective method	Other method related reasons	Other reasons	Any reason ($l_{i,any}$)	Switched to another method
0	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000
1	0.999663	0.999115	1.000000	0.992825	0.996984	0.999412	0.996048	0.984047	0.998560
2	0.999259	0.998672	0.999887	0.989099	0.996698	0.998945	0.995734	0.978294	0.997987
3	0.996624	0.994821	0.999730	0.965720	0.993499	0.997670	0.994273	0.942337	0.991840
4	0.995984	0.994821	0.998929	0.957091	0.993006	0.994509	0.993280	0.927620	0.989742
5	0.993461	0.994112	0.998436	0.954988	0.991502	0.994173	0.992939	0.919612	0.987777
6	0.990698	0.985857	0.998436	0.936143	0.988660	0.989013	0.989042	0.877850	0.976694
7	0.990293	0.981047	0.998436	0.931237	0.987076	0.989013	0.988865	0.865967	0.974374
8	0.988633	0.978868	0.998436	0.926961	0.987076	0.988461	0.981106	0.849541	0.972735
9	0.988633	0.972086	0.997921	0.913571	0.982880	0.988339	0.975676	0.819106	0.957673
10	0.987998	0.967406	0.997367	0.905177	0.981998	0.987903	0.974547	0.802397	0.952975
11	0.985578	0.963737	0.996213	0.902282	0.981089	0.987134	0.972880	0.788913	0.951664
12	0.984214	0.955581	0.994878	0.895883	0.977816	0.983723	0.966177	0.758270	0.942916

Finally, the 12-month discontinuation rates are simply 1 minus the rates of continuing at 12 months:

	Method failure	Desire to become pregnant	Other fertility related reasons	Side effects/ health concerns	Wanted more effective method	Other method related reasons	Other reasons	Any reason	Switched to another method
12	0.015786	0.044419	0.005122	0.104117	0.022184	0.016277	0.033823	0.241730	0.057084

Or, as percentages:

12	1.6	4.4	0.5	10.4	2.2	1.6	3.4	24.2	5.7

6.2 How to calculate discontinuation rates

Though discontinuation rates make use of straightforward demographic methods to calculate cumulative discontinuations, we must manipulate the data differently depending on whether Stata or SPSS is used for analysis. With both software programs, we will roughly follow the same six steps for constructing the discontinuation rate table:

1. Calculate exposure, late entries, and censoring for the period 3-62 months prior to interview
2. Recode methods, reasons for discontinuation, and create switching variable
3. Calculate competing risks cumulative incidence
4. Calculate weighted and unweighted denominators
5. Combine components for table output
6. Output table

Example 9 – Twelve-month discontinuation, failure, and switching rates

Logic for example 9 can be found in the following files:

Software	Commands	Output
Stata	Stata\Example9.do	Stata\Example9.log
SPSS	SPSS\Example9.sps	SPSS\Example9.txt

E9.1   Calculate exposure, late entries and censoring for the period 3-62 months prior to interview

If using Stata, first install `stcompet` if not already installed before starting at Step 1.

Once we open the events file created in Module 5, we need leave out episodes that do not contribute exposure time to this multiple decrement life table.

Begin by dropping episodes that were ongoing when the calendar began (`v017=ev900`), and drop births, terminations, and pregnancies. We calculate the time of the beginning of the episode (`tbeg_int = v008 – ev900`) and the end of the episode (`tend_int = v008 – ev901`), and generate variables for discontinuations and for late entries. By using the variables for the months an episode began (`tbeg_int`) and ended (`tend_int`), we can censor the calendar to five years of data and still include late entries (`v008–ev901>62`), to calculate the exposure within the window of 3-62 months prior to the interview.

Some analysts prefer to exclude female sterilization when calculating all method discontinuation rates, and others prefer to exclude all late entries. The DHS Program does not exclude either of these cases in the discontinuation rates produced.

Stata
```
* DHS Calendar Tutorial - Example 9
* Calculating discontinuation rates using event files

* note that the denominator in this table is all women, including sterilized women
* also includes missing methods to match the final reports

* if you don't have stcompet installed, use the line below to find it and follow instructions to
install it:
//findit stcompet

* change to a working directory where the data are stored
* or add the full path to the 'use' command below
```

```
cd "C:\Data\DHS_model"

* open the event file dataset created by the 'create events file.do'
use "eventsfile.dta", clear



* Step 1
* calculate exposure, late entries and censoring for the period 3-62 months prior to the interview

*gen wt
gen wt = v005/1000000

* drop events that were ongoing when calendar began
drop if v017 == ev900

* drop births, terminations, pregnancies, and episodes of non-use
* keep missing methods. to exclude missing change 99 below to 100.
drop if (ev902 > 80 & ev902 < 99) | ev902==0

* time from beginning of event to interview
gen tbeg_int = v008 - ev900
label var tbeg_int "time from beginning of event to interview"

* time from end of event to interview
gen tend_int = v008 - ev901
label var tend_int "time from end of event to interview"

* discontinuation variable
gen discont = 0
replace discont = 1 if ev903 != 0

* censoring those who discontinue in last three months
replace discont = 0 if tend_int < 3
label var discont "discontinuation indicator"
tab discont
tab ev903 discont, m

* generate late entry variable
gen entry = 0
replace entry = tbeg_int - 62 if tbeg_int >= 63
tab tbeg_int entry

* taking away exposure time outside of the 3 to 62 month window
gen exposure = ev901a
replace exposure = ev901a - (3 - tend_int) if tend_int < 3
recode exposure -3/0=0

* drop those events that started in the month of the interview and two months prior
drop if tbeg_int < 3

* drop events that started and ended before 62 months prior to survey
drop if tbeg_int > 62 & tend_int > 62

* to remove sterilized women from denominator use the command below - not used for DHS standard
//replace exposure = . if ev902 == 6

* censor any discontinuations that are associated with use > 59 months
* not censored in this example
//replace discont = 0 if (exposure - entry) > 59
```

133

```
* DHS Calendar Tutorial - Example 9.
* Calculating discontinuation rates using event files.

* note that the denominator in this table is all women, and includes sterilized women
* and also includes missing methods to match the final reports.

* change to a working directory where the data are stored
* or add the full path to the 'use' command below.
cd "C:\Data\DHS_model".

* open the event file dataset created by the 'create events file.sps'.
get file="eventsfile.sav".
* name the dataset.
dataset name eventsfile.



* Step 1.
* calculate exposure, late entries and censoring for the period 3-62 months prior to the interview.

* weight variable.
compute wt=v005/1000000.
* weight will be applied later when we need it in step 3.

* drop events that were ongoing when calendar began,
* keeping those that started after the start of the calendar.
select if (ev900 > v017).

* drop births, terminations, pregnancies, and episodes of non-use
* keep missing methods. to exclude, drop "| ev902 = 99".
select if (ev902 <> 0 & (ev902 < 80 | ev902 = 99)).

* time from beginning of event to interview.
compute tbeg_int = v008 - ev900.
variable labels tbeg_int "time from beginning of event to interview".

* time from end of event to interview.
compute tend_int = v008 - ev901.
variable labels tend_int "time from end of event to interview".
formats tbeg_int tend_int (f2.0).

* discontinuation variable.
compute discont = 0.
if (ev903 <> 0) discont = 1.

* censoring those who discontinue in last three months.
if (tend_int < 3) discont = 0.
variable labels discont "Discontinuation indicator".
value labels discont 0 "No discontinuation" 1 "Discontinuation".
formats discont (f1.0).
frequencies variables=discont.
crosstabs tables=ev903 by discont /cells=count column /count=asis.

* generate late entry variable.
compute entry = 0.
if (tbeg_int >= 63) entry = tbeg_int - 62.
variable labels entry "Late entry months".
formats entry (f1.0).
crosstabs tables=tbeg_int by entry /count=asis.

* taking away exposure time outside of the 3 to 62 month window.
```

```
compute exposure = ev901a.
if (tend_int < 3) exposure = ev901a - (3 - tend_int).
recode exposure (-3 thru 0=0).
variable labels exposure "Exposure".
formats exposure (f2.0).

* drop those events that started in the month of the interview and two months prior.
select if (tbeg_int >= 3).
* drop events that started and ended before 62 months prior to survey.
select if (tbeg_int <= 62 | tend_int <= 62).

* to remove episodes from sterilized women from denominator use the command below - not for DHS
standard.
/* if (ev902 = 6) exposure=$sysmis. */

* censor any discontinuations that are associated with use > 59 months.
* not censored in this example.
/* if ((exposure - entry) > 59) discont = 0. */
```

E9.2   Recode methods, reasons for discontinuations, and create switching variable

After the exposure time has been calculated, we now need to recode the methods (`ev902`) and reasons for discontinuation (`ev903`) of interest before doing any analysis. Because there are many methods, it is advised to group where possible – in the example below, several less common methods are grouped into an "Other" category. In many surveys there is interest in calculating discontinuation rates for IUD, Periodic Abstinence, and Withdrawal, but in the Model dataset these are too few cases, so these are also grouped into the "Other" category. When recoding discontinuations, it should be noted that when analyzing competing risks in Stata, only seven competing risks can be handled in the analysis at a time. Although this can be overcome by reorganizing discontinuations and running the analysis more than once, in this example, we conveniently want to recode our reasons for discontinuation into seven major categories.

To create a switching variable, we will look for places where the end of an event is one month less than the start of a new event (`ev901=ev900[_n+1]`). We must also account for women who discontinued a method because they wanted a more effective method (`ev903=7`) and switched to a *new* method with no more than a one-month gap (`ev901=ev900[_n+2] & ev905=0`).

Stata
```
* Step 2
* recode methods, discontinuation reason, and construct switching
* recode contraceptive method
* IUD, Periodic Abstinence, and Withdrawal skipped and grouped with other due to small numbers of
cases
recode ev902                                ///
        (1  = 1 "Pill")                     ///
/*      (2  = 2 "IUD") */                    ///
        (3  = 3 "Injectables")              ///
        (11 = 4 "Implant")                  ///
        (5  = 5 "Male condom")              ///
/*      (8  = 6 "Periodic abstinence") */   ///
/*      (9  = 7 "Withdrawal") */             ///
        (13 18 = 8 "LAM/EC")                ///
        (nonmissing = 9 "Other")            ///
        (missing = .), gen(method)
tab ev902 method, m
```

```
* LAM and Emergency contraception are grouped here
* Other category is Female Sterilization, Male sterilization, Other Traditional,
*       Female Condom, Other Modern, Standard Days Method
* plus IUD, Periodic Abstinence, Withdrawal
* adjust global meth_list below if changing the grouping of methods above

* change name of reasons label list to avoid labels we don't want
label copy reason ev903
label val ev903 ev903
label drop reason // we don't want the labels for reason being copied to var reason

* recode reasons for discontinuation - ignoring switching
recode ev903                                                   ///
       (0 .     = .)                                           ///
       (1       = 1 "Method failure")                          ///
       (2       = 2 "Desire to become pregnant")               ///
       (9 12 13 = 3 "Other fertility related reasons")         ///
       (4 5     = 4 "Side effects/health concerns")            ///
       (7       = 5 "Wanted more effective method")            ///
       (6 8 10  = 6 "Other method related")                    ///
       (nonmissing = 7 "Other/DK") if discont==1, gen(reason)
label var reason "Reason for discontinuation"
tab reason
tab ev903 reason if discont==1, m

* switching methods
* switching directly from one method to the next, with no gap
sort caseid ev004
by caseid: gen switch = 1 if ev901+1 == ev900[_n+1]
* if reason was "wanted more effective method" allow for a 1-month gap
by caseid: replace switch = 1 if ev903 == 7 & ev901+2 >= ev900[_n+1] & ev905 == 0
* not a switch if returned back to the same method
* note that these are likely rare, so there may be no or few changes from this command
by caseid: replace switch = . if ev902 == ev902[_n+1] & ev901+1 == ev900[_n+1]
tab switch

* calculate variable for switching for discontinuations we are using
gen discont_sw = .
replace discont_sw = 1 if switch == 1 & discont == 1
replace discont_sw = 2 if discont_sw == . & ev903 != 0 & ev903 != . & discont == 1
label def discont_sw 1 "switch" 2 "other reason"
label val discont_sw discont_sw
tab discont_sw
```

SPSS

```
* Step 2.
* Recode methods, reasons for discontinuations, and create switching variable.

* recode contraceptive method.
* IUD, Periodic Abstinence, and Withdrawal skipped and grouped with other due to small numbers of
cases.
recode ev902
  (sysmis = sysmis)
  (1 = 1) /*(2 = 2)*/ (3 = 3) (11 = 4) (5 = 5) /*(8 = 6)*/ /*(9 = 7)*/ (13 18 = 8) (else = 9)
  into method.
variable labels method "Contraceptive method".
value labels method
  1 "Pill"
  2 "IUD"
  3 "Injectables"
  4 "Implant"
  5 "Male condom"
```

```
  6 "Periodic abstinence"
  7 "Withdrawal"
  8 "LAM/EC"
  9 "Other [6]"
 99 "All methods". /* used later */
* LAM and Emergency contraception are grouped here.
* Other category is Female Sterilization, Male sterilization, Other Traditional,
*   Female Condom, Other Modern, Standard Days Method.
*   plus IUD, Periodic Abstinence, Withdrawal.

formats method (f1.0).
crosstabs tables=ev902 by method /count=asis.

* filter for discontinuations only.
compute filter$ = (discont = 1).
filter by filter$.
* recode reasons for discontinuation - ignoring switching.
recode ev903
  (0 sysmis = sysmis)
  (1       = 1 /* Method failure */)
  (2       = 2 /* Desire to become pregnant */)
  (9 12 13 = 3 /* Other fertility related reasons */)
  (4 5     = 4 /* Side effects/health concerns */)
  (7       = 5 /* Wanted more effective method */)
  (6 8 10  = 6 /* Other method related */)
  (else    = 7 /* Other/DK */)
  into reason.
variable labels reason "Reason for discontinuation".
value labels reason
  1 "Method failure"
  2 "Desire to become pregnant"
  3 "Other fertility related reasons"
  4 "Side effects/health concerns"
  5 "Wanted more effective method"
  6 "Other method related"
  7 "Other/DK".
formats reason (f1.0).
if (discont <> 1) reason = $sysmis.
frequencies variables=reason.
crosstabs tables=ev903 by reason /count=asis.
filter off.

* switching methods.
* switching directly from one method to the next, with no gap.
sort cases by caseid ev004 (d).
if (caseid = lag(caseid) & ev901+1 = lag(ev900)) switch = 1.
* if reason was "wanted more effective method" allow for a 1-month gap.
if (ev903 = 7 & ev905 = 0 & caseid = lag(caseid) & ev901+2 >= lag(ev900)) switch = 1.

* not a switch if returned back to the same method.
* there should be none of these, so there should be no changes from this command.
if (caseid = lag(caseid) & ev902 = lag(ev902) & ev901+1 = lag(ev900)) switch = $sysmis.

variable labels switch "Switching method".
value labels switch 1 "Switched method".
formats switch (f1.0).
frequencies variables=switch.

* calculate variable for switching for discontinuations we are using.
compute discont_sw=$sysmis.
if (switch = 1 & discont = 1) discont_sw = 1.
if (sysmis(discont_sw) & ev903 <> 0 & not sysmis(ev903) & discont = 1) discont_sw = 0.
```

```
variable labels discont_sw "Discontinuation for switching".
value labels discont_sw 1 "Switch" 0 "Other reason".
formats discont_sw (f1.0).
frequencies variables=discont_sw.
```

E9.3   Calculate the competing risks cumulative incidence for each method and for total

Using the variables created in E9.1 and E9.2, we can calculate cumulative incidence of discontinuations for each method and for all methods, regarding the reasons for discontinuation as competing risks.

In Stata we first declare the data to be survival-time data using `stset`. The time variable will be our `exposure` variable, and we will use our `entry` to indicate when the record comes under observation and use our `reason` variable as a failure event. Now we can use the `stcompet` command, which generates variables containing cumulative incidence for each of the competing risks. We must list the competing risks as values that compete with the failure event variable from the `stset` in the line of code above. We will save the resulting dataset, which will have the discontinuation rate for each method attached to each case.

Stata
```
* Step 3
* Calculate the competing risks cumulative incidence for each method and for all methods

* create global lists of the method variables included
levelsof method
global meth_codes `r(levels)'
*modify meth_list and methods_list according to the methods included
*global meth_list pill IUD inj impl mcondom pabst withdr lamec other
*global methods_list `" "Pill" "IUD" "Injectables" "Implant" "Male condom" "Periodic
abstinence" "Withdrawal" "LAM/EC" "Other" "All methods" "'
global meth_list pill inj impl mcondom pabst other
global methods_list `" "Pill" "Injectables" "Implant" "Male condom" "LAM/EC" "Other" "All
methods" "'
global drate_list
global drate_list_sw
foreach m in $meth_list {
        global drate_list $drate_list drate_`m'
        global drate_list_sw $drate_list_sw drate_`m'_sw
}

* competing risks estimates - first all methods and then by method
tokenize allmeth $meth_list
foreach x in 0 $meth_codes {

        * by reason - no switching
        * declare time series data for st commands
        stset exposure if `x' == 0 | method == `x' [iw=wt], failure(reason==1) enter(entry)
        stcompet discont_`1' = ci, ///
                compet1(2) compet2(3) compet3(4) compet4(5) compet5(6) compet6(7)
        * convert rate to percentage
        gen drate_`1' = discont_`1' * 100

        * switching
        * declare time series data for st commands
```

```
        stset exposure if `x' == 0 | method == `x' [iw=wt], failure(discont_sw==1) enter(entry)
        stcompet discont_`1'_sw = ci, compet1(2)
        * convert rate to percentage
        gen drate_`1'_sw = discont_`1'_sw * 100

        * Get the label for the method and label the variables appropriately
        local lab1 All methods
        if `x' > 0 {
                local lab1 : label method `x'
        }
        label var drate_`1' "Rate for `lab1'"
        label var drate_`1'_sw "Rate for `lab1' for switching"

        * shift to next method name in token list
        macro shift
}

* keep just the variables we need for output
keep caseid method drate* exposure reason discont_sw wt entry

* save data file with cumulative incidence variables added to each case
save "drates.dta", replace
```

In SPSS the standard life table procedures do not produce results that match the results that DHS presents, so it is necessary to calculate the life table in a more manual process, following the procedure described in section 6.1. The main difference is that the life table procedures such as survival count only half a month of exposure in the month of discontinuation, whereas the DHS approach uses a full month of exposure in the month of discontinuation.

We first create dichotomous variables for each reason for discontinuation category, and then aggregate the episode data by exposure for all reasons for discontinuation combined, each separate reason, and for switching. We do this first for all methods and then by each method group. Similarly, we aggregate the late entries for all methods and for each method group. We append these files together, and recode any missing values for late entries or switching to 0, and we recode the missing value for all methods to code 99. This gives a file of discontinuations and switching by method and total exposure.

We next sort the data in descending order by exposure within method and accumulate the exposure into the prior months to calculate the full exposure starting from the first month of use, subtracting out the late entries. We also accumulate the total episodes in the same way, but including the late entries. At this point, we can drop all exposure beyond 12 months as we are only interested in the 12-month discontinuation rates. The result is the data in the first table under E9.0, for all methods and also by method.

Now we convert the counts of discontinuations and exposure into monthly rates of discontinuation by dividing the reasons for discontinuation and switching by the exposure, as found in the second table under E9.0. Next, these are converted into a life table table of cumulative probabilities of not discontinuing or switching.

At the end of this step we have a dataset of probabilities of not discontinuing or switching with methods in the rows and reasons for discontinuation or switching in the columns - the opposite of the Stata version above, which has methods in the columns.

SPSS

```
* Step 3.
* Calculate the competing risks cumulative incidence for each method and for total.
weight by wt.

* Split reason for discontinuation into separate 0/1 variables.
recode reason (1 = 1)(else = 0) into reason_1.
recode reason (2 = 1)(else = 0) into reason_2.
recode reason (3 = 1)(else = 0) into reason_3.
recode reason (4 = 1)(else = 0) into reason_4.
recode reason (5 = 1)(else = 0) into reason_5.
recode reason (6 = 1)(else = 0) into reason_6.
recode reason (7 = 1)(else = 0) into reason_7.
variable labels
  reason_1 "Method failure"
  reason_2 "Desire to become pregnant"
  reason_3 "Other fertility related reasons"
  reason_4 "Side effects/health concerns"
  reason_5 "Wanted more effective method"
  reason_6 "Other method related"
  reason_7 "Other/DK".
formats reason_1 reason_2 reason_3 reason_4 reason_5 reason_6 reason_7 (f1.0).

* Aggregate counts by exposure of totals exposure (N) and discontinuations for each reason.
* by method.
dataset declare aggr_meth.
aggregate
  /outfile='aggr_meth'
  /break=method exposure
  /discont =sum(discont)
  /reason_1=sum(reason_1)
  /reason_2=sum(reason_2)
  /reason_3=sum(reason_3)
  /reason_4=sum(reason_4)
  /reason_5=sum(reason_5)
  /reason_6=sum(reason_6)
  /reason_7=sum(reason_7)
  /discont_sw=sum(discont_sw)
  /expo=N
  /expo_u=NU.

* for All methods.
dataset declare aggr_all.
aggregate
  /outfile='aggr_all'
  /break=exposure
  /discont =sum(discont)
  /reason_1=sum(reason_1)
  /reason_2=sum(reason_2)
  /reason_3=sum(reason_3)
  /reason_4=sum(reason_4)
  /reason_5=sum(reason_5)
  /reason_6=sum(reason_6)
  /reason_7=sum(reason_7)
  /discont_sw=sum(discont_sw)
  /expo=N
  /expo_u=NU.
```

```
* combine file of exposure for all methods and by method into one.
dataset activate aggr_meth.
add files
  /file=*
  /file='aggr_all'.
execute.

* recode missing to 99 for all methods.
recode method (sysmis = 99).

* Switch back to the events file for the late entries.
dataset activate eventsfile.

* Aggregate counts of late entries - to be removed later from cumulative exposure.
* by method.
dataset declare aggr_late_meth.
aggregate
  /outfile='aggr_late_meth'
  /break=method entry
  /lateentry=N
  /lateentry_u=NU.

* for All methods.
dataset declare aggr_late_all.
aggregate
  /outfile='aggr_late_all'
  /break=entry
  /lateentry=N
  /lateentry_u=NU.

* combine file of late entries for all methods and by method into one.
dataset activate aggr_late_meth.
add files
  /file=*
  /file='aggr_late_all'.
execute.

* recode missing to 99 for all methods.
recode method (sysmis = 99).

* drop cases without late entry (entry = 0).
select if (entry >  0).
* rename late entry variable to exposure.
rename variables entry = exposure.

* merge the exposure and late entries files into one file by method and exposure.
dataset activate aggr_meth.
match files
  /file = *
  /table = 'aggr_late_meth'
  /by method exposure.

* set any missing late entries and any missing switching to 0.
if (sysmis(lateentry)) lateentry = 0.
if (sysmis(lateentry_u)) lateentry_u = 0.
if (sysmis(discont_sw)) discont_sw = 0.
execute.

* close separate files that are no longer needed.
dataset close aggr_all.
dataset close aggr_late_all.
dataset close aggr_late_meth.
dataset close eventsfile.


* Accumulate the exposure and the episodes for the prior months.
```

```
* reverse the order of the file so longest exposure first to allow for cumulation of the
exposures.
sort cases method (a) exposure (d).
* initialize the cumulative exposure to 0.
compute cum_expo = 0.
compute episodes = 0.
compute cum_expo_u = 0.
* if the last month (first entry) for the method, set the cumulative exposure to the monthly
exposure minus the late entries.
if (missing(lag(method)) or method<>lag(method)) cum_expo = expo - lateentry.
if (missing(lag(method)) or method<>lag(method)) episodes = expo.
if (missing(lag(method)) or method<>lag(method)) cum_expo_u = expo_u - lateentry_u.
* if not the last month (first entry) for the method,
* set the cumulative exposure to the previous months cumulative exposure plus the monthly
exposure minus the late entries.
if (method=lag(method)) cum_expo = lag(cum_expo) + expo - lateentry.
if (method=lag(method)) episodes = lag(episodes) + expo.
if (method=lag(method)) cum_expo_u = lag(cum_expo_u) + expo_u - lateentry_u.
execute.

* drop the cases beyond 12 months exposure now as we are only interested in 12 month
discontinuation rates.
* change to 24 or 36 if two year or three year discontinuation rates are desired.
select if (exposure <= 12).
* resort the data to enable the calculation of the life table.
sort cases method (a) exposure (a).


* Monthly rates of discontinuation.
* Convert counts of discontinuation and switching rates to monthly rates.
compute discont = discont/cum_expo.
compute discont_sw = discont_sw/cum_expo.
compute reason_1 = reason_1/cum_expo.
compute reason_2 = reason_2/cum_expo.
compute reason_3 = reason_3/cum_expo.
compute reason_4 = reason_4/cum_expo.
compute reason_5 = reason_5/cum_expo.
compute reason_6 = reason_6/cum_expo.
compute reason_7 = reason_7/cum_expo.

* Construct the life table.
do if (exposure = 1).
* First month of life table = 1 minus the monthly rate for month 1.
+ compute lt_reason_1 = 1 - reason_1.
+ compute lt_reason_2 = 1 - reason_2.
+ compute lt_reason_3 = 1 - reason_3.
+ compute lt_reason_4 = 1 - reason_4.
+ compute lt_reason_5 = 1 - reason_5.
+ compute lt_reason_6 = 1 - reason_6.
+ compute lt_reason_7 = 1 - reason_7.
+ compute lt_discont = 1 - discont.
+ compute lt_discont_sw = 1 - discont_sw.
else.
* remaining months.
+ compute lt_reason_1 = lag(lt_reason_1) - (lag(lt_discont) * reason_1).
+ compute lt_reason_2 = lag(lt_reason_2) - (lag(lt_discont) * reason_2).
+ compute lt_reason_3 = lag(lt_reason_3) - (lag(lt_discont) * reason_3).
+ compute lt_reason_4 = lag(lt_reason_4) - (lag(lt_discont) * reason_4).
+ compute lt_reason_5 = lag(lt_reason_5) - (lag(lt_discont) * reason_5).
+ compute lt_reason_6 = lag(lt_reason_6) - (lag(lt_discont) * reason_6).
+ compute lt_reason_7 = lag(lt_reason_7) - (lag(lt_discont) * reason_7).
+ compute lt_discont = lag(lt_discont) - (lag(lt_discont) * discont).
+ compute lt_discont_sw = lag(lt_discont_sw) - (lag(lt_discont) * discont_sw).
end if.
execute.
```

```
formats lt_reason_1 lt_reason_2 lt_reason_3 lt_reason_4 lt_reason_5 lt_reason_6 lt_reason_7
lt_discont lt_discont_sw (f8.6).
```

E9.4   Calculate weighted and unweighted denominators

Once the discontinuation rates for each method and all methods combined are saved, we will move on to calculating weighted and unweighted denominators. The unweighted denominator is a count of episodes in the first month and can be used to determine if a cell has enough power to be reported. With discontinuation rates, The DHS Program does not show rates for methods that have less than 125 months of exposure in the first month of the life due to large sampling variance. Methods that have 125-249 months of exposure are shown in parentheses to caution the reader that estimates of the discontinuation rates are based on small sample sizes.

In Stata, we drop late entries, and then a simple count by method can be used to calculate the unweighted episodes per method in the first month of exposure. Save this dataset, we will merge this to the weighted denominators once we calculate them.

For weighted denominators, use the dataset saved at the end of E9.3, and count all episodes again (this time including late entries) being sure to weight them this time. Then merge back in the unweighted denominators using the variable `method` to link the denominators by method.

At this point we have two columns of denominators (see below), and we must transpose the rows and columns using `xpose` so the weighted and unweighted Ns become rows that will later be appended to the discontinuation rates.

	method	methodNwt	methodNunwt
1	Pill	677.8545	579
2	Injectables	1156.589	1007
3	Implant	380.7531	370
4	Male condom	137.4892	80
5	LAM/EC	120.5596	106
6	Other	224.1756	166

After transposing and renaming the columns to match the methods they represent (see below), save the dataset.

	drate_pill	drate_inj	drate_impl	drate_mcon~m	drate_lamec	drate_other
1	677.8546	1156.589	380.7531	137.4892	120.5596	224.1756
2	579	1007	370	80	106	166

Stata

```
* Step 4
* calculate and save the weighted and unweighted denominators
* and convert into format for adding to dataset of results

* calculate unweighted Ns, for entries in the first month of the life table
drop if entry != 0
collapse (count) methodNunwt = entry, by(method)
save "method_Ns.dta", replace

use "drates.dta", clear
* calculate weighted Ns, for total episodes including late entries
collapse (count) methodNwt = entry [iw=wt], by(method)

* merge in the unweighted Ns
merge 1:1 method using "method_Ns.dta"

* drop the merge variable
drop _merge

* switch rows (methods) and columns (weighted and unweighted counts)
* to create a file that will have a row for weight Ns and a row for unweighted Ns with methods as
the variables
* first transpose the file
xpose, clear
* rename the variables v1 to v9 to match the drate variable list (ignoring all methods)
tokenize $drate_list
local num : list sizeof global(drate_list)
forvalues x = 1/`num' { // this list is a sequential list of numbers up to the count of vars
        rename v`x' `1'
        mac shift
}
* drop the first line with the method code as the methods are now variables
drop if _n == 1
* generate the reason code (to be used last for the Ns)
gen reason = 9 + _n

* save the final Ns - two rows, one for weighhted N, one for unweighted N
save "method_Ns.dta", replace
```

SPSS

```
* Step 4.
* Total episodes, including late entries can be found in first row of life table
  use offset of 11 from 12th row to point to first.
if (exposure = 12) nepisodes = lag(episodes,11).
if (exposure = 12) nexpo_u = lag(cum_expo_u,11).
variable labels
  nepisodes "Number of episodes of use [5]"
 /nexpo_u "Unweighted exposure in first month".
formats nepisodes nexpo_u (f6.0).
execute.
```

In SPSS, the handling of the exposure and unweighted denominator is carried out in the prior step (Step 3), as we accumulated the table to produce the life table, and all that is needed here is to extract the weighted number of episodes and the unweighted exposure from the first month for each method.

E9.5   Combine components for output table

At this point, the rates have been calculated, but in Stata they are attached to each episode use from the original file, saved in drates.dta, while in SPSS we already have an aggregated file of discontinuation rates.

In Stata we now must collapse the data by reason for discontinuation, all reasons combined, and switching. Once we append these all together, we will have a final table of discontinuation rates.

In SPSS, we just need to select the rows for exposure at 12 months and then calculate the 12-month discontinuation rates as 1 minus the cumulative probability of not discontinuing at 12 months of exposure for each reason, all reasons, and for switching.

Stata
```
* Step 5
* Prepare resulting data for output
* This code can be used to produce rates for different durations for use,
* but is here set for 12-month discontinuation rates

* Loop through possible discontinuation rates for 6, 12, 24 and 36 months
//foreach x in 6 12 24 36 {
* current version presents only 12-month discontinuation rates:
local x 12

* open the working file with the rates attached to each case
use "drates.dta", clear

* collect information from relevant time period only
drop if exposure > `x'

* keep only discontinuation information
keep method drate* exposure reason discont_sw wt

* save smaller dataset for x-month duration which we will use in collapse commands below
save "drates_`x'm.dta", replace

* collapsing data for reasons, all reasons, switching, merging and adding method Ns
* reasons for discontinuation
* collapse data by discontinuation category and save
collapse (max) $drate_list drate_total, by(reason)
* drop missing values
drop if reason == .
save "reasons.dta", replace

* All reasons
* calculate total discontinuation and save
collapse (sum) $drate_list drate_total
gen reason = 8
save "allreasons.dta", replace

* switching data
use "drates_`x'm.dta"
* collapse and save a file just for switching
collapse (max) $drate_list_sw drate_total_sw, by(discont_sw)
* only keep row for switching, not for other reasons
drop if discont_sw != 1
* we no longer need discont_sw and don't want it in the resulting file
drop discont_sw
```

```
gen reason = 9 // switching
* rename switching variables to match the non-switching names
rename drate_*_sw drate_*
save "switching.dta", replace

* Go back to data by reasons and merge "all reasons" and switching data to it
use "reasons.dta"
append using "allreasons.dta" // all reasons
append using "switching.dta" // switching
append using "method_Ns.dta" // weighted and unweighted numbers
label def reason 8 "All reasons" 9 "Switching" 10 "Weighted N" 11 "Unweighted N", add

* replace empty cells with zeros for each method
* and sum the weighted and unweighted Ns into the method total variable
foreach z in drate_total $drate_list {
        replace `z' = 0 if `z' == .
        * sum the method Ns to give the total Ns
        replace drate_total = drate_total + `z' if reason >= 10
}

save "drates_`x'm.dta", replace
```

SPSS

```
* Step 5.
* Select just the 12 months exposure to report.
select if (exposure = 12).

* Now extract 12 month discontinuation rates.
+ compute disc_reason_1 = 100* (1 - lt_reason_1).
+ compute disc_reason_2 = 100* (1 - lt_reason_2).
+ compute disc_reason_3 = 100* (1 - lt_reason_3).
+ compute disc_reason_4 = 100* (1 - lt_reason_4).
+ compute disc_reason_5 = 100* (1 - lt_reason_5).
+ compute disc_reason_6 = 100* (1 - lt_reason_6).
+ compute disc_reason_7 = 100* (1 - lt_reason_7).
+ compute disc_any      = 100* (1 - lt_discont).
+ compute disc_switch   = 100* (1 - lt_discont_sw).
formats disc_reason_1 disc_reason_2 disc_reason_3 disc_reason_4 disc_reason_5
        disc_reason_6 disc_reason_7 disc_any disc_switch (f5.1).
variable labels
  disc_reason_1 "Method failure"
  disc_reason_2 "Desire to become pregnant"
  disc_reason_3 "Other fertility related reasons [1]"
  disc_reason_4 "Side effects/health reasons"
  disc_reason_5 "Wanted more effective method"
  disc_reason_6 "Other method related reasons [2]"
  disc_reason_7 "Other/DK"
  disc_any "Any reason [3]"
  disc_switch "Switched to another method [4]".
```

Both the Stata and the SPSS methods result in a dataset of discontinuation rates, but oriented in opposite directions due to the approaches used to produce them. It can be seen though that the results are the same.

Stata data

	reason	drate_pill	drate_inj	drate_impl	drate_mcon~m	drate_lamec	drate_other	drate_allm~h
1	Method failure	3.071256	1.004436	0	2.012593	1.054801	2.492505	1.578645
2	Desire to become pregnant	5.590367	4.280413	1.353072	15.31163	.8733277	1.673769	4.441921
3	Other fertility related reasons	.0444442	.5069776	0	.89911	5.086803	.4899289	.512217
4	Side effects/health concerns	9.395296	14.47674	5.38379	3.349708	0	11.94371	10.41175
5	Wanted more effective method	2.983462	2.258206	0	5.20434	0	2.405274	2.218379
6	Other method related	2.81886	.6105709	1.008694	7.452948	0	1.004965	1.627741
7	Other/DK	2.970416	1.805554	.7630174	8.302976	29.09449	1.462768	3.38234
8	All reasons	26.8741	24.9429	8.508572	42.5333	36.10942	21.47292	24.17299
9	Switching	6.019125	5.080995	.3349908	16.26432	4.478137	10.09472	5.644915
10	Weighted N	677.8546	1156.589	380.7531	137.4892	120.5596	224.1756	2697.421
11	Unweighted N	579	1007	370	80	106	166	2308

SPSS data

	disc_reason_1	disc_reason_2	disc_reason_3	disc_reason_4	disc_reason_5	disc_reason_6	disc_reason_7	disc_any	disc_switch	nepisodes	nexpo_u
1	3.1	5.6	.0	9.4	3.0	2.8	3.0	26.9	6.0	678	579
2	1.0	4.3	.5	14.5	2.3	.6	1.8	24.9	5.1	1157	1007
3	.0	1.4	0	5.4	.0	1.0	.1	8.5	.3	381	370
4	2.0	16.3	.9	3.3	5.2	7.5	8.3	42.5	16.3	137	80
5	1.1	.9	5.1	0	.0	0	29.1	36.1	4.5	121	106
6	2.5	1.7	.5	11.9	2.4	1.0	1.5	21.5	10.1	224	166
7	1.6	4.4	.5	10.4	2.2	1.6	3.4	24.2	5.6	2697	2308

E9.6 Output results

Now that we have calculated discontinuation rates, merged in unweighted and weighted denominators, and saved a dataset with all of our components, we can output our results.

In Stata, we have several options for outputting the results, including `list`, `outsheet`, or we can use `putexcel` to directly place each value from our results table into specific Excel cells.

Another option in Stata is to reshape the data for use with other tabulation commands using the `reshape long` command in Stata. This will change data from a wide format (Stata output above) with reasons for discontinuation in rows and discontinuation rates for each method as columns to a long data set where there are multiple records for each reason for discontinuation to accommodate every reason and method combination. This allows for an easier tabulation in Stata (`table method reason [iw=drate_]`).

In SPSS, a `ctable` can be used to tabulate method by the various reasons for discontinuation.

Stata
```
* Step 6
* Output results in various ways

* simple output with reasons in rows and methods in columns
list reason $drate_list drate_allmeth, tab div abb(16) sep(9) noobs linesize(160)
outsheet reason $drate_list drate_allmeth using `x'm_rates.csv, comma replace

* Outputting as excel file with putexcel
* putexcel output
putexcel set "drates_`x'm.xlsx", replace
putexcel B1 = "Reasons for discontinuation"
putexcel A2 = "Contraceptive method"
* list out the contraceptive methods
```

```
local row = 2
foreach method of global methods_list {
        local row = `row'+1
        putexcel A`row' = "`method'"
}

putexcel B3:J`row', nformat(number_d2)
putexcel K3:L`row', nformat(number)

tokenize B C D E F G H I J K L
local recs = [_N]
* loop over reasons for discontinuation
forvalues j = 1/`recs' {
        local lab1 : label reason `j'
        putexcel `1'2 = "`lab1'", txtwrap
        local k = 2
        * loop over contraceptive methods
        local str
        foreach i in $drate_list drate_allmeth {
                local k = `k'+1
                local str `str' `1'`k' = `i'[`j']
        }
        * output results for method
        putexcel `str'
        mac shift
}


* Converting results dataset into long format for use with other tab commands

* convert results into long format
reshape long drate_, i(reason) j(method_name) string
gen method = .
tokenize $meth_list allmeth
foreach m in $meth_codes 10 {
        replace method = `m' if method_name == "`1'"
        mac shift
}
label var method "Contraceptive method"
label def method            ///
1 "Pill"                    ///
2 "IUD"                     ///
3 "Injectables"             ///
4 "Implant"                 ///
5 "Male condom"             ///
6 "Periodic abstinence"     ///
7 "Withdrawal"              ///
8 "LAM/EC"                  ///
9 "Other"                   ///
10 "All methods"
label val method method

* Now tabulate (using table instead of tab to avoid extra Totals)
table method reason [iw=drate_], cellwidth(10) f(%3.1f)


* close loop if multiple durations used and file clean up
* closing brace if foreach is used for different durations
//}


* clean up working files
```

```
erase "drates.dta"
erase "reasons.dta"
erase "allreasons.dta"
erase "switching.dta"
erase "method_Ns.dta"
```

SPSS

```
* Step 6.
* Output the table.
ctables
  /vlabels variables=method display=none
  /vlabels variables=disc_reason_1 disc_reason_2 disc_reason_3 disc_reason_4 disc_reason_5
                          disc_reason_6  disc_reason_7  disc_any  disc_switch  nepisodes
nexpo_u display=label
  /format maxcolwidth=55
  /table method [c] by
  (disc_reason_1 + disc_reason_2 + disc_reason_3 + disc_reason_4 +
   disc_reason_5 + disc_reason_6 + disc_reason_7 + disc_any + disc_switch) [s] [mean,'',f6.1] +
(nepisodes + nexpo_u) [s] [mean,'',f8.0]
  /categories var=all empty=exclude missing=exclude
  /slabels visible=no
  /titles title=
  "Table 7.11 Twelve-month contraceptive discontinuation rates"
  "Among episodes of contraceptive use experienced within the 5 years preceding the survey, "+
  "percentage of episodes discontinued within 12 months, according to reason for "+
  "discontinuation and specific method, DHS-6 Model Data"
  corner="Contraceptive method"
  caption=
  "Note: Figures are based on life table calculations using information on episodes of "+
  "use that occurred 3-62 months preceding the survey"
  "[1] Includes infrequent sex/husband away, difficult to get pregnant/menopausal, "+
  "and marital dissolution/separation"
  "[2] Includes lack of access/too far, costs too much, and inconvenient to use"
  "[3] Reasons for discontinuation are mutually exclusive and add to the total given in "+
  "this column"
  "[4] A woman is considered to have switched to another method if she used a different method "+
  "in the month following discontinuation or if she gave 'wanted a more effective method' "+
  "as the reason for discontinuation and started another method within two months "+
  "of discontinuation."
  "[5] All episodes of use that occur within the 5 years preceding the survey are included. "+
  "Episodes of use include episodes that were discontinued during the period of observation "+
  "and episodes of use that were not discontinued during the period of observation."
  "[6] Includes Female Sterilization, Male sterilization, Other Traditional, Female Condom, "+
  "Other Modern, Standard Days Method plus IUD, Periodic Abstinence, and Withdrawal.".
```

The resulting output is the below table of discontinuation rates, failure rates (first column), and switching rates:

Stata output

```
---------------------------------------------------------------------------------------------------
Contracepti |                              Reason for discontinuation
ve method   | Method  Desire  Other f Side ef Wanted  Other m Other/D All rea Switchi Weighte Unweigh
------------+--------------------------------------------------------------------------------------
       Pill |    3.1     5.6     0.0     9.4     3.0     2.8     3.0    26.9     6.0   677.9   579.0
Injectables |    1.0     4.3     0.5    14.5     2.3     0.6     1.8    24.9     5.1  1156.6  1007.0
    Implant |            1.4             5.4             1.0     0.8     8.5     0.3   380.8   370.0
Male condom |    2.0    15.3     0.9     3.3     5.2     7.5     8.3    42.5    16.3   137.5    80.0
     LAM/EC |    1.1     0.9     5.1                            29.1    36.1     4.5   120.6   106.0
      Other |    2.5     1.7     0.5    11.9     2.4     1.0     1.5    21.5    10.1   224.2   166.0
All methods |    1.6     4.4     0.5    10.4     2.2     1.6     3.4    24.2     5.6  2697.4  2308.0
---------------------------------------------------------------------------------------------------
```

SPSS output

Table 7.11 Twelve-month contraceptive discontinuation rates
Among episodes of contraceptive use experienced within the 5 years preceding the survey, percentage of episodes discontinued within 12 months, according to reason for discontinuation and specific method, DHS-6 Model Data

Contraceptive method	Method failure	Desire to become pregnant	Other fertility related reasons [1]	Side effects/health reasons	Wanted more effective method	Other method related reasons [2]	Other/DK	Any reason [3]	Switched to another method [4]	Number of episodes of use [5]	Unweighted exposure in first month
Pill	3.1	5.6	.0	9.4	3.0	2.8	3.0	26.9	6.0	678	579
Injectables	1.0	4.3	.5	14.5	2.3	.6	1.8	24.9	5.1	1157	1007
Implant	.0	1.4	.0	5.4	.0	1.0	.8	8.5	.3	381	370
Male condom	2.0	15.3	.9	3.3	5.2	7.5	8.3	42.5	16.3	137	80
LAM/EC	1.1	.9	5.1	.0	.0	.0	29.1	36.1	4.5	121	106
Other [6]	2.5	1.7	.5	11.9	2.4	1.0	1.5	21.5	10.1	224	166
All methods	1.6	4.4	.5	10.4	2.2	1.6	3.4	24.2	5.6	2697	2308

Note: Figures are based on life table calculations using information on episodes of use that occurred 3-62 months preceding the survey
[1] Includes infrequent sex/husband away, difficult to get pregnant/menopausal, and marital dissolution/separation
[2] Includes lack of access/too far, costs too much, and inconvenient to use
[3] Reasons for discontinuation are mutually exclusive and add to the total given in this column
[4] A woman is considered to have switched to another method if she used a different method in the month following discontinuation or if she gave 'wanted a more effective method' as the reason for discontinuation and started another method within two months of discontinuation.
[5] All episodes of use that occur within the 5 years preceding the survey are included. Episodes of use include episodes that were discontinued during the period of observation and episodes of use that were not discontinued during the period of observation.
[6] Includes Female Sterilization, Male sterilization, Other Traditional, Female Condom, Other Modern, Standard Days Method plus IUD, Periodic Abstinence, and Withdrawal.

It should be noted that for male condom and LAM/EC the unweighted number of cases (80 and 106 respectively) are too small to present in a report based on the DHS rules for minimum sample sizes. The Other category also has too few cases (166) and at a minimum would be shown in parentheses. We would recommend combining male condom, LAM/EC, and Other into a single "Other methods" category.

Notes and Considerations

Use of contraception is generally not allowed to be missing in any month in the calendar. In the few surveys where it is missing, these are treated as months of non-use of contraception. Missing and unknown reasons for discontinuation are treated as "Other" reasons.

It is worth noting that different assumptions can be made to the calculation of the at risk component of the life table for contraceptive discontinuation. These assumptions are related to the fact that contraceptive information is usually collected using a calendar that collects information on use in calendar months, whereas the life table refers to actual months of use. One consequence of this approach is that censored observations actually contribute a full month of exposure in the last month of observation included in the analysis rather than half a month of exposure. In many life table analyses the number at risk is often taken as the number continuing to the month minus half of the censored observations. For the calculation of discontinuation rates The DHS Program assumes that all observations are at risk for the full month, rather than excluding half the censored observations. Consult Changes over Time in Module 1 for more information on how the calendar has changed over the many phases of The DHS Program.

See also FA59: Model Further Analysis Plan: Contraceptive Use Dynamics (Curtis and Hammerslough, 1995), to provide further ideas and guidance in approaches to manipulating the DHS calendar data.

Programs and coding resources

Examples

Programs for all of the examples found in this tutorial are available for Stata and for SPSS, and can be found in the Stata.zip and SPSS.zip files accompanying this tutorial. For Example 1, simple programs are available for R, SAS, CSPro and Excel in addition to the Stata and SPSS examples. Output files for each example are also included in the zip files.

Example	Software	Commands	Output
Example 1: Basic string functions			
	Stata	Stata\Example1.do	Stata\Example1.log
	SPSS	SPSS\Example1.sps	SPSS\Example1.txt
	SAS	SAS\Example1.sas	SAS\Example1.log
	R	R\Example1.R	R\Example1.txt
	CSPro	CSPro\Example1.bch.apc	CSPro\Example1.lst
	Excel	Excel\Example1.xls	
Example 2: Last pregnancy, duration of pregnancy and method used before pregnancy			
	Stata	Stata\Example2.do	Stata\Example2.log
	SPSS	SPSS\Example2.sps	SPSS\Example2.txt
Example 3: Postpartum family planning			
	Stata	Stata\Example3.do	Stata\Example3.log
	SPSS	SPSS\Example3.sps	SPSS\Example3.txt
Example 4: Stillbirths and perinatal mortality			
	Stata	Stata\Example4.do	Stata\Example4.log
	SPSS	SPSS\Example4.sps	SPSS\Example4.txt
Example 5: Reasons for discontinuation in the last five years by method			
	Stata	Stata\Example5.do	Stata\Example5.log
	SPSS	SPSS\Example5.sps	SPSS\Example5.txt
Example 6: Contraceptive prevalence over time			
	Stata	Stata\Example6.do	Stata\Example6.log
	SPSS	SPSS\Example6.sps	SPSS\Example6.txt
Example 7: Create events file			
	Stata	Stata\Create events file.do	Stata\Create events file.log
	SPSS	SPSS\Create events file.sps	SPSS\Create events file.txt
Example 8: Reasons for discontinuation from an events file			
	Stata	Stata\Example8.do	Stata\Example8.log
	SPSS	SPSS\Example8.sps	SPSS\Example8.txt
Example 9: Twelve-month discontinuation, failure and switching rates			
	Stata	Stata\Example9.do	Stata\Example9.log
	SPSS	SPSS\Example9.sps	SPSS\Example9.txt
Additional Resources			
	Stata	Calendars shifted.do	Checks for misalignment
		Realign vars.do	Realigns calendar
		Data fixes.do	Fixes data problems

	SPSS	Calendar recoding.do	Recodes calendar vars
		Data fixes.sps	
		Calendar recoding.sps	

Complete sets of example programs, output and model data can be found at the following links:

Software	Commands and Output	Model Dataset
All examples		
Stata	Stata.zip	zzir62fl.dta
SPSS	SPSS.zip	zzir62fl.sav
Example 1		
SAS	SAS.zip	zzir62fl.sd2
R	R.zip	zzir62fl.dta
CSPro	CSPro.zip	zzir62.dat
Excel	Excel.zip	

Survey-specific coding

While the DHS Individual recode datasets follow a standard structure, there is always some survey-specific variation in the coding used. This survey-specific coding can affect the DHS contraceptive calendar data. This section discusses some of the broader survey-specific coding and describes three sets of syntax:

1. Realignment of string variables – corrections for calendar and other strings that are left-aligned in some Stata datasets.
2. Data fixes – corrections for known problems in datasets.
3. Calendar recoding – recoding of method codes and reasons for discontinuation to produce a consistent set of numeric codes across all surveys.

Realignment of string variables

In a small number of Stata datasets, all alphanumeric strings in the dataset were left-aligned at the time the file was constructed. This misalignment affects not only the calendar variables, but also the ID variables such as `caseid`. The misalignment will cause much of the logic in this tutorial to inaccurately process the calendar data. For most surveys that were affected the datasets were modified and the current Stata datasets are correct[16]. To check for misalignment of the calendar data, the following code will create a simple tabulation of the first position of the calendar.

Stata
```
gen x=substr(vcal_1,1,1)
tab x
* should be all blank
```

In all surveys, except one[17], this should be blank for all cases, as below. If any other codes show for the variable x, there is a problem of misalignment of the calendar:

Stata output
```
        x |      Freq.     Percent        Cum.
------------+-----------------------------------
          |      8,348      100.00      100.00
------------+-----------------------------------
    Total |      8,348      100.00
```

To check all datasets, use Calendars shifted.do to process all datasets to look for calendars misaligned.

To correct for any misalignment of data, the do file Realign vars.do can be used to make the modifications. This do file is set to loop through all of the files known to be misaligned and to correct the alignment of both `caseid` and the calendar variables `vcal_*`. Users may prefer to re-download the affected datasets

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[16] Note, though, that the version number of the dataset was not updated and users that had previously downloaded the dataset may not be aware of the modified version. For almost all of the corrected datasets the date of the modified dataset is 10/29/2015.
[17] In the Maldives 2009 DHS (MVIR52FL.dta) there are 7 cases with non-blank codes in the first position.

to ensure that the datasets are not misaligned. Corrected versions of the datasets are dated October 29, 2015. The list of datasets that were corrected in 2015 can be found in the do file.

Recommendation: It is recommended that any corrections needed are made to the datasets prior to using them for any analysis.

Data fixes

This section discusses survey-specific modifications to the data needed to successfully process the calendar data. There are two main types of modifications needed:

1) Modifications for extended ASCII characters in the calendar.
2) Modifications to correct for problems in specific datasets.

Extended ASCII characters:

One of the complications for recoding the survey-specific codes is the alpha codes that have been used in particular surveys. The alpha method and reason codes are generally the letters "A"-"Z" and the numbers "1"-"9" (and "0" meaning not using a method), however in a small number of surveys extended ASCII characters (with ASCII codes 128-255) have been used, principally the codes for "α", "ß", and "Γ" (often displayed as "à", "á", "â"). These codes, though, create a complication in processing in both Stata and SPSS. In most cases the individual recode datasets are saved in pre-Unicode versions of Stata and SPSS, and this means that the codes do not necessarily display well in these software.

For Stata, the Calendar recoding.do file (see below) handles the recoding of these characters, both in versions prior to Unicode (13 and below), and in the Unicode versions (14 and higher).

For SPSS, this is more complicated, and modifications are needed to the data prior to the processing discussed in this tutorial. The SPSS syntax file, Data fixes.sps, contains logic for replacing the internal codes for "α", "ß", and "Γ" (binary pairs of codes with decimal codes 160-162, preceded by decimal code 195) with the characters "$", "%", "&", respectively. The Calendar recoding syntax (see below) then looks for the new codes "$", "%", "&" in the later recoding steps.

Survey-specific issues:

There are a few problems in specific datasets, including the following:

- Dominican Republic DHS 2013 (DRIR21FL) – contains two duplicated cases that are removed prior to further processing.
- Egypt DHS 2005 (EGIR51FL) – vcal_1 contains a code ("Z") in column 1 for a change in source of contraception (not a change in method), and these need to be removed and replaced with the code for the adjacent month for most analyses.
- Honduras DHS 2005-06 (HNIR51FL) – vcal_1 contains two cases of code "M" that should be code "B".

- Peru DHS 2009 (PEIR5IFL) – vcal_1 contains the incorrect codes for several methods. Codes "F", "L", "8", "9", "E", "M", "*" need to be changed to "C", "F", "L", "8", "9", "E", "M", respectively.
- Peru DHS 2012 (PEIR6IFL) – the supplementary variables v017, v018, and v019 are off by 12 months, and are corrected by adding 12 to v017 and v018, and subtracting 12 from v019. Additionally the calendar contains "*" for several months following the month of interview, and needs to be replaced with " ".

Each of these problems is resolved with the logic found in the Data fixes.do file or Data fixes.sps syntax file.

Recommendation: These modifications should be applied immediately after the dataset has been opened and before any other processing of the calendar data. Alternatively, these modifications may be made one time for each relevant dataset and the datasets saved with the modifications in place.

Calendar recoding

In each survey, survey-specific contraceptive method codes or codes for reasons for discontinuation may have been added to the questionnaires. There are no standard codes for these survey-specific methods, and the codes used will vary from survey to survey. For example, several surveys in Indonesia have used added categories for the use of herbs and massage as folkloric contraceptive methods. Additionally, prior to their inclusion as standard methods, some surveys include Emergency Contraception and Standard Days Method as methods of contraception, but used non-standard codes for them. Similarly, surveys have added survey-specific codes for reasons for discontinuation, such as IUD Expelled, Medical Advice, Ramadan, Husband absent/away, in addition to the standard list of reasons.

To facilitate the identification and recoding of these survey-specific codes into a standard set, a Stata do file (Calendar recoding.do) and an SPSS syntax file (Calendar recoding.sps) have been created to help with the recoding.

This calendar recoding will not work when the data are in the original string format (e.g. `vcal_1`). They are designed to work when the data have been restructured into single months or events, or single months have been extracted through string parsing. This code should be run after the data have been either restructured or extracted. See step 2.7 in Example 2.

The calendar recoding routines do three things:

1) Set up string variables `methodlist` and `reasonlist` that contain the list of alpha codes that are used in the calendar for the particular survey, including the survey-specific codes. The character position in this string will represent the numeric code that will later be assigned for that alpha code. For example if the `methodlist` contains "123456789WNALCF~M~", the letter "M" is in position 17, indicating that an "M" will later be recoded into code 17 in the resulting numeric variable. The actual list of codes in `methodlist` and `reasonlist` will be 99 characters in length, mostly filled with tildes (~) as place holders, but permitting the recoding of alpha codes into numeric values from 1 to 99. No actual recoding of data is done in this step – only the creation of survey-specific lists of codes for the methods and reasons.

2) Recode individual codes for the method (or birth, termination or pregnancy) from a single alpha code into a single numeric code and label the resulting variable with the expanded set of harmonized codes. This step uses the `methodlist` created in the prior step to determine the numeric codes to assign for the contraceptive method, or the birth, termination or pregnancy.

3) Recode individual codes for the reason for discontinuation from a single alpha code into a single numeric code and label the resulting variable. This step uses the `reasonlist` created in the first step to determine the numeric codes to assign for the reason for discontinuation.

The end result of this recoding is that each contraceptive method and each reason for discontinuation has the same numeric value and appropriate label in each dataset.

These calendar recoding routines can be run either without parameters[18] (point 1 only) to just produce the lists of survey-specific codes, with parameters for the variable containing the alpha code for the method and a resulting variable for the numeric code (points 1 and 2) to recode just the contraceptive method (and/or pregnancy) codes, or with two additional variables for the alpha code for the reason for discontinuation and a resulting variable for the numeric code (points 1, 2, and 3) to recode both the contraceptive method and the reason for discontinuation codes.

For example, the logic below uses a variable called `method_str` as the code extracted from a single month from `vcal_1`, and creates a numeric variable called `method_num` with the recoded value. The example also uses a variable called `reason_str` as the code extracted from a single month from `vcal_2` for the reason for discontinuation, and creates a numeric variable called `reason_num` with the recoded numeric value. The calendar recoding routines are used as follows:

Stata
```
run "Calendar recoding.do" method_str method_num reason_str reason_num
```
SPSS
```
* Load the macro for the recoding.
insert file="Calendar recoding.sps".
* recode the method and/or reason for discontinuation.
!Calendar_recoding method_str method_num reason_str reason_num.
```

Step 2.7 of Example 2 provides sample code (in the comments) to replace the recoding used with the model dataset.

The calendar recoding also recodes the births, terminated pregnancies, and other months of pregnancy into numeric codes 81, 82, and 83, respectively, as well as recoding the contraceptive methods.

Recommendation: The Calendar recoding.do or Calendar recoding.sps should be run from within the example code when a single month method code or reason for discontinuation code is to be recoded to a numeric code. This recoding cannot be used to recode all months of the calendar at the same time – it only works for a single month at a time.

---

[18] Parameters here are variables passed to the Calendar recoding routines for 1) the alpha method code variable, 2) the resulting numeric method variable, 3) the alpha reason for discontinuation code variable, and 4) the resulting numeric reason for discontinuation variable.

Annexes

Acknowledgements

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History of the calendar:

Dominican Republic: 1986 - Dominican Republic 1986 Final Report (Experimental)
http://dhsprogram.com/publications/publication-FR11-Other-Final-Reports.cfm

Peru: 1986 - Peru 1986 Final Report (Experimental)
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