

Reproductive milestones: the association of menarche, childbirths and menopause

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Extended Abstract

As shown in a number of studies, the age at menopause varies between populations (1), but even more between women within a population (2). In addition to genetic factors (3, 4), studies have shown that the age at menopause is related to a woman's menstrual and reproductive history, such as the number of children, the length of the menstrual cycle, and the use of oral contraceptives (5-8). Variables that characterize a woman's lifestyle, such as smoking, body mass index, caloric intake, or physical activity (9) or socioeconomic variables (10), have also been studied in detail. Even though socioeconomic and lifestyle factors may play an important role in the timing of menopause at the individual level, and modification of some risk factors (e.g., smoking) may delay the onset of menstruation, these factors do not explain the large differences in the age at menopause in different populations (2).

Reproductive history, defined by reproductive milestones such as age at menarche, age at first birth, interbirth intervals, or number of children born, provides an important context for the timing of menopause, or the length of the reproductive period. The association between age at menarche and age at menopause has been discussed in the literature with mixed results. Some studies document that women with early menarche also have early menopause (10, 11). Others show that women with early menarche have late menopause (12) or find only a very weak (6) or no association (13, 14). A more recent study using robust population data demonstrates that age at menarche is associated with the overall length of the reproductive period in women (6). Although women with menarche at age 16 years or older have, on average, a year later onset of menopause than women with menarche at age 13 years, the total length of the reproductive period measured from menarche to onset of menopause decreases with increasing age at menarche (6).

New results show that the age at menopause increased with increasing number of births, but only up to three births; subsequent births of higher order (4 or more) did not further increase the age at menopause (5). The association of age at menopause with the timing of first birth has been less frequently examined, with conflicting findings. Some authors have shown that age at first birth does not affect the timing of menopause, but other events of a woman's reproductive history, such as early menarche (<14 years) and short menstrual cycles (<28 days), lead to a lower age of onset of menopause; conversely, oral contraceptive use and a higher number of children delay the onset of menopause (15). Conversely, other studies have documented the effect of age at first childbirth on the length of a woman's reproductive period, and low age at first childbirth is associated with a slightly later onset of menopause, as is a later age at last childbirth (9).

From a brief introduction of the context, it is clear that the timing of menopause is the subject of many studies worldwide. However, there are significantly fewer studies focused on Central and Eastern Europe (2, 13, 15) and they are more focused on menopause-related health symptoms than on issues related to reproductive history, changing reproductive patterns in European populations, and the timing of menopause onset and related factors (2). Central and Eastern European countries are of great interest when discussing the relationship between reproductive history and age at menopause because social transformation in the 1990s began not only significant changes in population health and improvements in mortality rates (16), but also a dynamic shift in reproduction toward lower fertility at older ages (17).

The aim of this paper is to evaluate the association between selected aspects of reproductive history and different reproductive contexts (understood as different reproductive regimes in terms of quantum and tempo of reproduction) **and the age at menopause**. The analysis will cover countries that represent different patterns of the onset of SDT, which also correspond to the historical period of the onset of the postponement of first births (18). Therefore, the analysis will cover so-called postponement leaders (such as Denmark, Finland, Sweden), and Central and Eastern European countries that can be classified as late starters (Estonia) and countries in between (Czech Republic) (18). The final decision on countries will depend on the availability of GGP data for countries that are currently in the process of publishing the latest data. We focus mainly on the association between the age at menopause and the number of children/ the age at first birth.

Data and methods

We employ data from the Generations and Gender Programme, where the onset of menopause is determined by self-reporting a question in the questionnaire: “How old were you when you started menopause? If you have not started menopause, select not applicable”.

We focus on a subsample of women aged 40-69 at the time of the interview. The choice of this age range is due to the fact that we also want to capture the occurrence of early menopause before the age of 45.

Since not all women had reached menopause at the time of data collection, we employed survival analyses to estimate mean age at menopause, survival curves for subgroups of women and Cox proportional hazard models to assess the association of reproductive history with age at menopause. In the survival analysis, women were considered to have entered the study at birth; if they reported reaching menopause, they were considered completed cases, otherwise, they were censored. The endpoint time was defined as the age of menopause for those already have started menopause and the age at the interview for censored observations.

Preliminary results: Timing of menopause and age at first birth – an example of the Czech Republic

Table 1 shows age at menopause according to the age of women at 1st childbirth. The results show that menopause occurs earlier in the case of women who became mothers before the age of 20. The difference in the onset of menopause is 1.2 – 1.5 years when comparing women who gave 1st birth before the age of 20 with those becoming first-time mothers at the age of 20-34.

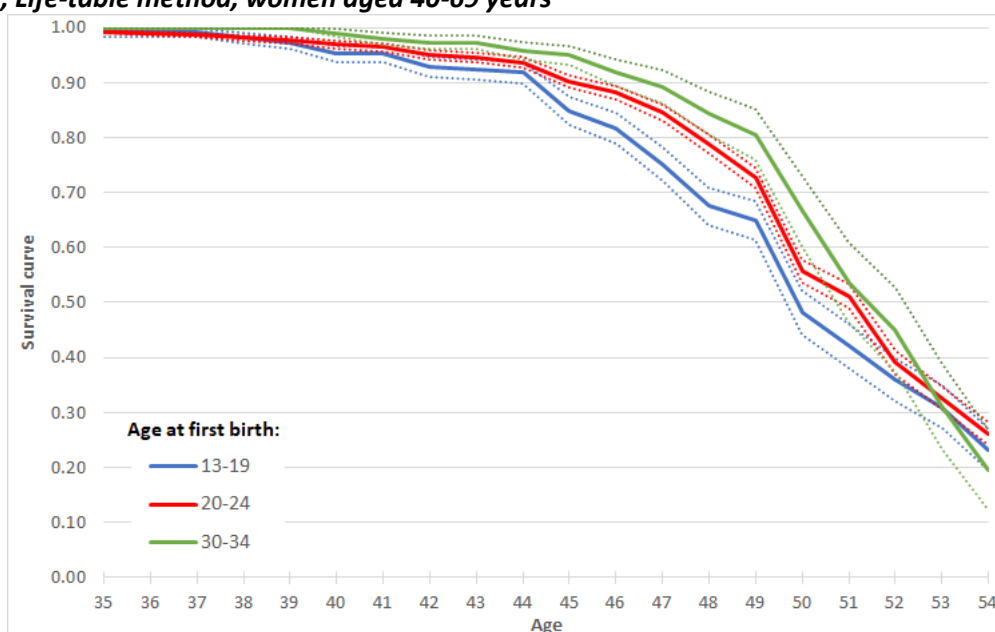
Table 1 Median age at menopause by age at first birth, Life-table method, women aged 40-69 years

	Age at first birth (years)				
	13–19	20–24	25–29	30–34	35+
Median age at menopause (years)	50.9	52.1	52.3	52.4	53.5

Source: Generations and Gender Survey – Czechia (2020-2022)

Survival curves (including a 95% confidence interval, show in detail three age groups of first-time mothers (Fig. 1). The results clearly show differences in the onset of menopause in connection with the age at the birth of the 1st child. Menopause occurs earliest in first-time mothers under the age of 20, later in first-time mothers aged 20-24 and even later in first-time mothers aged 30-34 which is the reproductive model more common in the youngest cohort under observation. It is also evident that the main differences in the onset of menopause are observed between the ages of 45-51 years (Fig. 1). After this age, the proportion of women who have not yet gone through menopause is similar in all age groups.

Fig. 1 Age at menopause by selected age groups at first birth, survival curve and 95% confidence interval, Life-table method, women aged 40-69 years



Source: Generations and Gender Survey – Czechia (2020-2022)

Table 2 confirms that the age at menopause is related to the age at first childbirth, even when controlling for other variables. For women who became mothers for the first time before reaching the age of 20, the risk of menopause onset is higher (1.28-1.25 depending on the model) and, therefore, menopause occurs earlier even when controlling for the reproductive history (number of children and age of menarche) and for cohorts, which can serve, among other things, as a proxy for the prevailing reproductive mode.

Table 2 Risk of menopause (Exp(B)) according to the age at first birth, Cox proportional hazard model

	Model 1		Model 2		Model 3		Model 4	
	Exp(B)	95% CI	Exp(B)	95% CI	Exp(B)	95% CI	Exp(B)	95% CI
Age at first birth								
13-19	1.24	1.03-1.50	1.28	1.06-1.55	1.24	1.02-1.51	1.25	1.02-1.52
20-24	1				1		1	
25-29	1.00	0.83-1.21	0.98	0.82-1.18	0.95	0.78-1.15	0.98	0.81-1.19
30-34	0.86	0.62-1.17	0.81	0.59-1.12	0.90	0.65-1.24	0.99	0.71-1.37
35+	0.69	0.43-1.13	0.62	0.38-1.01	0.68	0.40-1.16	0.75	0.44-1.29
N	1,645		1,645		1,514		1,514	
Number of events	804		804		751		751	
Number of censored cases	841		841		763		763	

Source: Generations and Gender Survey – Czechia (2020-2022)

Note: Model 1: plain model (effect of the age at first birth only); Model 2: controlled for the number of children; Model 3: controlled for the number of children and age at menarche; Model 4: controlled for the number of children, age at menarche and cohort.

Similarly to some other studies, our first results based on the example of the Czech Republic indicate connections between the timing of the onset of menopause and reproductive history. Previous studies, however, have rarely investigated the relation between the timing of first childbirth and the timing of

menopause. More frequently, other aspects of women's reproductive history have been analysed, such as the effects of parity, the use of hormonal contraception, the age of menarche or the length of the menstrual cycle.

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