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Age at menopause and reproductive determinants in Polish women

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ABSTRACT Selected reproductive determinants of age at menopause were analyzed using data from a representative sample of 4354 women aged 35-65 years. The data were collected in cross-sectional surveys carried out in Wielkopolska and Western part of Poland in the years 1998 to 2001. Menopausal status and median and mean ages at menopause were estimated with the use of retrospective and status-quo methods. It was found that the median age at natural menopause, estimated by probit analysis, was 50.1 years. Women, who had been treated with HRT (Hormonal Replacement Therapy) in the period of perimenopause, underwent menopause significantly later – their median age at menopause was 52.9 years. Results of ANOVA revealed that of all characteristics of female reproduction taken into consideration, age at menarche and length of menstruation cycle had significant influence on age at menopause. Menopause occurred markedly later in women who began to menstruate after 15 years of age and whose menstrual cycles lasted longer than 32 days. Reproductive determinants were considered as a complex factor. Stepwise multiple regression analysis with backward elimination revealed that the reproductive determinants including the length of menstruation cycle, age at menarche, age at first and last pregnancies and length of lactation in combination affected age at menopause.

KEY WORDS menarche, menstruation cycle, menopausal status, reproduction

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Introduction

Unlike the decline of other physiological functions, including male reproduction, the rate of senescent changes in female reproductive capacity shows striking abruptness (Fig. 1). A transition from reproductive to non-reproductive

phase in woman's life considerably long before the end of her life is a unique feature of human female [HILL and HURTADO 1991; PAVELKA and FEDIGAN 1991; AUSTAD 1994]. In 1821 a French physician, Gardanne invented the term "menopause" to describe the phenomenon of this transition [Tilt 1870; cited

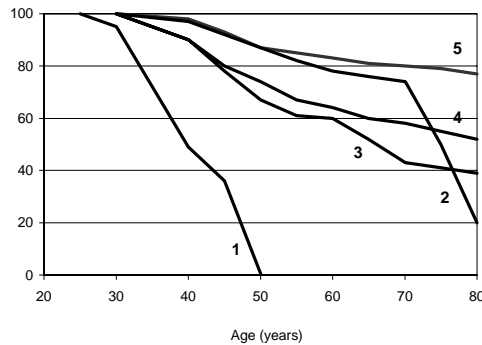


Fig. 1. Rate of human senescent changes in reproductive capacity and selected physiological functions: (1) female reproductive capacity; (2) male reproductive capacity; (3) max. breathing capacity; (4) vital capacity; (5) basic metabolism [Kinsey *et al.* 1948; Shock 1961; Wood 1990, cited after Austad 1994].

after LOCK and KAUFERT 2001]. Menopause signifies the permanent cessation of ovarian follicular function, thus the mechanism responsible for the menopause refers to the continuous loss of ovarian follicles up to the point at which menstrual cycles are increasingly variable in length and finally cease.

Explanation of the origin and existence of menopause can be classified among adaptive or non-adaptive theories. The adaptive theories of menopause assume that age-specific increasing probability of reproductive failure and risk of death in childbirth make it evolutionally more advantageous to redirect reproductive energies towards maternal investment in existing progeny by increasing their survivorship and potential fertility (the mother hypothesis) [WILLIAMS 1957; GAULIN 1980; LANCASTER and LANCASTER 1983; PECCEI 1995*a,b*] or by caring directly for grandchildren (the grandmother hypothesis) [PAVELKA and FEDIGAN 1991; AUSTAD 1994; PECCEI 2001]. The non-adaptive theories of menopause consider

this phenomenon as a recent artifact created by the relatively sudden lengthening of human life over the past several centuries. Implications of either scenario are significant for the understanding of the role the menopause is likely to play in women's aging, quality of life, and differential susceptibility to disease.

Menopause is defined as a complex biosocial and biocultural phenomenon, which occurs in a woman's mid-life phase. Although biological changes associated with this phase of life are essentially universal, the subjective experiences of individual women vary according to sociocultural settings. Cross-cultural studies of multiple perspectives demonstrate a continuous feedback relationship of biological and sociocultural variables [LOCK and KAUFERT 2001]. Therefore, in order to provide an insight into the universal nature of the menopause and individual experiences of women undergoing menopause, a population study of Polish women was undertaken. This paper, part of a larger work, is focused on the distribution of the age at menopause in relation to the reproductive determinants.

Methodology

Survey and sample

Investigations were carried out in the years 1998 to 2001 in the framework of the project "Biological aspects of human aging". In the years 1998-2000, a pilot study was undertaken in Poznań and in the Wielkopolska region. A sample of more than 2400 women were inquired with the use of a menopause-specific questionnaire. Anthropometric measurements and body composition were examined at the same time. Results of this

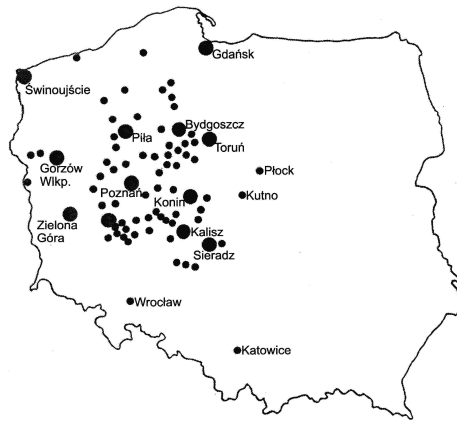


Fig. 2. Location of samples examined for the menopause in 1998-2001.

investigation were presented in: KACZMAREK and SZWED [2000, 2001], and SZWED [2001]. The experience gained from the pilot study led the authors to expand the investigation to the regions situated in the West part of Poland. Locations of samples examined for menopause are presented in Fig. 2.

The menopause-specific questionnaire, used in the present study, was addressed to women older than 35 years of age, and focused mainly on women aged 45-54 years, as it is known that a great majority of women experience natural menopause within this age range. Of the 5500 respondents, replies were obtained from 4354. This gives a 79.2% final response rate. The figure meets the requirements of sample quality. The reliability of replies was estimated by the repeated "test-retest" procedure [FERGUSON and TAKANE 1999]. After a one-year interval, 100 women of post-menopausal status were selected at random and asked to fill in the same menopause-specific questionnaire. The discrepancies in replies between the two

inquiries were tested according to the character of variables. Statistical significance of the differences between quantitative variables was tested with the use of the t-test and between qualitative variables with the use of the chi-square test. In general, a high consistence was found between the replies in the two inquiries, except for the statistically significant difference in the replicates of the age at menarche [SZWED 2001].

The age of the women who participated in the survey varied from 27.4 to 93.0 years with a mean of 47.6 and median of 47.2 years. The age was distributed into 5-year interval cohorts. The largest groups are made of women aged 45-49 years (28.3%) and 50-54 years (21.7%). Subjects older than 50 years constitute 33.7% of the total sample. Distribution of women according to the age category is shown in Fig. 3.

The socioeconomic stratification, described in the present paper in terms of the degree of urbanization and educational level, is shown in Fig. 4. Majority of subjects in the sample comes from urban settings: 30.3% from small towns and 25.4% from large cities. Those from villages constitute 18.3% of the total

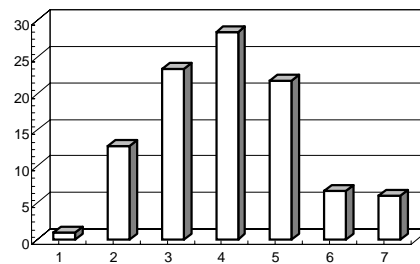


Fig. 3. Percentage age distribution in sample of women participating in menopausal survey: (1) x-34 years; (2) 35-39 years; (3) 40-44 years; (4) 45-49 years; (5) 50-54 years; (6) 55-59 years; (7) 60-x years.

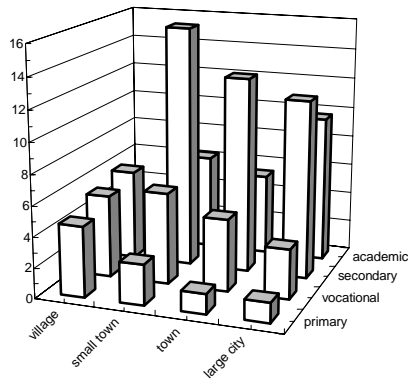


Fig. 4. Percentage distribution of women according to their education levels and dwelling places.

sample. The level of education in the sample under study reflects the general pattern of women's education in Poland. The largest group consists of women with secondary education (45.5%) and is followed by the group with primary and vocational levels of education (29.4%). Women with academic education make - 23.5% of the total sample. A clear gradient of education and the degree of urbanization was found. The higher (lower) the degree of urbanization, the higher (lower) the educational level (see Fig. 4).

The distribution of marital status in the sample under examination, with 80.6% of married women versus only 0.6% of women living in concubinage, reflects a norm current in Polish society, in which marriage is a prevailing form of the male-female relationship.

Menopausal status of women

The term "menopause", used in the present study, is defined according to its derivation as the last menstrual period (LMP) as a result of the loss of ovarian

follicular activity. Following the recommendation of the WHO, we use this term to describe the spontaneous cessation of menstruation preceded by the occurrence of amenorrhea for 12 months [Report... 1981, 1996]. Women whose menses stopped as a result of surgical bilateral oophorectomy, with or without hysterectomy, or X-ray or radium treatment were sampled separately and excluded from subsequent analysis. The number of excluded subjects was 313; which is 7.1% of all the subjects under investigation.

Considering the above given definition, the term "post-menopause" denoting the cessation of the menses for a period of 12 months, was applied to 1300 subjects - 29.8% of the total sample. Out of this number, 1033 women had undergone natural menopause, i.e., menopause resulting from spontaneous loss of ovarian activity. 267 of post-menopausal women declared that in the period of perimenopause they had undergone the hormonal replacement therapy in order to alleviate symptoms and complaints accompanying the beginning of the menopause. It is known that factors used to treat the accompanying symptoms in the period prior to the menopause can have various effects on the cessation of reproductive functions. Therefore, those women were sampled in a separate group and labeled as having gone through "hormonally controlled menopause".

The status of 2410 women (55.3% of all the subjects under investigation) who had menstruated within the last 3 months was defined as premenopausal. 331 women, whose menses had terminated in the last year, but whose period of amenorrhea had not exceeded 12

months, were defined as being at the menopause.

Considering the biological dimension of the menopause, further analysis was undertaken in relation to those women whose status was defined as undergoing the natural menopause. Thus, the total number of subjects used for statistical calculations was 1033.

Age at the menopause – study's design

The individual age at menopause was obtained by asking postmenopausal women to recall their age at the last menstrual period (LMP). The accuracy of the replies depends on the interval of time since the menopause – the older the woman, the more marked the tendency to round off the date of the onset and the end of the menstruating period. The average age at menopause was estimated with the use of the retrospective method, by calculating the mean and median age from individual data. In the status-quo approach each age-specific prevalence of the postmenopausal state was transformed to a probit scale, and median age was calculated from these transformed data [FINNEY 1952]. The status-quo method is a more reliable measure, since it can be determined on the basis of each woman's 'yes' or 'no' reply referring to events that have occurred only during the previous year. However, the median menopausal age for a population, the resultant of the retrospective method, though considerably biased due to inaccuracy in reporting, is useful for purposes of quantitating the relationship between age at menopause and its biological and sociocultural determinants. Therefore, in the present paper we have referred to the results of both methods.

Statistical computations were made with the use of the Statistica 5.5 program package [STATSOFT, INC 1999, Statistica for Windows].

Selected characteristics of female reproductive period

Female reproduction history is well described by events such as the onset and the end of reproductive capacity, pattern of menstruation cycles, potential and real reproductive period, abortions, pregnancies and parity. Those characteristics were employed in the present study, bearing in mind their biological and sociocultural backgrounds. The onset of the reproductive period was dated by the age at menarche. The time interval between the age at menarche and the age at menopause was used for estimating the maximum length of potential reproductive period. While estimating the impact of reproductive activity on age at menopause we used two variables: number of pregnancies and parity. The latter is defined as a number of live births ever given, whereas the "number of pregnancies" variable included spontaneous abortions, live and stillbirths. Factors such as length of menstrual cycles, regularity of the menses, number of pregnancies, length of lactation are supposed to delay the menopause, therefore these variables were also included into the analysis.

It is known that the variables of the female reproductive period are related with one another to the extent they constitute a complex factor. It is important to bear this in mind while interpreting the influence of a single reproductive characteristic on the age at menopause.

Results

Determining the age at menopause

It has been known from data in the literature, that women living in developed countries currently reach menopause around the age of 51, whereas those from underdeveloped countries, a few years earlier (Menopause Core Center Study, cited after PARAZZINI *et al.* 1992]. However, individual records indicate a great variety in the age at menopause. While describing a normal range of the age distribution within a population, one may see its negatively skewed shape with a wider scatter of women reaching menopause at younger rather than older ages. The description of the normal range is important for establishing the upper and lower limits of normality while estimating the median age at menopause, and, practically, in order to establish appropriate definitions for the terms of premature and delayed menopause.

In the present work, mean and median ages at menopause have been calculated with the use of the retrospective (the age at the last menstrual period – LMP) and the current status of menstrual cycles (the status-quo method). Furthermore, apart from the group of women undergoing natural menopause we selected a

group of women whose menopause had occurred under hormonal treatment. Results of descriptive statistics with the use of retrospective and status quo methods are presented in Table 1. Figures in the table revealed that menopause occurred considerably later in women undergoing hormonal replacement treatment. Median age at hormonally controlled menopause according to the retrospective and status-quo methods was 50 and 52.9 years, respectively. The age at natural LMP ranges from 37.7 to 57.7 years, with median age of 49.4 years. While using the status-quo method the median age at menopause was estimated at 50.1 years of age. The resultant differences meet statistical significance as derived from the chi-square and Kruskal-Wallis's tests. This finding has convinced us that it was necessary to separate those two groups of women.

In order to delimit the ages of premature and delayed menopause, a purely statistical point of view indicates 45.3 years for the lower and 53.5 years for the upper limits of normality (the median diminished or increased by the quartiles range). Thus, natural menopause occurring before the age of 45 years is defined as premature and that occurring after 53.5 years, as delayed.

Table 1. Descriptive statistics of the age at menopause – results of the retrospective and status-quo approaches

Menopause	Retrospective approach									
	N	Mean	Min	Max	SD	Median	Lower quartile	Upper quartile	Range	
Natural	851	48.9	37.7	57.7	3.4	49.4	46.9	51.0	4.1	
Hormonally controlled	221	49.8	41.2	58.5	3.2	50.0	48.0	51.8	3.8	
Artificial	293	44.2	27.0	54.0	5.1	45.0	41.0	48.2	7.2	
Probit analysis										
Natural	1033					50.1	Var = 0.009			
Hormonally controlled	221					52.9	Var = 0.015			
Artificial	313					45.1	Var = 0.031			

Reproductive determinants influencing the age at menopause

Aiming at justifying the controversial findings known from the literature, we have analyzed the relationships between factors causing long anovulatory periods during reproductive years, and age at menopause. Results of ANOVA in terms of statistics F, mean ages and standard deviation at menopause in strata of selected menstrual and reproductive characteristics are given in Table 2; the graphic representation is shown in Fig. 5.

Considering the marital status of our subjects, we did not find a significant impact of this variable on age at menopause. Mean ages at menopause of never married women and of those currently

married, widowed and divorced were slightly different.

There are many contradictions concerning the relationship between the onset and the end of the reproductive period dated by the age at menarche and the age at menopause. In our sample the age at menarche ranges from 9 to 20 years with the mean of 13.5 years and the median of 14.0 years. In a great majority of subjects menarche occurred at the age category of 12-14 years (81.4%). Very few experienced menarche earlier than at 12 years of age (5.2%). In 13.4% of subjects, menarche occurred after the age of 15 years. The distribution of age at menarche is positively skewed with a wider scatter of women beginning to menstruate after 14 years of age. We found a significant

Table 2. ANOVA – mean age at menopause in strata of selected menstrual and reproductive characteristics: statistics F and level of significance (p)

Characteristics	N	Mean age	SD	F and p
Age at menarche:				
1. less than 12 years of age	42	49.32	3.5	F = 8.88 p < 0.001
2. 12-14 years of age	661	48.72	3.4	
3. after 15 years of age	109	50.18	3.3	
Length of menstruation cycles:				
1. less than 28 days	268	47.51	3.5	F = 59.86 p < 0.001
2. 28-32 days	464	49.32	3.1	
3. longer than 32 days	99	51.35	2.7	
Regularity of menses:				
yes	682	48.91	3.3	F = 0.14 p = 0.71
no	140	49.02	3.6	
Marital status:				
1. never married	43	48.82	2.9	F = 0.13 p = 0.72
2. married, widowed, divorced	800	49.01	3.4	
Number of pregnancies:				
0	50	49.06	3.3	F = 1.55 p = 0.18
1	127	48.85	3.4	
2	334	48.82	3.4	
3	193	48.87	3.1	
4 and more	147	49.61	3.7	
Parity:				
nulliparous	61	48.94	3.7	F = 0.36 p = 0.83
1 child	141	49.04	3.4	
2 children	371	48.92	3.3	
3 children	176	48.89	3.2	
4 and more children	101	49.34	3.7	

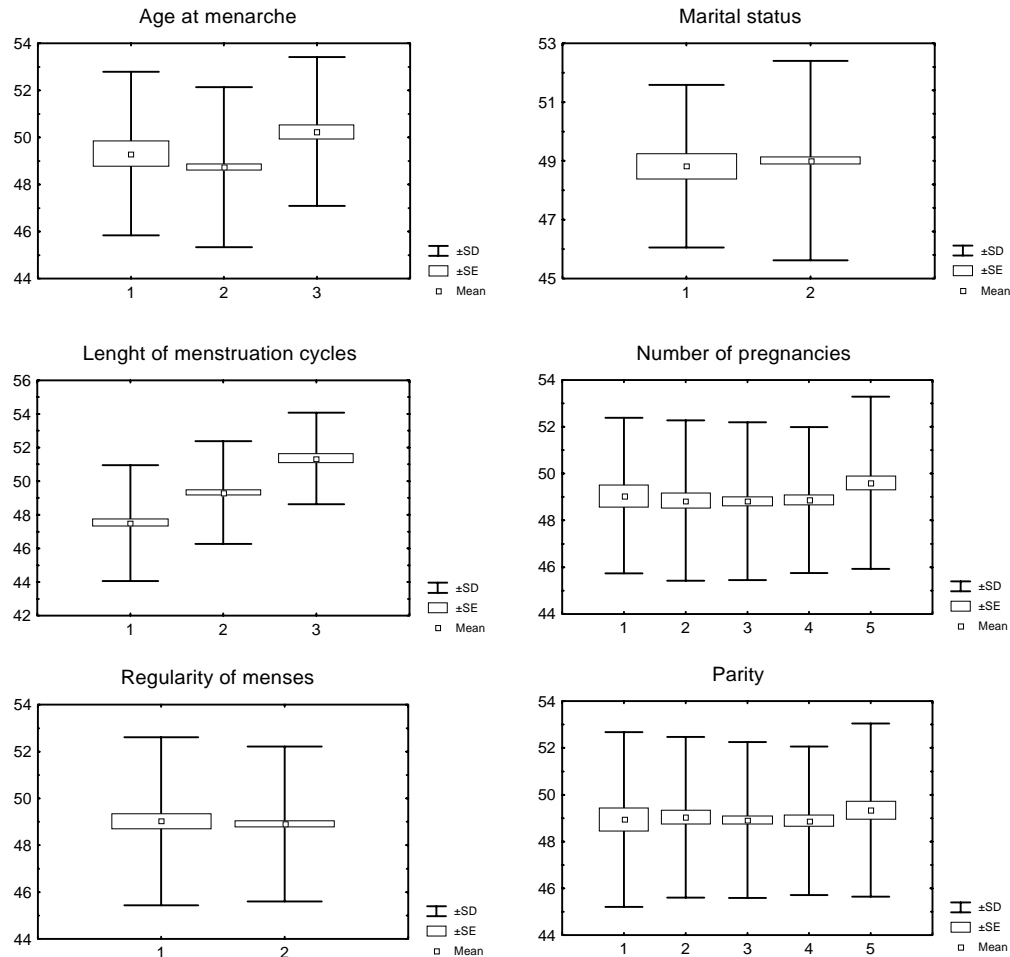


Fig. 5. Graphic representation of the results of ANOVA (for explanation see Table 2).

correlation between the age at menarche and the age at menopause (linear regression analysis indicates $r = 0.11$). The earlier (later) age at menarche, the earlier (later) age at menopause.

Similarly, we have found a significant correlation between the age at menopause and the length of menstrual period. The longer the menstrual period lasts, the later the menopause occurs.

While considering both variables – the length of the menstrual cycles and the age at menarche, results of MANOVA confirmed the relationships between these variables and the age at menopause, however there is no interaction between these factors. The later the onset of the menses and the longer the menstrual period lasts, the later the menopause occurs. When menarche

Table 3. Results of stepwise multiple regression analysis with backward elimination for reproductive determinants of the age at menopause

Characteristics	b	SE	t	p
Length of menstruation cycles (in days)	0.15	0.048	3.10	0.001
Age at menarche (in years)	0.08	0.05	1.69	0.09
Age at first pregnancy (in years)	0.11	0.06	1.91	0.06
Age at last pregnancy (in years)	0.08	0.05	1.39	0.17
Length of lactation (in months)	0.05	0.05	1.05	0.29

occurs before 12 years of age and the menstrual cycle lasts less than 28 days the menopause occurs on average at 46.2 years of age (SD = 3.6 years). When menarche occurs after 15 years of age and the menstrual cycle is longer than 32 days, the menopause occurs on average at 52.8 years of age (SD = 3.1 years). When long-lived irregularity of the menses and the age at menopause were tested, we failed to find relationships between these variables. Thus, age at menopause does not depend on the long-lived regularity of the menses.

Results of regression analysis indicate lack of correlation between age at menopause and age at first and last pregnancies (correlation coefficient $r = 0.065$ and $p = 0.06$ for the age at first pregnancy and $r = 0.068$, $p = 0.08$ for the age at last pregnancy). This means that menopause occurs at a definite age irrespective of the time of pregnancies. Number of pregnancies did not influence the age at menopause either. We found no relationship between the age at menopause and parity. The age at menopause was similar in nulliparous women and those having one or more children. The age at menopause did not depend on the length of lactation either. It was similar irrespective of how long women breast-fed their babies.

Considering all reproductive determinants, selected for the purpose of the present study, results of the stepwise

multiple regression analysis with backward elimination, presented in Table 3, revealed that variables essential for the age at menopause are the following: the length of menstruation cycles, the age at menarche, the age at first and last pregnancies and the duration of the lactation period. Some of these variables, taken separately, as for example the age at first and last pregnancies or the duration of lactation period, had no significant influence on the age at menopause, but their influence intensified when they interacted. Altogether, they explain 3.9% of the variation of the age at menopause, thus their magnitude in modifying the age at menopause is considerable.

Discussion

The age at menopause has been considered to be an indicator of population health, in terms of not only individual women's but also of entire population's well-being. At the same time, the age at menopause might be used as a marker of increased risk for chronic diseases, such as cardiovascular diseases, increased rate of bone loss or breast cancer. Thus, the estimation of the age at menopause in populations of different biological and sociocultural background plays an important role in current investigations of the health of aging women [LEIDY SIEVERT 2001].

In Poland, the investigation of the middle-aged women has had a long tradition and it goes as far back as to the research by STOLYHWOWA [1938]. Majority of hitherto existing population studies have focused on estimating the age at menopause, its biological and sociocultural determinants, and symptoms experienced at perimenopausal period [GÓRSKA 1949; BIELICKI and WELON 1964; PANEK 1967; BOCHEŃSKA 1978; BARON 1968; STOKOWSKI 1968; JASICKI and WOLAŃSKI 1972; SZEMIK 1984; KONIAREK and ŻUKOWSKI 1987; RODZIEWICZ-GRUHN 1998, KACZMAREK and SZWED 2000]. It is known that every society has its own understanding of the norms regarding the timing of marriage, family formation and childbearing as well as cultural values regarding the role of motherhood, or fitness of parents changing with age. The present study provides some quantitative clues to the understanding of the possible impact of reproductive determinants on menopausal age in Polish women.

There is a general agreement, as far as an average age at menopause is concerned, that menopause occurs at around 50 years of age. However, there are discrepancies in detailed figures. It seems that the methodological background may be an important source of the differences here. As McKinley claims, the majority of investigations are biased by imprecise methodology [MCKINLEY *et al.* 1972]. Many researchers used to draw conclusions on grounds of data collected in medical centers [BALLINGER *et al.* 1987; STANOSZ *et al.* 1993; MIZIA-STEC *et al.* 1998] or in selected groups of women [MARIN *et al.* 1993; PIPLAI 1991]. There

are also discrepancies in the precise definition of menopause. According to the recommendation of the WHO, the postmenopausal status of a woman might be defined as the age at which the last menstrual period occurs, followed with a 12 months' period of amenorrhea. Reviewing literature on the menopause one may find out that there are several researchers who do not follow the WHO's recommendations and use different criteria for the estimation of the age at menopause. The period of amenorrhea, referred to in their works, ranges from 6 months, as for example in LINDQUIST and BENGTTSSON [1980], HOLTE [1992], KULIKOWSKI and TOMASZEWSKA [1995], WARENIK-SZYMANKIEWICZ [1996], to 9 months, as postulated by FROMMER [1964]. KONIAREK and ŻUKOWSKI [1987], in turn, postulate a 10 months' period of amenorrhea to be employed for the estimation of the age at menopause. There are some researchers who ignore the information about the precise definition of menopause [RODZIEWICZ-GRUHN 1998]. Some others, as for example, Neugarten and Kraines [cited after MCKINLEY *et al.* 1972] rely on subjective responses of women and their own understanding of menopause and postmenopausal status. We have to bear in mind that a mean age at menopause is calculated for postmenopausal women, therefore the estimation of the age at menopause is of great importance for both the range of variation in age distribution and the value of the mean age. The methodological bias refers also to statistical procedures such as calculation of the mean age at menopause either retrospectively or with the use of probit analysis. Another source of error lays in reducing the

median age calculated by probit transformation by the period of amenorrhea, thus from the median age at menopause calculated for the sample, a 12 months' period is subtracted [MCKINLEY *et al.* 1972; KONIAREK and ŻUKOWSKI 1987].

As revealed by our data, in women who had used HRT in the perimenopausal period the age at menopause occurred significantly later. Sampling those women together with those who had gone through natural menopause might delay the mean age at menopause and lead to false conclusions. Therefore, in order to investigate the relationship between menopause and reproductive determinants we excluded from our sample all those women who had experienced hormonally controlled menopause. Thus, average age at menopause in our sample, estimated by probits was 50.1 years. Comparative data for Polish women, presented in Table 4, indicate minor discrepancies, which might be caused by differences in the methodologies used. In contrast to the trend towards earlier menarche noted during the last decades in Poland and associated with improved nutrition, health and socioeconomic conditions [MILICER, 1966; ŁASKA-MIERZEJEWSKA *et al.*, 1982; BIELICKI and WELON, 1982], no secular trend has been observed with regard to the age at menopause (see MALINA [1979], JOHNSTON [2001], and Table 4). The absence of a secular trend in the age at menopause could be ex-

plained by the length of the time interval between changes in socioeconomic conditions in childhood and physiological manifestations in adulthood [LEIDY SIEVERT 2001: 430].

Our findings provide quantitative evidence that the majority of the reproductive characteristics selected for the purpose of the present study are not correlated with the age at menopause. Several observers have reported later ages at natural menopause among married or widowed women compared to never married or divorced women [MCKINLEY *et al.* 1972; STANFORD *et al.* 1987]. An earlier menopause in unmarried women was reported by JASZMAN *et al.* [1969], MCKINLEY *et al.* [1972], LEIDY SIEVERT *et al.* [2001]. These are controversial findings, however explanations suggesting an effect of marriage on the age at menopause involving pheromonal influence of a continuing presence of a male in the household [LEIDY SIEVERT *et al.* 2001] are still to be considered. Although attractive, this explanation needs further substantiation. In our sample we did not find any correlation between these factors. Our findings correspond with the results of Medical Women's Federation Research carried out in 1933 (see BENJAMIN [1960] or MACMAHON & WORCESTER [1966]).

It is supposed that childbearing and weaning period might stop the atresion of ovum because of the anovulatory menses, and in this way delay the age at meno-

Table 4. Age at menopause in Polish women according to various authors

Source	N	Place of investigation	Mean age (yrs.)
Bielicki & Welon [1964]	341	Wrocław	49.33
Bocheńska [1978]	564	Radom	50.1
Baron [1968]		Poland	49.2
Koniarek & Żukowski [1987]	1655	Wrocław	49.66
Present data	4354	Wielkopolska, West Poland	50.1

pause. The onset of the childbearing capacity in women can be dated by menarche, the beginning of the menstrual cycles. Although, the age at menarche does not imply an actual fecundity, as the latter is determined by the first ovulation, it is sufficiently well suited for practical purposes. The end of childbearing comes from data on women's menopausal status relative to age, although, by observation, fecundity ceases some time before the menopause [BONGAARTS and POTTER 1983]. Gray estimates the difference between median age of infecundity and median age of menopause to be around 8 years [GRAY 1979].

There are studies postulating that an early age of menarche might lead to a late menopause (for example PARAZINI *et al.* [1992]). In our sample we have found a significant relationship between those variables, however, with the opposite tendency – the earlier the menarche the earlier the menopause. This result does not surprise us since the same was stated by CRAMER *et al.* [1995], TREOLAR [1974], BEAL [1983], REBATO [1988], WHELAN *et al.* [1990].

We have found a statistically significant relationship between the length of the menstrual cycle and the age at menopause. Short menstrual cycles (less than 28 days) are related with earlier menopause, whereas long menstrual cycles with later menopause. This finding corroborates the results obtained by TREOLAR [1981], WHELAN *et al.* [1990], CRAMER *et al.* [1995], *Report...* [1996]. STANFORD *et al.* [1987] found that women whose menses were regular before 25 years of age or before the first pregnancy experienced menopause around 2 years earlier than women whose menstrual cycles were irregular.

Our findings concerning the lack of correlation between the age at first and last pregnancies with the age at menopause are controversial in the light of the reference data. WHELAN *et al.* [1990] noticed that women who at first pregnancy had been younger than 30 years of age experienced earlier menopause. But there are also indications of a lack of relationship between these variables, as found in our sample [STANFORD *et al.* 1987; WALSH 1978; CRAMER *et al.* 1995].

The correlation between parity and menopausal age seems to be equally controversial. It has been suggested that conditions causing long anovulatory periods during reproductive years may be associated with delayed menopause [STANFORD *et al.* 1987; WHELAN *et al.* 1990; PARAZINI *et al.* 1992]. However, results of surveys may cast doubt upon this statement. A consistent relationship between the number of births and earlier menopause was found in some works (findings of the BCDDP Project; cited after PARAZINI *et al.* [1992]). In our sample we did not find a significant relationship between these variables, the same was stated in other studies [BRAND & LEHERT 1978; VANKEEP *et al.* 1979].

Conclusions

Our findings, deriving from the sample, which meets the requirements of sample quality, are conclusive for the controversies concerning the age at menopause and its reproductive determinants and can be summarized in the following statements:

1. Median age at natural menopause in Polish women is 50.1 years.

2. There is a significant correlation between the age at menopause and the age at menarche. The earlier the menarche, the earlier the menopause.

3. There is a significant correlation between the age at menopause and the length of menstrual cycles. The longer the menstrual cycles, the later the age at menopause.

4. Characteristics of female reproduction, such as age at menarche, length of menstrual cycles, age at first and last pregnancy and length of lactation period, interacting in a complex way, account for the range of variability in the age at menopause.

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Streszczenie

Porównanie tempa zmian zdolności rozrodczych kobiet z tempem starzenia się innych cech fizjologicznych, w tym możliwości reprodukcyjnych mężczyzn, ukazuje gwałtowny spadek zdolności rozrodczych aż do całkowitego zakończenia manifestującego się ostatnią miesiączką w życiu kobiety – menopauzą (rys. 1). Zakończenie okresu reprodukcyjnego u kobiet (menopauza) znacznie przed końcem życia jest zjawiskiem unikatowym, nie spotykanym u innych ssaków żyjących w warunkach naturalnych [HILL i HURTADO 1991; PAVELKA i FEDIGAN 1991; AUSTAD 1994]. Teorie dotyczące pochodzenia i utrwalenia się menopauzy klasyfikowane są jako adaptacyjne (hipoteza matki oraz hipoteza babki) lub nieadaptacyjne. Menopauza kończy okres zdolności reprodukcyjnych kobiet, zatem w pracy podejmuje się próbę określenia, czy i w jakim stopniu historia cyklu płciowego oraz aktywność rozrodcza kobiet wpływają na indywidualne zróżnicowanie wieku wystąpienia menopauzy u kobiet.

W pracy analizowano dane ankietowe i antropometryczne 4354 kobiet z Wielkopolski i zachodniej Polski, w wieku 35-65 lat, zebrane podczas badań przekrojowych w latach 1998-2001, w ramach projektu „Biologiczne aspekty starzenia się człowieka”. Lokalizację miejsc badań przedstawia rys. 2. Strukturę demograficzną i społeczno-ekonomiczną badanych kobiet ilustrują rys. 3-4. Zgodnie z wytycznymi WHO [Report... 1981, 1996] wiek menopauzy określono jako wiek ostatniej miesiączki w życiu kobiety, po której następuje 12 miesięczny okres amenorrhea. Wśród badanych kobiet wydzielono grupę kobiet, które stosowały hormonalną terapię zastępczą w celu złagodzenia dolegliwości klimakteryjnych w okresie bezpośrednio poprzedzającym menopauzę. Te kobiety, określone jako przechodzące menopauzę pod kontrolą hormonalną, wydzielono z analiz statystycznych. Kobiety rozdzielono według statusu menopausalnego na następujące grupy: będące przed menopauzą, w trakcie menopauzy i po menopauzie. Status kobiet miesiączkujących w okresie poprzedzającym badanie i w ciągu 3 ostatnich miesięcy określono jako przedmenopausalny. Stanowiły one grupę liczącą 2410 kobiet (55,3% wszystkich badanych). 331 kobiet zanotowało ostatnią w życiu miesiączkę ale od tego momentu do chwili badania nie upłynęło 12 miesięcy. Status tych kobiet określono jako menopausalny. Status 1300 kobiet określono jako po-menopausalny, z czego 1033 kobiety przeszły menopauzę naturalną.

Wyliczono przeciętny wiek menopauzy posługując się metodą retrospektywną i status quo. Wyniki statystyki opisowej oraz transformacji probitowej przedstawiono w tabeli 1. Niezależnie od stosowanej metodyki, wiek menopauzy różnił się istotnie w zależności od charakteru menopauzy. Przeciętny wiek menopauzy naturalnej, oszacowany za pomocą analizy probitowej, wynosi 50,1 lat.

Wyniki analizy wariancji jednokierunkowej, zawarte w tabeli 2 oraz na rys. 5 wskazują, iż wiek menopauzy jest istotnie zróżnicowany ze względu na wiek menarche oraz długość cyklu płciowego. Kobiety wcześniej dojrzewające i mające krótszy cykl płciowy przechodzą menopauzę wcześniej w porównaniu z kobietami, u których menarche wystąpiła późno a cykl płciowy trwał dłużej. Wyniki analizy regresji krokowej z eliminacją wsteczną (tabela 3) pozwoliły wskazać zmienne, które wyjaśniają 3,96% całkowitej zmienności wieku menopauzy i wzajemnie współdziałając jako kompleksowy czynnik są ważne w analizie tego zjawiska. Są to: długość cyklu miesięczkowego, wiek menarche, wiek pierwszej i ostatniej ciąży oraz długość okresów laktacji.

Dane porównawcze na temat przeciętnego wieku menopauzy kobiet polskich zestawiono w tabeli 4. Wskazują one iż przeciętny wiek menopauzy, w przeciwieństwie do wieku menarche, nie wykazuje trendu sekularnego. Źródeł niewielkich różnic w przeciętnym wieku menopauzy należy upatrywać w zastosowanych metodach badań.