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Age at Puberty of Girls and Boys in France

Measurements from a Survey on Adolescent Sexuality

Élise de LA ROCHEBROCHARD*

Little research has been carried out in France on age at puberty. In general terms, of course, female puberty occurs long before first birth, and several years before first intercourse. Although over the last hundred years age at first intercourse has fallen faster than age at menarche, the latter almost always precedes (by more than 5 years on average) first intercourse. However, this change in "biological statute" remains an important stage in the development of both boys and girls. In this paper, Élise de LA ROCHEBROCHARD uses data from the large-scale survey of the sexual behaviour of 15-18 year-olds (ACSJ) to evaluate a number of markers for age at puberty and compares the results with those from international studies.

Puberty has been defined as "the period in which the child becomes an adolescent" (Forrest and Lavoisier, 1991, p.551). This stage is marked by acquisition of reproductive capacity and by the development of secondary sexual characteristics (the word puberty comes from the latin *pubescere* meaning "to become covered in hair"). The changes that lead to sexual maturation extend over a period of four to five years.

In girls, the physiological indicator of puberty is the first menstrual flow, known as menarche. This clearly defined and memorable event is used as an indicator for the study of female puberty. By means of this indicator, a secular fall in age at puberty has been identified for girls in the industrialized countries (Eveleth and Tanner, 1976; Wyshak and Frisch, 1982). The most recent French data show that this long-term historical change was still continuing in 1975 (Ducros and Pasquet, 1978).

Information about age at menarche is often collected retrospectively in surveys on fertility. The assumption made in these surveys is that the

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onset of menstruation is a landmark event in the lives of women and a date that they will never forget. However, retrospective reports are susceptible to recall bias. The size of this bias has been measured by comparing data collected retrospectively with data collected during the puberty of the women. These comparisons have shown that the distortion of memory increases with the number of years since menarche occurred. The coefficient of correlation between the age reported retrospectively and the actual age falls from 0.81 for an interval of 4 years (Bergsten-Brucefors, 1976) to 0.75–0.78 for an interval of 17–19 years – that is for a population of women aged 30 (Livson and McNeill, 1962; Damon *et al.*, 1969) – and falls to 0.60–0.67 when the interval is 40 years, that is for a population of women aged 50 (Damon and Bajema, 1974; Casey *et al.*, 1991). These recall errors are hard to correct since they appear to occur at random. They produce no systematic over- or under-estimation, nor any clustering of the distribution around the median (Livson and McNeill, 1962; Damon *et al.*, 1969).

In boys, the physiological indicator of puberty is the first ejaculation (Forest and Levasseur, 1991, p. 551). However, male puberty is not usually studied from this angle since data on age at first ejaculation is seldom available. Even surveys of sexuality do not systematically collect this information. The problem therefore is to choose an event that is both clearly defined and easily memorable and that can serve as a marker for the study of male puberty. Possible indicators are of two types: indicators of body development (such as height, appearance of body hair, voice change, etc.) and/or indicators of sexual maturation (such as erection, masturbation, first intercourse, etc.).⁽¹⁾ In addition to this methodological problem, the study of male puberty is also handicapped by a shortage of data. Men are less often questioned than women in fertility studies and their life histories are not known in as much detail. These difficulties are one reason for the small number of studies on male puberty.

As part of the survey conducted in France on 15-18 year-olds in 1994, girls were asked about their first menstruation, while boys were asked about their voice change, growth spurt, and first masturbation. This data, collected from a population which had only recently experienced puberty, is used here to answer a number of questions: At what age do young people in France experience puberty? Is the secular fall in age at menarche continuing in France? How should male puberty be measured? Does puberty occur later in boys than in girls?

⁽¹⁾ For example, in an article entitled “Le premier rapport sexuel des adolescents” [“First sexual intercourse of adolescents”] (Bonierbale-Branchéreau *et al.*, 1987), age at first intercourse is taken as an indicator “of psychological and physical maturation” in a population.

I. The survey “Analysis of sexual behaviour of young people”, 1994

The ACSJ (Analyse du Comportement Sexuel des Jeunes) survey that formed a complement to the ACSF (Analyse des Comportements Sexuels en France) survey (Spira *et al.*, 1993) was conducted in France in January-March 1994 (Lagrange *et al.*, 1997) on 6,175 young people in the 1975-1978 generations (Table 1). Sample post-stratification was applied to obtain a representative sample of 15-18 year-olds in the 18 departments of France where the survey was conducted.⁽²⁾ The statistics reported here include the weightings (though the subject numbers are all unweighted).

TABLE 1. – NUMBER OF ACSJ SURVEY RESPONDENTS BY SEX AND GENERATION

Generation	Boys	Girls	Total
1975	1,065	926	1,991
1976	1,252	998	2,250
1977	734	587	1,321
1978	290	323	613
Total	3,341	2,834	6,175

Source: ACSJ survey, 1994.

The ACSJ survey allows us to study the onset of puberty in girls by age at menarche, and in boys by age at voice change, growth spurt and first masturbation. For each of these pubertal events, the respondents were asked if they had experienced it: “already had menstrual flow”, “had a change of voice”, “grown by ten centimetres in a single year in recent years”, “stroked your own genitals for pleasure for the first time”⁽³⁾. Those replying in the affirmative were asked at what age. Table 2 shows the distribution of answers concerning the state of pubertal changes at the time of the survey. Almost all the girls (99.1%) had started menstruating. For the boys, the pubertal changes are harder to identify (voice change and growth spurt) or are more sensitive (because they concern sexual activity, as for first masturbation). Despite this the level of non-response is low: 2.7% for change of voice, 7.2% for the growth spurt, and 2.8% for the first masturbation. A large majority of boys report having had the change of voice (85.0%) and a first masturbation (90.3%). By contrast, only 53.4% of boys report having had a growth spurt in recent years.

⁽²⁾ “The sample was designed to over-represent the zones with a high frequency of AIDS and to increase the weight in the total number of the ‘oldest’ young people and those attending technical training centres. Uniform probability was restored by giving each individual a weight $p1$ which is the inverse of the product of the selection probabilities of the institution and of the individual. This procedure gives a correct representation of the parent population, that is of the 15-18 year-olds in the eighteen departments where the survey was conducted.” (Lagrange *et al.*, 1997, p. 356-7). (Note: metropolitan France is made up of 95 *départements*, or main administrative divisions.)

⁽³⁾ The term masturbation is not actually used but the question is clearly based on the dictionary definition of masturbation: “manual stimulation of one’s own genitals in order to produce sexual pleasure” (Larousse dictionary).

TABLE 2.— DISTRIBUTION OF REPLIES ON THE OCCURRENCE OF PUBERTAL EVENTS AT THE TIME OF THE SURVEY

Pubertal event	Distribution of replies (%)			
	Yes	No	Missing or NS	Total
Girls				
Menarche	99.1	0.6	0.3	100.0
Boys				
Voice change	85.0	12.3	2.7	100.0
Growth spurt	53.4	39.4	7.2	100.0
First masturbation	90.3	6.9	2.8	100.0

Source: ACSJ survey, 1994.

The young people who answered in the affirmative to questions about the occurrence of pubertal changes were then asked about the age at which they had taken place. For menarche, voice change and growth spurt, the age was asked in years and months, while for first masturbation it was asked in years only. The year in which the changes of puberty occurred is almost always known (in over 98% of cases) and there is no a priori reason to suspect that it suffers from any inconsistency. By contrast, information about the month in which the changes took place is missing in over 80% of cases. The difficulty of collecting information about the exact age at menarche, after even a short interval, has already been established: Koo and Rohan (1997) estimated that only 66.1% of young women could remember their exact age (in years and months) at menarche when questioned less than one year after it had taken place (on average 323 days after the first menstruation), and the percentage fell to 44.8% at a distance of around two years (on average 649 days after menarche). For this reason, the timing of puberty of the adolescents in the ACSJ survey was examined by age at last birthday. So as to allow for censoring caused by the date of the survey, particularly for boys, life tables of puberty have been constructed.

II. Female puberty

1. *Distribution of age at menarche*

The life table of menarche is given in Table 3. This distribution is quite tightly clustered: nearly 90% of girls become pubescent between ages 11 and 14, and the median age at menarche is 13.1 years. The interquartile range is about twenty months (1.69 years).⁽⁴⁾ The puberty life table probabilities rise between ages 10 and 15 and reach a very high level: at age 15 the probability of having first menstruation among pre-pubescent

⁽⁴⁾ The first quartile is at 12.28 years, the second at 13.12 years and the third at 13.97 years.

girls is close to 0.8. After age 15, estimation of puberty life table probabilities becomes difficult due to the small number of subjects on which the calculation is based.

TABLE 3.— MENARCHE LIFE TABLE FOR GIRLS, FRENCH POPULATION, 1975-1978 GENERATIONS

Age (years)	Annual puberty rate (per 1,000)	Survival function in pre-pubescent state (per 1,000)	Distribution of pubertal events (per 1,000)
8	0.00	1,000	0
9	4.72	1,000	5
10	34.83	995	35
11	130.39	960	125
12	359.32	835	300
13	550.18	535	294
14	725.93	241	175
15	799.43	66	53
16	(769.21)	13	10
17	(399.43)	3	1
18	(494.55)	2	1
Total	—	—	999

Note: estimation of rates of puberty is made difficult after age 15 by the small numbers observed: 57 girls still pre-pubescent at age 16, 12 at age 17 and 6 at age 18.
Source: ACSJ survey, 1994.

2. Historical evolution of age at puberty of girls

Age at menarche has declined considerably over the last two hundred years. In France, age at first menstruation has fallen by 3 years, from around age 16 in the second half of the eighteenth century to around age 13 in the second half of the twentieth century. Ducros and Pasquet (1978) fit the average ages at menarche observed between 1841 and 1974 with the following regression line equation:

$$\text{Age at menarche} = (-0.0175 \times \text{calendar year}) + 47.4$$

Figure 1 displays this regression line, which is continued as a broken line beyond 1975. The average age at menarche observed in the ACSJ survey for French adolescents of 1994 is 12.6 years⁽⁵⁾; this average is close to the 12.5 years estimated from the model of Ducros and Pasquet (1978).

A similar historical pattern has been observed for all the industrialized countries (Tanner, 1973; Eveleth and Tanner, 1976; Wyshak and Frisch, 1982): in the United States (Wyshak, 1983; Sandler *et al.*, 1984; N.C.H.S., 1973), in Scandinavia (Manniche, 1983; Helm and Helm, 1984; Rosenberg, 1991), in England (Brown, 1966), in Spain (Prado, 1984), in

⁽⁵⁾ Two averages can be calculated: the average age at last birthday (estimated at 12.6 years) and the average age at menarche plus 0.5 years. Ducros and Pasquet (1978) adopted the first solution. We used the same method in order to compare our results with theirs.

Belgium (Wellens *et al.*, 1990), in Greece (Dacou-Voutetakis *et al.*, 1983), in Japan (Takahashi, 1978; Hoshi and Kouchi, 1981; Nakamura *et al.*, 1986), and so forth. The early studies (Eveleth and Tanner, 1976) concluded in favour of a historical change occurring at the same speed and level in all the countries (at least in Europe). However, this hypothesis was later rejected when studies revealed cross-national variations in the level and speed of the fall in age at first menstruation (Wyshak and Frisch, 1982).

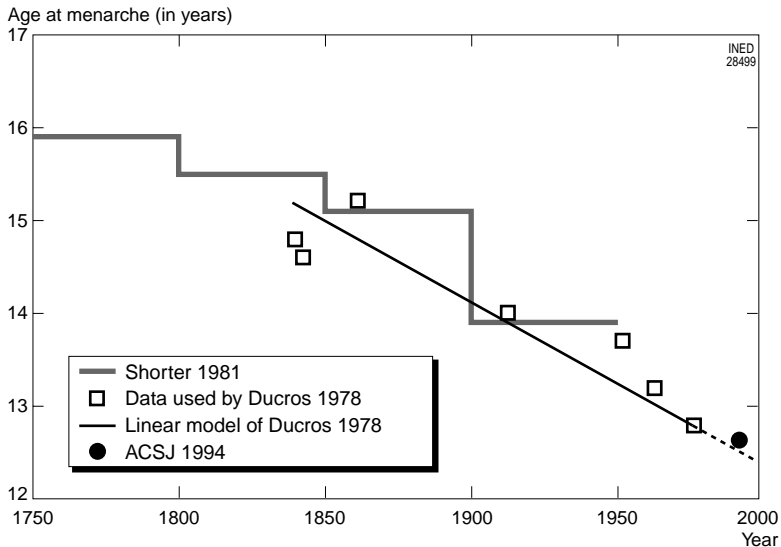


Figure 1.— Secular decline in age at menarche in France between 1750 and 1995

NB: The estimations of age at menarche reported by Ducros and Pasquet (1978) for the period prior to 1970 are based on data from Brierre de Boismont (1841), Raciborski (1844), Soyre (1863), Leudet (1891), Gibert (1913), Campunaud (1919), Leschi (1953), Aubenque (1964). The estimation of age at menarche for 1974 is based on a sample of 3,355 young women aged 17-21, surveyed in six education regions (Strasbourg, Reims, Caen, Rennes, Limoges, Bordeaux). The estimations of age at menarche reported by Shorter (1981) are based on two types of source: (i) observations by doctors, (ii) survey data. The results from these two types of source give estimations that are fairly close and are combined to give an overall average.

It is possible that this secular fall has now stopped, since age at menarche appears to have reached a stable level in several countries: in Scandinavia (Brundtland and Walløe, 1973; Liestøl and Rosenberg, 1995; Helm and Helm, 1984), in England (Tanner, 1973; Roberts and Dann, 1975; Dann and Roberts, 1984, 1993),⁽⁶⁾ in the United States (Zacharias *et al.*,

⁽⁶⁾ Roberts and Dann (1975) and Dann and Roberts (1984, 1993) conclude that the long-term trend of falling age at menarche has not only halted but has actually been reversed, with a slight increase in age at menarche among their two study populations (female students at the universities of Swansea and Warwick).

1976; Sandler *et al.*, 1984), in Belgium (Wellens *et al.*, 1990), in Greece (Dacou-Voutekakis *et al.*, 1983) and in Japan (Hoshni and Kouchi, 1981). In all these countries, age at menarche seems to have stabilized around an average of 13 years with variations of approximately 0.5 years. However, care is needed when interpreting this average (between 12.5 and 13.5 years) since depending on the study the average age given is either the age at last birthday or the mid-class age. Moreover, some authors give the median age rather than the average age (because the distribution of age at menarche is slightly skewed, the median age is usually higher than the average age). For some authors this stabilization around an average of 13 years is evidence of a biological minimum: "It seems clear that a biological minimum age at menarche exists and the distributions of age at menarche in some developed nations are pushing up against this limit" (Becker, 1993, p. 31); "This finding suggests that there may be a biological minimum below which the age at menarche will not fall, perhaps reflecting the close relationship between menarche and overall physical maturation." (Wood, 1994, p. 417).

In France, the question of the stabilization of age at menarche remains a subject for debate. For the year 1974, Ducros and Pasquet (1978) estimated the average age at last birthday during menarche at 12.8 years and concluded that there was no evidence of a halt or slowdown in the trend. This conclusion remains valid: the estimated age at menarche in 1994 (12.6 years) is compatible with the model of a sustained fall in age at menarche between 1840 and 1995 according to a linear model with a slope of -0.0175 . If the trend were to continue on this course, average age at menarche would be 12.4 years in 2000. However, if the trend observed for the other industrialized countries were to spread to France, average age at menarche could be expected to level off in the course of the coming decades.

The historical fall in average age at menarche may be accompanied by a modification in the heterogeneity of this age. Specifically, the hypothesis can be put forward of a reduction in the variability of age at menarche in the populations of the industrialized countries. Few authors have examined this question, and the analysis by Ducros and Pasquet (1978) is valuable in this respect. They fitted nine estimations of the standard deviation between 1841 and 1974 to a linear curve with a slope of -0.00904 . In this model, the standard deviation of age at first menstruation falls from 2.6 years in 1841 to 1.3 years in 1974. It was seen earlier that the distribution of age at menarche estimated for the French generations 1975-1978 was quite clustered (with the onset of puberty concentrated in an interval of about twenty months for 50% of girls). The standard deviation is 1.7 years, which is thus higher than the value estimated for 1994 in the model of linear fall (1.2 years) and the estimation by Ducros and Pasquet for 1974 (1.3 years). According to the Ducros and Pasquet study, the secular decline in age at menarche has been accompanied by a decline in the va-

riability between girls; the data from the ACSJ survey do not provide a basis for concluding that this trend continued in 1994.

Much research has been done to identify the mechanisms of this historical fall in age at menarche. The most generally accepted explanation ascribes the main role to diet (Mosley, 1979). The last one or two hundred years have seen a considerable improvement in the quantity and quality of nutritional intake in the industrialized countries (Montanari, 1995). This improvement has been reflected in particular by an increase in height (Frisch and Revelle, 1969; Brundtland *et al.*, 1980; Biraben, 1982; Floud *et al.*, 1990). Physical and genital maturation are closely related during puberty in adolescent girls (Ellison, 1982); indeed, age at menarche can be predicted from indicators of physical maturation such as height and weight (Onat and Ertem, 1974; Zacharias and Rand, 1983; Foster *et al.*, 1986; Boukhris *et al.*, 1988a, 1988b; Elizondo, 1992).⁽⁷⁾ In addition, the impact of nutrition on age at menarche has been documented for some extreme conditions. For example, the secular decline in menarcheal age was interrupted in Germany during the famine that followed the Second World War (Noord and Kaaks, 1991). In point of fact, pubertal development may be determined less by the quality of nutritional intake than by the energy balance, that is, the correct balance between nutrition and energy expenditure. Studies have found that age at menarche is delayed among adolescents who are well nourished but practice sport at a top level (Malina *et al.*, 1978; Frisch *et al.*, 1980, 1981; Mathur and Toriola, 1982; Malina, 1983; Sharma and Shukla, 1992).

III. Male puberty

1. *Distribution of age at pubertal events in boys*

The voice change life table is given in Table 4. For more than 80% of boys, voice change occurs between 13 and 17 years, the median age being 14.8 years. The puberty probabilities follow a bell-shaped curve, increasing between 8 and 15 years, then decreasing. At age 15, the probability of voice change for pre-pubescent boys is close to 0.5. At their nineteenth birthday, nearly 10% of boys have not yet had the change of voice.

⁽⁷⁾ In the sequence of female puberty, physical maturation precedes menarche (Marshall and Tanner, 1986). This observation has been the basis for many studies attempting to predict age at menarche from indicators of physical maturation in young girls (Tanner, 1962; Marshall and De Limongi, 1976), and in particular from indicators of height (growth spurt) and weight. The existence of this link between physical maturation and onset of menarche led to the formulation in the early 1970s of the hypothesis that reaching a critical body weight was a precondition for puberty (Frisch and Revelle, 1970, 1971; Frisch and MacArthur, 1974). This hypothesis has since been seriously criticized (Johnston *et al.*, 1971, 1975; Billewicz *et al.*, 1976; Cameron, 1976; Trussell, 1978; Ellison, 1982).

TABLE 4. – VOICE CHANGE LIFE TABLE FOR BOYS, FRENCH POPULATION, 1975-1978 GENERATIONS

Age (years)	Annual puberty rate (per 1,000)	Survival function in pre-pubescent state (per 1,000)	Distribution of pubertal events (per 1,000)
8	0.25	1,000	0
9	0.00	1,000	0
10	4.36	1,000	4
11	9.15	996	9
12	57.06	987	56
13	187.85	931	175
14	422.20	756	319
15	537.34	437	235
16	411.88	202	83
17	192.09	119	23
18	32.35	96	3
Total	–	–	907

Source: ACSJ survey, 1994.

The growth spurt life table is given in Table 5. The growth spurt occurs between 12 and 17 years for approximately 60% of boys, the median age being 16.0 years. The puberty probabilities follow a bell-shaped curve, increasing between 9 and 15 years, then decreasing. At age 15, the probability of having a growth spurt for pre-pubescent boys is close to 0.25. At their nineteenth birthday, nearly 40% of boys have not yet had the growth spurt.

TABLE 5. – GROWTH SPURT LIFE TABLE FOR BOYS, FRENCH POPULATION, 1975-1978 GENERATIONS

Age (years)	Annual puberty rate (per 1,000)	Survival function in pre-pubescent state (per 1,000)	Distribution of pubertal events (per 1,000)
8	0.00	1,000	0
9	0.61	1,000	1
10	5.85	999	6
11	7.41	993	7
12	35.63	986	35
13	90.99	951	87
14	231.05	864	200
15	247.72	664	165
16	165.80	499	83
17	56.09	416	23
18	15.86	393	6
Total	–	–	613

Source: ACSJ survey, 1994.

The first masturbation life table is given in Table 6. The first masturbation may take place from the age of 2. It occurs between 12 and 15 years

for approximately 75% of boys, the median age being 14.2 years. After 6 years, the puberty probabilities follow a bell-shaped curve: increasing between 6 and 15 years, then decreasing. At age 15, the probability of masturbating for the first time among the pre-pubescent boys (that is among the boys who have never fondled themselves) is close to 0.5. At their nineteenth birthday, 6% of boys have never masturbated.

TABLE 6.— FIRST MASTURBATION LIFE TABLE FOR BOYS, FRENCH POPULATION, 1975-1978 GENERATIONS

Age (years)	Annual puberty rate (per 1,000)	Survival function in pre-pubescent state (per 1,000)	Distribution of pubertal events (per 1,000)
1	0.00	1,000	0
2	0.26	1,000	0
3	0.00	1,000	0
4	3.28	1,000	3
5	2.15	997	2
6	1.99	995	2
7	2.76	993	3
8	7.26	990	7
9	5.88	983	6
10	28.08	977	27
11	45.81	950	43
12	152.51	907	138
13	285.44	769	219
14	441.06	550	242
15	463.98	308	142
16	402.54	166	66
17	297.09	100	29
18	154.81	71	11
Total	—	—	940

Source: ACSJ survey, 1994.

2. What population for the study of male puberty?

The initiation of male puberty is relatively late and the tail of the distribution of pubertal events could not be observed with the ACSJ survey. At the time of their nineteenth birthday, 6% of boys have never masturbated, 10% have not had the voice change and 40% have not yet had the growth spurt. *A priori* it would appear that the study of male puberty has to be extended beyond the nineteenth birthday.

In a retrospective American survey (Kinsey et al., 1948) in which men were questioned about their pubertal development,⁽⁸⁾ the interval of

⁽⁸⁾ Five pubertal events were reported (Kinsey *et al.*, 1948, p. 184, table 35): appearance of genital hair (between 9 and 20 years), first ejaculation (between 8 and 24 years), voice change (between 10 and 24 years), growth spurt (between 8 and 20 years), end of growth (between 10 and 25 years).

variation of the reported ages went from 8 to 25 years, which is seven years more than in ACSJ. Similarly, on the basis of data from Tanner (1962) and from Roche and Davila (1972), Malina (1974) concludes that the study of male puberty should examine men aged between 10 and 22 or 23 years.

The study of male puberty appears therefore to require working with a quite large age interval: from 10 to 22 or 25 years. However, this initial explanation may be incomplete, and analysis of puberty probabilities can be used to suggest other hypotheses to explain the size of the censoring observed for voice change and growth spurt in the ACSJ survey.

3. *Voice change versus growth spurt as indicator of male puberty?*

Change in the annual puberty probabilities for voice change and growth spurt follows an identical monotonic relation, increasing up to 15 years and declining thereafter (Figure 2). An effect of symmetry is observed, especially for the voice change probabilities, between 12 and 18 years in relation to the maximum reached at 15 years. At 18 years these are very low, respectively 3.2% and 1.6%. Consequently the probability of the occurrence of these pubertal events tends to zero although 10% of boys have not yet had the voice change and 40% have not had the growth spurt.

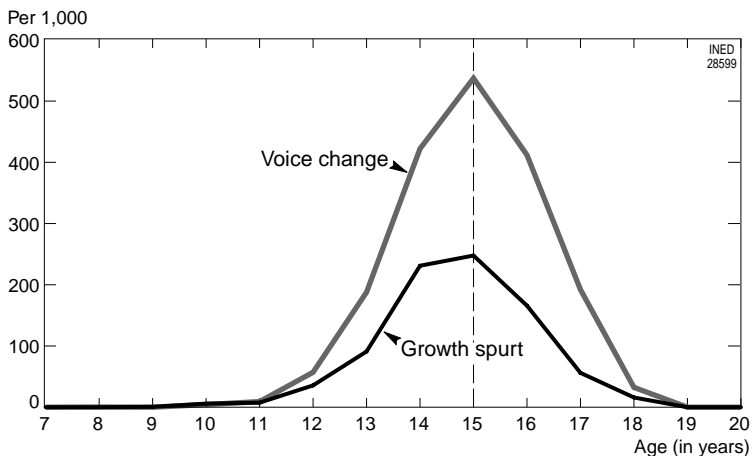


Figure 2.— Annual life table probabilities of pubertal development in boys (voice change and growth spurt), French population, 1975-1978 generations

Source: ACSJ survey, 1994.

Are we to conclude from this that some adolescent boys will never experience voice change or a growth spurt? An alternative explanation is to be sought in the quality of the data: the degree of censoring observed could result from under-reporting of these events by the boys in the ACSJ survey. In particular, the assumption can be made that the growth spurt is subject to under-reporting. The adolescents were asked the following question: “Have you ever grown by 10 cm in a single year, in recent years?”. Presented with such a precise question, the adolescents may have under-estimated their growth. The voice change is certainly easier to identify than the growth spurt, which is defined in terms of both a temporal period during which growth occurs (in the ACSJ: 1 year) and by a size threshold that defines the notion of growth spurt (in the ACSJ: 10 cm). Because voice change occurs earlier and/or because it is less subject to under-reporting than the growth spurt, it is a better indicator of male puberty in the ACSJ survey.

According to the answers of boys interviewed in the ACSJ survey, 59% experienced voice change before the growth spurt, 18% had the growth spurt before the voice change, and 23% experienced both in the same year.⁽⁹⁾ But this apparent precocity of voice change could be linked

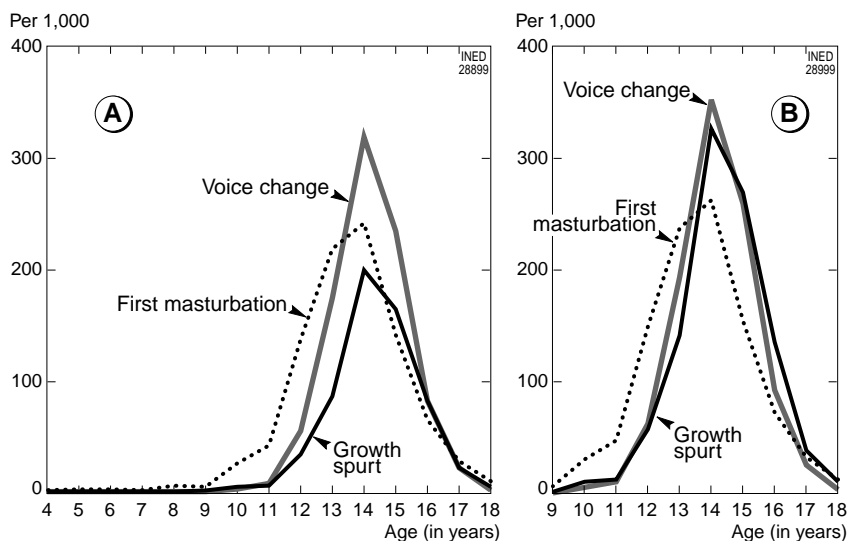


Figure 3.— Distribution of ages at puberty in boys, French population, 1975-1978 generations

A: distribution of events with censoring at 19th birthday.
 B: distribution of events having occurred between 9th and 19th birthdays.
 Source: ACSJ survey, 1994.

⁽⁹⁾ These percentages relate to the 2,969 boys who replied “yes” or “no” to the questions about the occurrence of the voice change and growth spurt.

to the censoring which is an obstacle to estimation of the growth spurt. Thus when the two distributions are estimated for the events occurring before the nineteenth birthday, they become quite similar (Figure 3). In addition, of boys who have experienced both voice change and growth spurt in recent years ($n = 1,419$), 42.7% reported that these two events occurred at the same age, and 83.2% reported identical ages to within ± 1 year (Figure 4a). The hypothesis can therefore be made that the growth spurt and voice change occur close together in boys. *Voice change can thus provide a general indicator of physical maturation in boys*, with growth spurt providing a redundant information.

In order to assess the quality of the voice change life table (Table 4) the distribution estimated in ACSJ was compared with that from another survey. Kinsey *et al.* (1948) contains a distribution of age at voice change in the American population for the period 1900-1940.⁽¹⁰⁾ The two distributions are displayed on Figure 5a; they show the American boys of 1900-1940 to have reached puberty earlier than their French counterparts of 1994. The disparity between these two distributions could be due in part to the type of information collected: whereas Kinsey *et al.* (1948) asked for the age at the start of the period of voice change, no such detail is given in the ACSJ. The voice change actually extends over a period of 12 to 18 months and the difference between the American and French estimations is between 7 and 10 months. Subjecting the American distribution to a translation of + 0.7 years (+ 8.4 months) (Figure 5b) results in two distributions having strong similarities. However, they differ in two respects: first, the mode of the French distribution is higher; second, the American and French distributions diverge after age 16, with the number of voice changes being higher for the Americans than for the French. This second difference is explained by the fact that in the distribution observed by Kinsey, 100% of the boys experience voice change, whereas in the French table only 90% of boys have experienced voice change at the time of their nineteenth birthday. The hypothesis put forward earlier of an under-estimation of life table probabilities of age at voice change is thus supported by this comparison and can be made more precise: the probabilities of age at voice change calculated using the ACSJ survey would appear to be under-estimated at 17-18 years. However, up to 16 years the two sources produce very close results.

⁽¹⁰⁾ The survey by Kinsey *et al.* (1948) was conducted in the United States (and particularly in the northern states) between 1938 and 1947: age at voice change was collected retrospectively for 2,279 men (Kinsey *et al.*, 1948, p. 184, table 35).

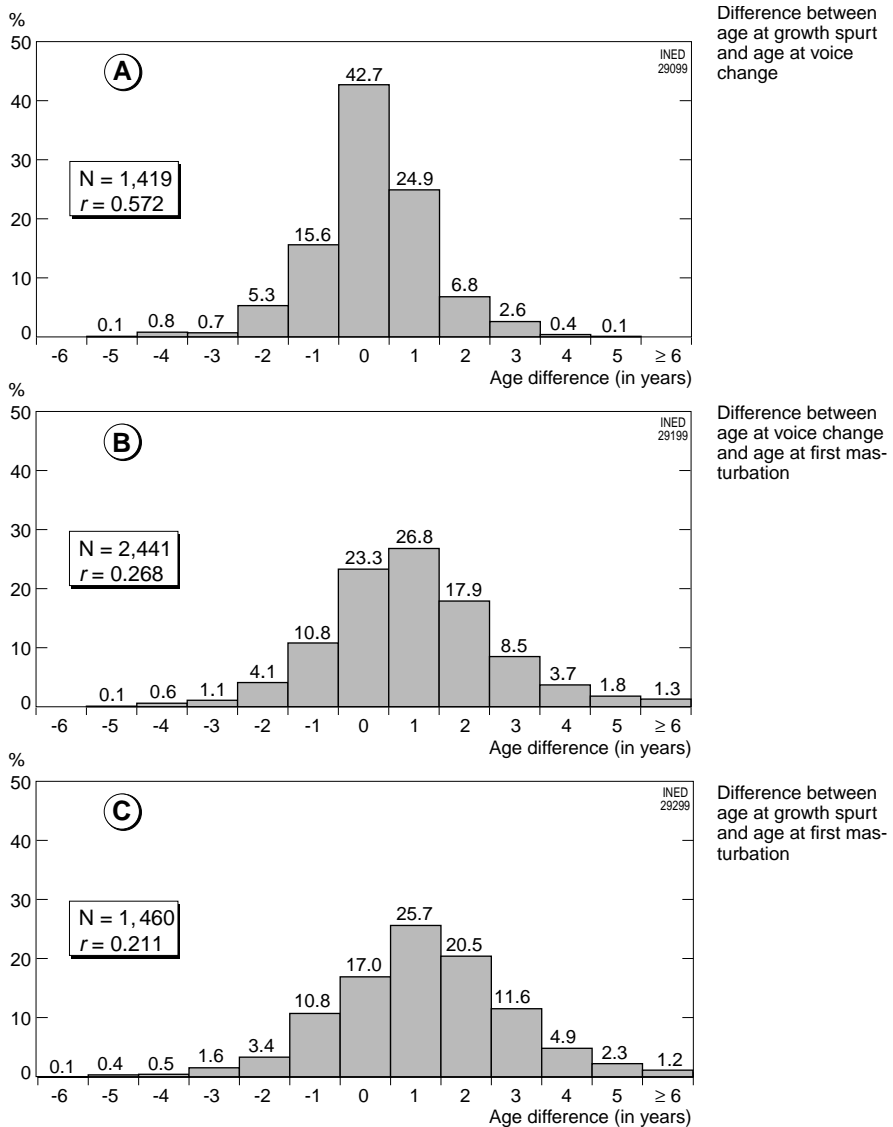


Figure 4.— Distribution of differences in age between the occurrence of pubertal events in boys, French population, 1975-1978 generations

Notes: The distributions are estimated in the population of boys having experienced both events (the size of these sub-populations is indicated on the left of each diagram). The age difference is calculated from the ages at last birthday and is expressed in years. r is Pearson's correlation coefficient.

Source: ACSJ survey, 1994.

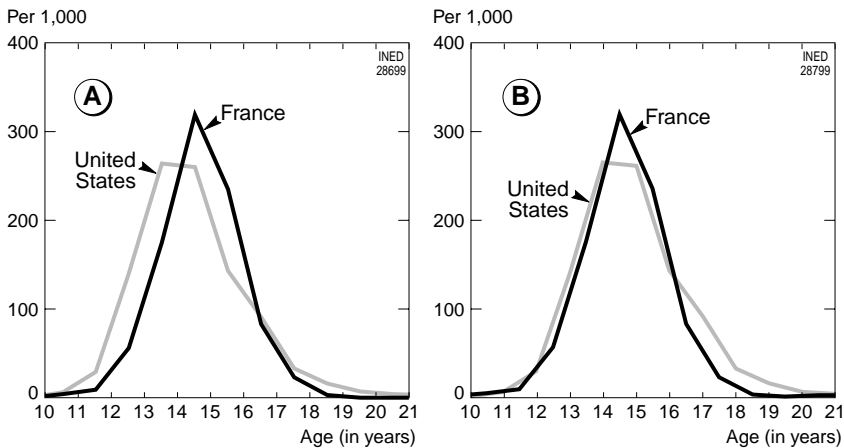


Figure 5.— Distribution of ages at voice change of Americans in 1900-1940 and French youth in 1994

A. observed distributions.

B. American distribution translated by + 8.4 months.

Sources: France, ACSJ survey, 1994; United States 1900-1940, Kinsey *et al.*, 1948.

4. *First masturbation as an indicator of puberty in boys?*

A third indicator of male puberty available in the ACSJ survey is age at first masturbation. In the life table of first masturbation (Table 6), the censoring at the nineteenth birthday (6% of individuals) is almost half that observed for voice change (10% of individuals). In addition, the puberty probability at 18 years is almost five times higher when based on first masturbation (155 per 1,000) than when based on voice change (32 per 1,000). Age at first masturbation would thus appear to be free of the problems of censoring and under-reporting noted for voice change and growth spurt.

However, use of age at first masturbation as an indicator of male puberty presents other problems. Our discussion will be structured around three themes: the confusion between infant and pubertal masturbation; the validity of masturbation for measuring puberty; the extent of prejudice and its implications for the study of masturbation.

—One limitation of the “first masturbation” indicator emerges from an examination of the range of reported ages. Four boys reported having masturbated for the first time at age 2, 10 at age 4, 6 at age 5, and so on. Masturbation that occurs at these young ages cannot be treated as an indicator of puberty. Between birth and full maturity, sexual expression is usually divided into five phases (Virag, 1997, pp. 192-3, Figure 4.1): the *oral stage* (from 0 to 18 months) characterized by the sucking reflex; the

anal stage (from 18 months to 3 years) characterized by control of the anal function; the *phallic phase* (from 3 to 5 years) characterized by discovery of his penis by the boy (and of its absence by the girl); the *phase of sexual latency* (from 5 years to puberty) characterized by pre-pubescent sexual awakening, curiosity about the bodies of the parents and of the opposite sex and by auto-eroticism; and lastly the *pubertal phase* characterized by masturbation and the first orgasm. Masturbation can be associated erroneously with the child's discovery of the penis or with auto-eroticism. For example, in an American survey involving 1,482 parents of children aged 3 to 11 (Gagnon, 1985), 47.0% of mothers and 29.8% of fathers thought their sons masturbated. Clearly the notion of masturbation must be defined carefully. In an American study carried out on 1,073 students, the questions examined, first, pre-adolescent masturbation, and second, adolescent masturbation, the latter being defined by the pursuit of orgasm (Green, 1985). The ACSJ questionnaire adopted the same approach since it specified: "you fondle your genitals *to give yourself pleasure*". However, infantile masturbation was reported in the ACSJ and it has to be asked from what age can masturbation be used as an indicator of puberty: From age 6 (the age at which 11 boys reported having masturbated for the first time)? From age 7 (as reported by 12 boys)? From age 8 (as reported by 37 boys)?

—J. Richard Udry *et al.* (1985) conducted a study on 102 American adolescents with a view to distinguishing the "hormonal" and "social" components in the sexual behaviour motivation of adolescent boys at puberty. They concluded in favour of a dominant effect for the hormonal factor. Research along these lines suggests the value of indicators of sexual maturity for measuring pubertal development. Within this perspective, age at first masturbation appears as a possible indicator, and Hugues Lagrange has suggested that "in boys, age at first masturbation is closely related to pubertal change, so that the precocity of masturbation appears to be a response to the pressure exerted on the psyche by pubertal change" (Lagrange, 1997, p. 77). It may also be that masturbation plays a preponderant role in the sexual maturity of the adolescent male by enabling him to get his first ejaculations. In the American survey carried out in 1938-1947 (Kinsey *et al.*, 1948), the first ejaculation was obtained by masturbation in 68% of cases.

In order to assess the quality of the "first masturbation" variable as a general indicator of male puberty we have tested for a correlation between timing of first masturbation and of physical maturation. To do this we began by examining the sequence of pubertal events. For 52% of boys, the first event in the sequence is masturbation, compared with 23% whose puberty begins with voice change or growth spurt;⁽¹¹⁾ for the remaining 25%, the start of puberty is marked by first masturbation plus one of the other two pubertal events (voice change or growth spurt) at the same time. First masturbation thus appears to be the earliest event in male pubertal

development. However, two biases could account for this chronology. First, the voice change and growth spurt may be under-estimated (see previous section); second, the first masturbation reported by some boys was infantile rather than pubertal. In order to compare the pubertal events while controlling for these possible biases, distributions of voice change, growth spurt and first masturbation, between ages 9 and 18 were calculated and are shown on Figure 3b. The distribution of first masturbation appears set off to the left in relation to the distributions of voice change and growth spurt. At the time of their thirteenth birthday, 8% of boys have had the voice change and the same proportion have had a growth spurt whereas 23% have masturbated for the first time. Another difference is that the mode for first masturbation is much less clear than the other two distributions. At age 14, 35% of boys experience voice change, 33% have a growth spurt, compared with 26% who masturbate for the first time. Of the boys who have had voice change and first masturbation (Figure 4b), no strong correlation is observed in the timing of these events: the Pearson correlation coefficient between the two ages is 0.268. The distribution of age differences between voice change and first masturbation is fairly widely scattered: 87.3% of subjects are situated in an interval of variation ranging from -1 year to +3 years, and this distribution has no clearly identifiable mode. Characteristics identical to these are observed for the population of boys who have had a growth spurt and have masturbated (Figure 4c): the distribution is fairly dispersed (85.8% of boys have an age difference of between -1 and +3 years at the time of these two events) and there is no clear mode. These findings all point to *the lack of any clear correlation between first masturbation and physical maturation*. First masturbation appears to be governed by its own determinants, resulting in a greater heterogeneity between boys than for physical maturation.

—The third limitation that must be examined concerns the role of prejudice. Masturbation is the subject of numerous superstitions, and has been blamed, variously, for causing deafness, blindness, insanity, physical wasting, gastric upsets, epilepsy, neurasthenia⁽¹²⁾, impotence, sterility, homosexuality, tuberculosis, and even death (Hare, 1962; Shen, 1982, pp. 92, 96; Laumann *et al.*, 1994). Christian culture has contributed greatly to the development of these superstitions. “Since the High Middle Ages, confessors denounced masturbation in Christian society. In 1585, Benedicti claimed that most young people of both sexes were addicted to this filthy sin” (Flandrin, 1975, p. 161). It must be noted in particular that the term

(11) These percentages relate to 2,802 boys of the 3,341 surveyed in ACSJ. The other 539 individuals were excluded for three reasons: 450 because their puberty status was not known for at least one of the three events (Table 2); 55 because they had experienced at least two pubertal events and that their age at one of the pubertal events at least was missing, with the result that it was impossible to establish the order in which the different events had occurred; and 34 boys because they had not experienced any of the three pubertal events.

(12) Neurasthenia is a neurotic state characterized by excessive fatigability, mental disorders (anxiety, insomnia), as well as disorders of the cardiovascular, digestive, sexual and endocrine systems, and various pains (headaches, aching limbs, etc.).

“onanism”, used as a synonym for masturbation, was invented by reference to a biblical figure, Onan (Genesis 38)⁽¹³⁾, whose premature death was considered to be a divine punishment. Condemned by the church on moral grounds (Flandrin, 1981, pp. 296-299), masturbation was later condemned for “medical” reasons:

“An English moralist by the name of Bekker seems to have been the first, around 1710, to have added medical arguments to the moral arguments against masturbation. His book, entitled *Onania, or the Heinous sin of Self Pollution, and all its frightful consequences in both sexes considered with Spiritual and Physical Advice to those who have already injur'd themselves by this abominable Practise*, had an enormous success: twelve editions by 1727, and many subsequent editions. And between editions the book was swelled with new letters from repentant sinners who sought to thank the author and help to save their fellow men by reporting further examples – each more ghastly than the previous – of the ills likely to strike down masturbators. When in 1760, the famous Dr Tissot wrote the first of a long series of medical books on the subject, he was merely giving scientific backing to a superstition that had developed spontaneously” (Flandrin, 1981, p. 298).

The belief that masturbation was a serious illness leading “inexorably to madness and death” spread rapidly in France in the second half of the eighteenth century and the first half of the nineteenth century (Flandrin, 1975, p. 160). During this period, official medical opinion held that masturbation was a major and common cause of insanity (Hare, 1962).⁽¹⁴⁾ This medical theory was quickly abandoned between 1885 and 1900 for a new doctrine which stayed in favour for forty years and according to which masturbation was a cause of neuroses (Hare, 1962, pp. 12-15). Although from a medical standpoint, all these ideas are now obsolete, they can still have an influence on some adolescents and inhibit their impulses. Questions must therefore be asked about the quality of the answers supplied by adolescents.

The socio-cultural limitations of this indicator are revealed by a study carried out on 163 Chinese students (Liu, 1997): 62% of respondents reported having never masturbated (and they had never had sexual relations either), 20% refused to answer and just 18% reported masturbating. Of the latter, 25% (7/29) were concerned about the consequences of their actions for their health. In a study conducted in Hamburg in 1970 on ado-

(13) Onan’s “crime” was in fact coitus interruptus, but the term “onanism” is used to refer to masturbation. “The story of Judah and Tamar” (Genesis, 38): “And Judah took a wife for Er his firstborn, whose name was Tamar. And Er, Judah’s firstborn, was wicked in the sight of the Lord; and the Lord slew him. And Judah said unto Onan, ‘Go in unto thy brother’s wife, and marry her, and raise up seed to thy brother’. And Onan knew that the seed should not be his; and it came to pass, when he went in unto his brother’s wife, that he spilled it on the ground, lest that he should give seed to his brother. And the thing which he did displeased the Lord: wherefore he slew him also”. It is worth pointing out that for the ancient Hebrews, as for other eastern populations (Hittites, Assyrians), the brother of a dead man who had no children was obliged to marry the dead man’s widow in order to perpetuate the line. This is the law of the “levirate” (so called from the Latin *levir* “brother-in-law”). The firstborn son of a leviratic marriage was recognized as the dead man’s son and heir. (From R. de Vaux, *op. cit.*, eds. du Cerf, 1951).

(14) E. H. Hare (1962) has studied the history of the acceptance and subsequent rejection of this idea among the medical profession.

lescents aged 16-17 years, 40% expressed unease about masturbation, leading the study's authors to conclude that "The myth of 'excessive' masturbation still exists" (Sigusch and Schmidt, 1973, pp. 109-111). Despite their reservations, 93% of the German boys had already masturbated, and of these, 15% feared that it might be harmful to their health. Two other studies allow us to assess the attitude of French adolescents to masturbation. In the first, 386 young Parisians of both sexes aged 16-18 were asked: "What is your view of masturbation?". 7% of the adolescents answered that masturbation was "harmful", whereas 32% considered it "part of normal behaviour" (Werebe and Reinert, 1983). In a second study, conducted on 266 arts and science undergraduates at the Université de Provence-Aix-Marseille II, 10% of boys and 13% of girls considered masturbation to be an "abnormal" act (Bonierbale-Branchereau *et al.*, 1987). Overall, therefore, it can be estimated that 10% of French adolescents have a real prejudice against masturbation. Religion may be a key factor in this opinion (Werebe and Reinert, 1983).

5. Conclusions on measurement of male puberty

In contrast to female puberty, little research has been done on male puberty. Using the results from the ACSJ survey, we have examined the question of male puberty measurement. Is a study population of adolescents aged 15 to 18 appropriate? Which indicator(s) among voice change, growth spurt and first masturbation provide(s) a good measure of puberty in boys?

The study of male puberty may require observation of a fairly long age interval, from 10 to 22 or 25 years. However, the large censoring observed for voice change and growth spurt in the ACSJ survey may also be explained by under-reporting of pubertal events, particularly at 17 and 18 years. Under both of these hypotheses, voice change is better than growth spurt as an indicator of the onset of male puberty, since it occurs earlier and/or is less subject to under-reporting. In addition, the voice change life table constructed from the ACSJ results is consistent with the results of the study by Kinsey *et al.* (1948). What conclusion can be reached concerning first masturbation? For the majority of boys, first masturbation precedes physical maturation, characterized by voice change and the growth spurt which occur fairly close together. The distribution of first masturbation has very different characteristics to the distributions of physical maturation: the timing of first masturbation does not have the same determinants as the timing of voice change and growth spurt. Reporting of first masturbation is probably determined in part by socio-cultural parameters (the impact of prejudice in particular has been discussed). On balance, the conclusion is that of the three indicators proposed for measuring puberty in boys, voice change appears to be the most satisfactory.

6. Which hypotheses for a possible historical change in age at male puberty?

Age at male puberty may well have declined in the course of the last two centuries. A link is observed in boys between pubertal development and nutrition, like that observed for girls (Frisch and Revelle, 1969; Brown *et al.*, 1996a, 1996b). Boys having benefited in the same way as girls from the improvement in nutrition, a historical decline in age at puberty may also have occurred for boys.

For recent decades, however, the opposite hypothesis of an increase in age at male puberty also has to be considered. Epidemiologists are currently examining the hypothesis of a change in the working of the male reproductive system over the last fifty years in the industrialized countries. This research has identified a number of changes: decline in the quantity and quality of semen, increase in testicular cancer, increase in anomalies of the male reproductive system – for example, non-descent of testicles into scrotum after birth (cryptorchism) or non-closure of urethra (hypospadias) (Skakkebak *et al.*, 1998; Auger, 1997; Mouzon *et al.*, 1996; Jégou, 1996; Bujan *et al.*, 1996; Spira *et al.*, 1995; Cohen, 1995; Adami, 1994; Sharpe and Skakkebak, 1993; Carlsen *et al.*, 1992, 1995). This research raises the broader question of possible modifications in male reproductive characteristics; and it is in this context that the hypothesis of an increase in age at puberty may be considered.

Mention was made earlier of the lack of research on male puberty, and one consequence of this is to limit the scope for comparisons across time and between countries. It was seen (Figure 5a) that the Americans observed over the period 1900-1940 had experienced voice change earlier (median age 14.2 years) than French males in 1994 (median age 14.8 years). Likewise, the median age at voice change was estimated at 14.0 years in a prospective study on 36 American adolescents in 1969-1974 (Lee, 1980). However, the precocity of the American adolescents interviewed before 1975 compared with their French counterparts questioned in 1994 may be related to the type of information collected, since the two American studies asked specifically for the age when voice change started.

IV. Is puberty later in boys than in girls?

The idea that puberty occurs later in boys than in girls is generally accepted. In the American textbook *Focus on Health*, for example, we read: “This process [puberty in boys] takes place about 2 years later than in young females” (Hahn and Payne, 1999, p. 312). What is the value of this statement in view of the ACSJ data?

Male and female puberty are compared here using the age distributions of first menstruation and of voice change (which, as we have seen, is the best indicator for measuring male puberty). Voice change in boys is about twenty months later than menarche in girls: there is a difference of 20.2 months between the two median ages (Figure 6a), and of 18.4 months between the median ages of the distributions providing that the pubertal events have occurred before the nineteenth birthday (Figure 6b); this result is thus unrelated to the censoring observed for voice change.⁽¹⁵⁾ The disparity between the two median ages is thus close to the two years mentioned in the American textbook (Hahn and Payne, 1999, p. 312). To identify the source of this disparity, the intensities with which the pubertal events occur have been compared using the probabilities from Table 3 for menarche and from Table 4 for voice change. The earliest first menstruations occur one year before the earliest voice changes (first probabilities at 4-5 per 1,000 at 9 years for girls and at 10 years for boys). The probabilities for both menarche and voice change increase up to 15 years, though at every age the former are appreciably higher: for example, the menarche probability at 15 years is 1.5 times higher than that of voice change at 15 years. Female and male puberty thus differ by their intensity, that of menarche being higher. After age 15, almost all girls are pubescent and the estimated menarche probabilities become largely meaningless; for voice change, the probabilities fall after age 15. From observation of first menstruation and voice change, *female puberty thus occurs earlier than male puberty*, and this precocity is related primarily to a faster progression of puberty in girls than in boys.

However, comparison of male and female puberty is difficult given that two different processes are involved (Theintz, 1997). The sequence of the different stages of male and female puberty was analyzed for an English population by Marshall and Tanner (1969, 1970)⁽¹⁶⁾, and this study has often served as a model to describe the stages of puberty in works by both English (Wood, 1994) and French researchers (Forest and Lévassieur, 1991). The main stages of pubertal development for an “average” adolescent in the industrialized countries are shown in Figure 7: menarche takes place at 13 years, two years after the start of female puberty (11 years); voice change starts around 13.5 years, two years after the start of male puberty (11.5 years). In this respect, menarche and voice change are comparable, but it must be remembered that whereas menarche is a specific event occurring at a precise point in time, voice change extends over 12 to 18 months. Other comparisons of male and female puberty have been made, in particular based on the one event that is common to both, the growth spurt, which occurs on average two years later in boys (Marshall and Tan-

⁽¹⁵⁾ It has been seen that this censoring is most likely related to an under-estimation of the frequency of voice change between 16 and 18 years.

⁽¹⁶⁾ Marshall and Tanner's study was based on data from the *Harpden Growth Study*, a prospective survey carried out in England between 1950 and 1970. This multi-round survey (every 3 months) collected information on the pubertal development of 228 boys and 192 girls.

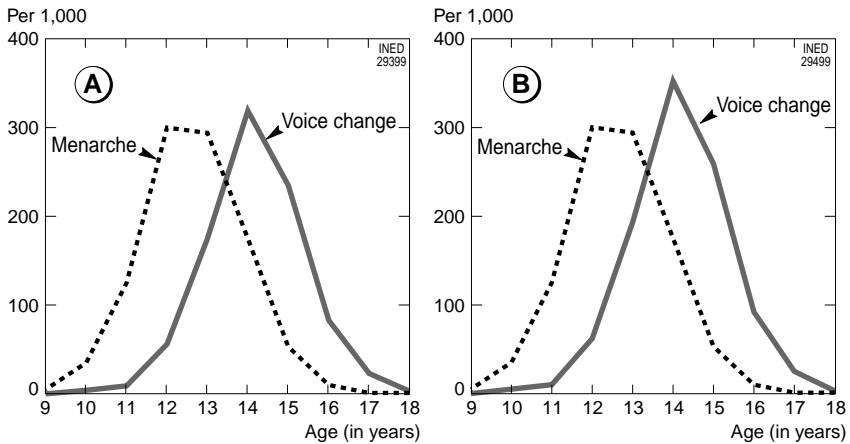


Figure 6.– Distributions of ages at puberty for boys and girls, French population, 1975-1978 generations

A. distribution of events with censoring at 19th birthday.
 B. distribution of events having occurred before 19th birthday.
 Source: ACSJ survey, 1994.

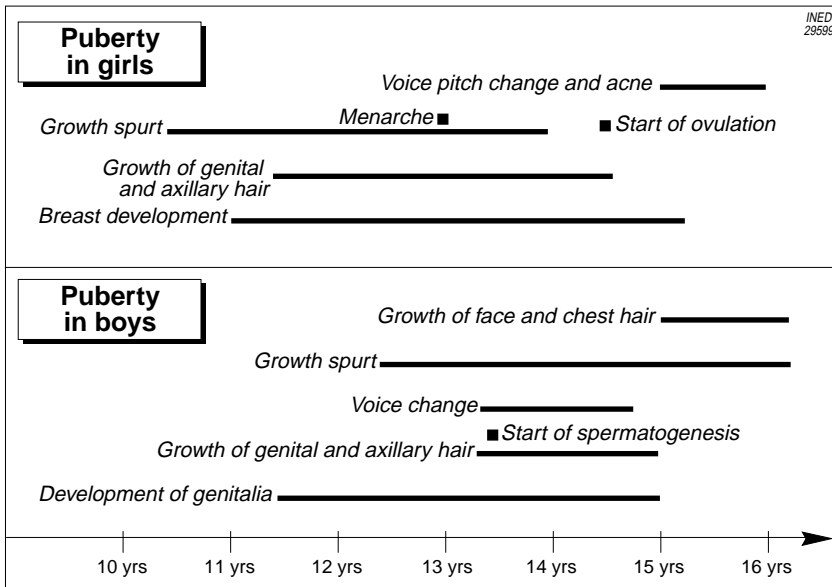


Figure 7.– Stages in male and female puberty

N.B.: this type of diagram was first presented by Tanner (1962) and was subsequently used and developed by Marshall and Tanner (1970, p. 22, Fig. 8) and by Wood (1994, p. 426, Fig. 9.4). Construction of our diagram is based on these sources, and also incorporates the remarks by Forest and Levasseur (1991, pp. 551-557). These remarks draw in particular on the works of Forest. The stages of puberty are given for an 'average' adolescent in the industrialized countries.

ner, 1970; Tanner *et al.*, 1976). However, the growth spurt occurs in the early stages of female puberty but in the late stages of male puberty, so the comparison between them is of questionable value.

Taken as a whole, male pubertal development seems to be later than female pubertal development. Yet boys can acquire reproductive capacity before girls. Spermatozoa production (spermarche) occurs at an early point in their pubertal development, shortly after the thirteenth birthday (Hirsch *et al.*, 1985), whereas production of ovules begins at a very late stage of female puberty, several months after the first menstruation (menarche taking place around 13 years). Moreover, during the first 5-7 years after menarche the female reproductive system functions in an erratic way, reflected in the extreme variation in the length of the menstrual cycle (Matsumoto *et al.*, 1963; Tréolar *et al.*, 1967; Vollman, 1977; Billewicz *et al.*, 1980) and in a high proportion of anovulatory cycles (Vollman, 1966, 1977; MacMahon *et al.*, 1982; Apter and Vihko, 1983; Metcalf *et al.*, 1983; Borsos *et al.*, 1986). This erratic functioning of the female reproductive system can continue up to the age of twenty. This is referred to as adolescent subfecundity and even "adolescent sterility" (Montagu, 1946). A period of subfecundity can also be postulated for boys but is hard to establish since it implies studying the characteristics of semen during the years after spermarche. However, two studies do lend support to this hypothesis. By observation of 134 Polish adolescents, Janczewski and Bablok (1985a, 1985b, 1985c, 1985d) were able to demonstrate the absence of spermatozoon (azoospermia) in the early ejaculates. The first spermatozoa appear after five months though their morphology and mobility are abnormal. The semen characteristics gradually improve over time and have become normal two years after the first ejaculation, at around 17 years (when the external genital organs have reached adult size). Marson *et al.* (1991) identified a change in semen quality (low numbers and reduced mobility and viability of spermatozoa) in the months after spermarche in chimpanzees – this animal was chosen because it is the primate which most resembles man in terms of pubertal development. The authors conclude from this that in humans, boys are probably infertile up to the age of 15 years.

Conclusion

First menstruation is a good indicator of female puberty. A secular fall in age at menarche has taken place in the industrialized countries since the second half of the eighteenth century, and in France this fall appears to have continued at a constant tempo since 1850. However, a stabilization of menarcheal age has been observed in several industrialized countries, and the French downward trend could also be halted. This hypothesis will have to be tested over the coming decades.

Male puberty is more difficult to study. Among the possible indicators of male puberty, that of voice change is potentially interesting and

merits further exploration. In particular, it would be useful to examine the quality of the answers reported by men in function of the length of time since the event. Such an approach requires defining accurately the age asked for; it could be the age at the start of the voice change (the first breaking of the voice, for example). With a more systematic measure of male puberty the question of historical change could be addressed. More generally, the value of collecting data on male reproductive characteristics in fertility surveys is increasingly clear, given the epidemiological hypotheses about negative changes affecting male fecundity in the last fifty years.

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LA ROCHEBROCHARD Élise de. – Age at Puberty of Girls and Boys in France. Measurements from a Survey on Adolescent Sexuality

Life tables of male and female puberty were constructed using the Analysis of Sexual Behaviour of Young People (ACSJ) survey conducted in France in 1994 on the 1975-1978 generations, at that time aged between 15 and 18.

Puberty in girls is identified by the onset of menstruation, at a median age of 13.1. Using this indicator, a long-term decline in age at puberty has been established for the developed countries as a whole. This historical change seems to be continuing in France though it has stabilized in several countries.

Puberty in boys is harder to identify and there is continuing debate over the choice of a suitable indicator. Using the ACSJ survey, three possible indicators can be suggested: the breaking of the voice (median age 14.8), the maximum growth rate (median age 16) and the first masturbation (median age 14.2). Of these three indicators, the breaking of the voice appears to be the most satisfactory for identifying male puberty.

LA ROCHEBROCHARD Élise de. – Les âges à la puberté des filles et des garçons en France. Mesures à partir d'une enquête sur la sexualité des adolescents

Des tables de puberté féminine et masculine ont été construites à partir de l'enquête française sur l'Analyse du comportement sexuel des jeunes (ACSJ), menée en 1994 auprès des générations 1975-1978, alors âgées de 15 à 18 ans.

Chez les jeunes filles, la puberté est identifiée par la survenue des premières règles dont l'âge médian est de 13,1 ans. À partir de cet indicateur, un déclin séculaire de l'âge à la puberté a été mis en évidence dans l'ensemble des pays développés. Cette évolution historique semble se poursuivre en France alors qu'elle s'est stabilisée dans plusieurs pays.

Chez les jeunes hommes, la puberté est plus difficilement repérable et la discussion quant au choix d'un indicateur pour l'identifier reste ouverte. À partir de l'enquête ACSJ, trois indicateurs peuvent être envisagés : la mue de la voix (dont l'âge médian est de 14,8 ans), le pic de croissance (âge médian de 16,0 ans) et la première masturbation (âge médian de 14,2 ans). Parmi ces trois indicateurs, la mue de la voix apparaît comme le plus pertinent pour mesurer la puberté chez le garçon.

LA ROCHEBROCHARD Élise de. – Las edades de inicio de la pubertad de las y los adolescentes en Francia. Medición a partir de una encuesta sobre sexualidad de los adolescentes

A partir de la encuesta francesa Análisis del Comportamiento Sexual de los Jóvenes (ACSJ), llevada a cabo en 1994 entre las generaciones de 1975-1978, que entonces tenían entre 15 y 18 años, se construyeron tablas de pubertad femenina y masculina.

La primera regla define el inicio de la pubertad de las jóvenes. La edad mediana a la primera regla es de 13,1 años. En base a este indicador, se observa una disminución secular de la edad de inicio de la pubertad en el conjunto de países desarrollados. Esta tendencia se ha estabilizado en varios países pero continúa progresando en Francia.

El inicio de la pubertad de los adolescentes es más difícil de determinar. La discusión relativa a qué indicador utilizar permanece abierta. Sobre la base de la encuesta ACSJ se pueden considerar tres indicadores: el cambio de la voz (que se produce a una edad mediana de 14,8 años), el punto álgido del crecimiento (edad mediana 16,0 años) y la primera masturbación (edad mediana 14,2 años). De los tres indicadores, el cambio de la voz parece el más pertinente para medir el inicio de la pubertad masculina.