Appendix 1. The Factors That Determine the Climate Observed in the Three Regions According to the Japan Meteorological Agency

	Hokkaido					Okinawa					Tokyo				
	Average Temp	Highest Temp	Lowest Temp	Precipitation Amount	Sunshine Hours	Average Temp	Highest Temp	Lowest Temp	Precipitation Amount	Sunshine Hours	Average Temp	Highest Temp	Lowest Temp	Precipitation Amount	Sunshine Hours
Jan-16	-3.5	4	-10.7	74	88.2	17.4	26.6	6.1	272.5	75.8	6.1	16.2	-2.6	85	201.5
Feb-16	-2.3	8.3	-10.9	109.5	99.3	16.9	25.9	9.8	157.5	83.1	7.2	23	0.1	57	160.1
Mar-16	2.1	13.5	-6.9	60.5	164.1	18.7	24.8	11.4	168.5	106.6	10.1	21.4	1.1	103	161.9
Apr-16	7.8	21.1	0.1	58.5	174.9	23	28.7	16	350.5	125.5	15.4	26.8	5.1	120	149.2
May-16	14.9	29.7	1.7	40.5	229.5	25.7	31.1	19.2	129.5	143.2	20.2	30.9	11.9	137.5	204.9
Jun-16	16.3	28.4	8.4	112.5	157.7	28.4	33.1	23.3	319.5	185.7	22.4	33	14.2	174.5	139.1
Jul-16	20.7	30.5	13.4	118.5	211.1	29.8	33.6	25.4	193	253	25.4	36.7	19	81.5	143.7
Aug-16	23.9	31.9	15.1	279	225.3	29.5	33.9	24.7	209	226.4	27.1	37.7	21.3	414	156.5
Sep-16	19.4	31.1	9.5	107	155	28.4	32.8	24.9	342	141.8	24.4	33	17.6	287	79.4
Oct-16	10.6	24.7	0.5	78	145	27.7	31.7	23.5	75.5	175.6	18.7	32	9.6	96.5	119.6
Nov-16	2.1	14.5	-7	115.5	89.6	23.2	29.9	17.9	103	128.4	11.4	20.8	0.3	139	132.1
Dec-16	-1	11.9	-9.2	206.5	78.8	20.5	28.2	14.9	47.5	112.1	8.9	20.2	0	84	193.7
Jan-17	-3.9	4.7	-12.8	72.5	77.2	18.4	25	12.3	92.5	77	5.8	19.5	-2.3	26	226.7
Feb-17	-2	8.3	-10.8	57.5	87	17.1	24.3	10.7	84	79.9	6.9	20.6	-1.6	15.5	193.7
Mar-17	1.4	9.6	-5.7	75.5	184.1	18.3	25	11.8	96.5	102.4	8.5	18.7	0	85.5	190.3
Apr-17	7.7	20	-2.4	65.5	193.2	21.6	27.1	14.8	67	128.6	14.7	26.1	4.5	122	198.8
May-17	14.4	27.7	4.2	57.5	212.4	24.2	29.7	18.7	315.5	112.1	20	30.9	11.3	49	216.9

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Jun-17	16	29.6	7.2	168.5	165.8	26.6	33.2	19.9	444.5	107.7	22	30.6	14.8	106.5	158.8
Jul-17	22.9	34.9	16	75.5	200.8	29.9	35.1	24.9	44	267.2	27.3	35	20.9	81	189.1
Aug-17	21.7	29.6	12.5	78.5	184.4	30.4	34.9	26.4	56.5	242.1	26.4	37.1	20	141.5	83.7
Sep-17	17.7	26.9	7.6	187	183.3	28.9	33.9	23	239.5	186.1	22.8	33.3	16	209.5	124.4
Oct-17	11.3	22.3	1.4	114	152.9	27	33	20	270	155.8	16.8	29	9.1	531.5	94.7
Nov-17	4.3	17.4	-6.6	129	94	22.8	27.9	15.9	146.5	85.6	11.9	21.9	3.2	47	162.7
Dec-17	-2	8.8	-9	77	84.8	18	25.5	13.1	50.5	101.5	6.6	16	-0.2	15	211.1

Temp, temperature.

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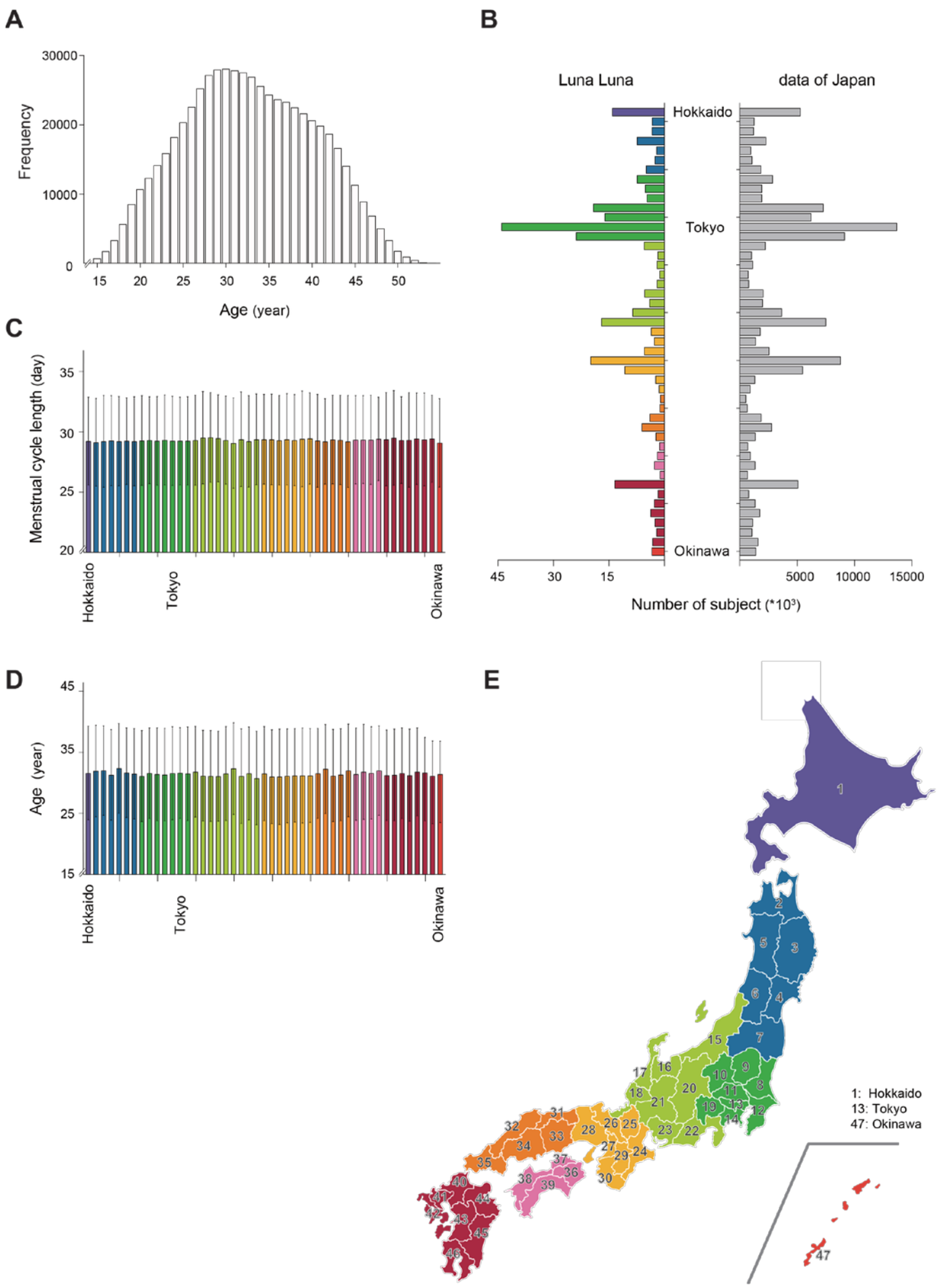
Appendix 2. (A) Age distribution of study subjects. (B) Numbers of study subjects and general populations shown by prefecture. Numbers divided by prefecture and color-coded by region (see also Appendix 2, part E). (C) Means and standard deviations of menstrual cycle length (day) shown by prefecture. (D) Means and standard deviations of age (year) of study subjects shown by prefecture. (E) Map of Japan numbered by prefecture and color-coded by region.



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Appendix 3. Baseline Characteristics of Study Subjects Stratified by Age (n =310,668)

Characteristics	mean age (year)	SD	number of study subjects (%)
Purpose for app usage			
contraception	30.89	8.5	166,221 (53.5)
pregnancy hope	32.41	5.9	118,852 (38.3)
others	30.19	7.1	25,595 (8.24)
Number of children			
0	29.25	5.4	24,007 (7.73)
1	32.01	5.7	1388 (0.45)
2	35.91	6.6	410 (0.13)
3	37.66	6.8	119 (0.038)
4	38.46	4.4	17 (0.0055)
unknown	31.62	7.7	284,727 (91.6)
Marital status			
unmarried	25.49	6.4	1684 (0.54)
married	30.77	5.4	6147 (1.98)
divorce or bereavement	35.91	6.7	240 (0.077)
others	31.48	7.6	302,597 (97.4)

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Partner status			
absent	27.73	7.8	505 (0.16)
present	29.88	6.1	7873 (2.53)
others	31.49	7.6	302,290 (97.3)

Data are presented as mean (SD) for continuous variables and n (%) for dichotomous variables.

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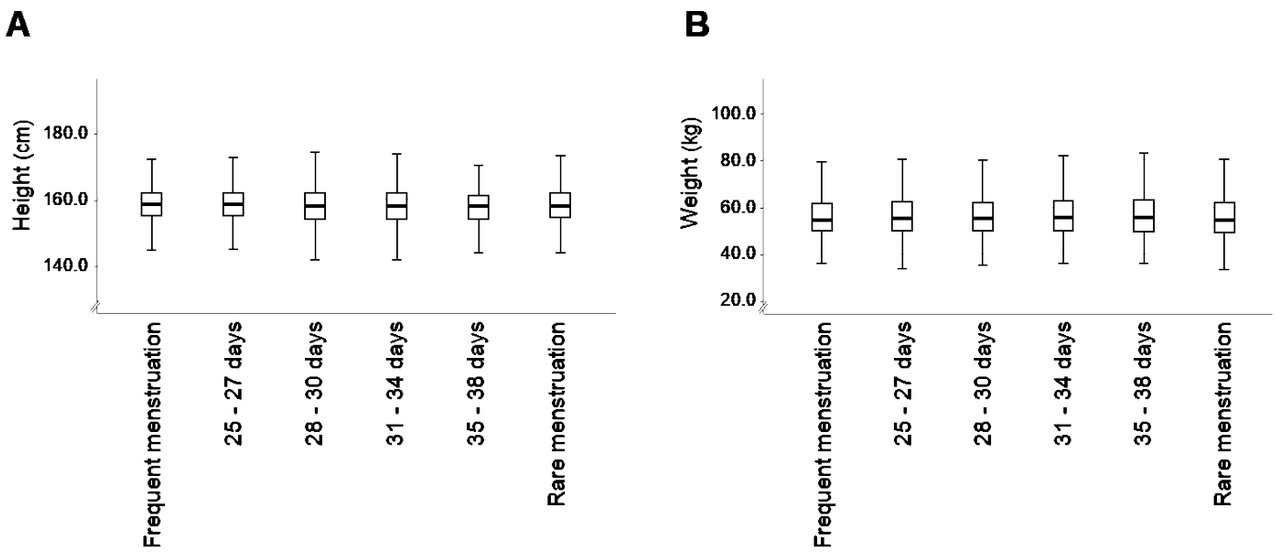
Appendix 4. Box plots of body height (A) and weight (B), based on classification by menstrual cycle length. The box bounds the interquartile range divided by the median, and Tukey-style whiskers extend to a maximum of 1.5 × interquartile range beyond the box.



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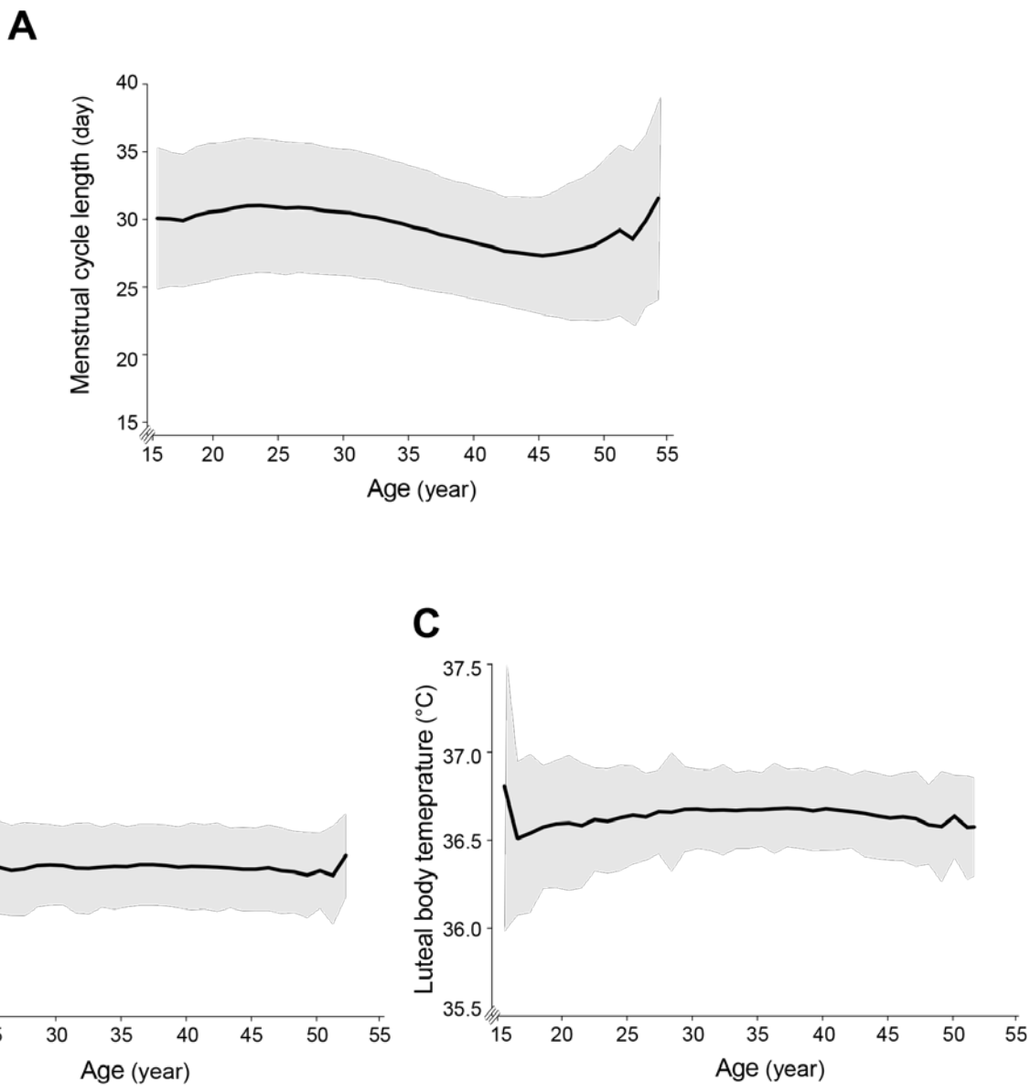
Appendix 5. Age-dependent changes in menstrual cycle length (A), follicular phase temperature (B), and luteal phase temperature (C) restricted to one cycle per woman. Five percent trimmed means (lines) and standard deviations (shaded area) are shown.



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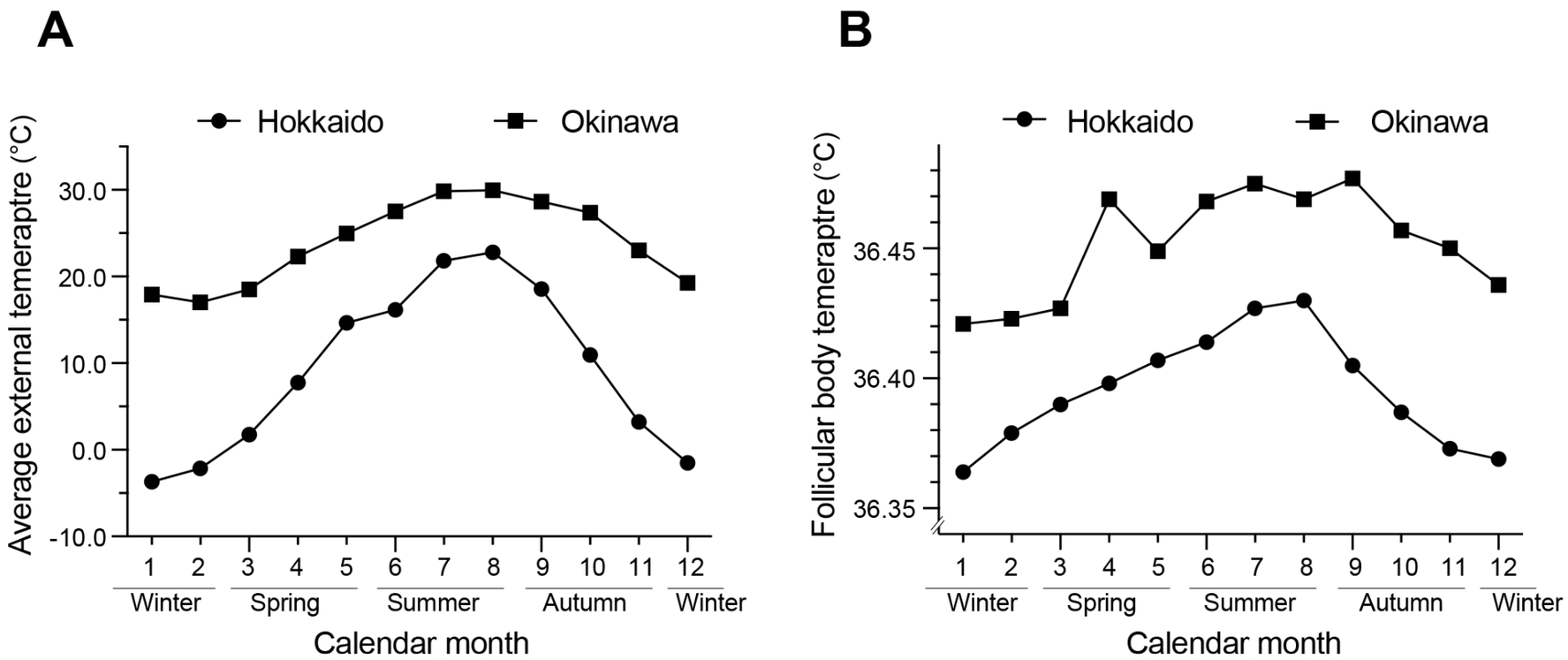
Appendix 6. External average temperatures in Hokkaido and Okinawa (A) and average follicular body temperatures of women in those prefectures (B).



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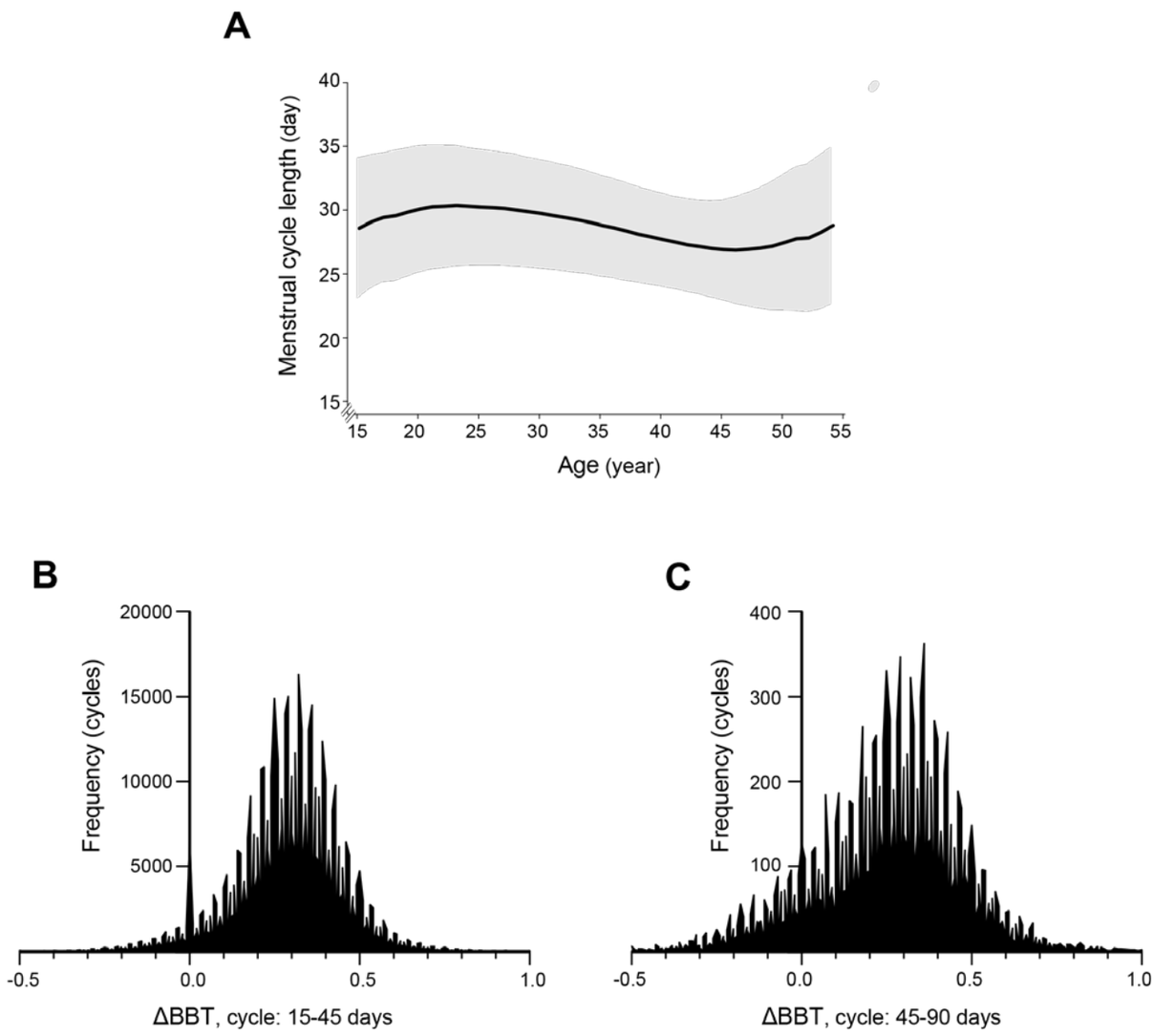
Appendix 7. Age-dependent changes in menstrual cycle length (days) restricted to cycles of 15–45 days (A). Comparison of frequency distributions among ΔBBT and cycles of 15–45 days (B), and 45–90 days (C). Five percent trimmed means (lines) and standard deviations (shaded area) are shown.



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Appendix 8. Additional Analysis With GEE (Corresponding to Table 1) for Data Restricted to Cycles of 15–45 Days

Characteristics	Menstrual cycle length days (n = 798,589)		Menstrual cycle length days restricted to 15-45 days (n = 768,563)	
	95% CI[†]	*p* value[*]	95% CI[†]	*p* value[*]
Age of women (years)				
19≥	Reference		Reference	
20–24	.327 − .682	<.001	.422 − .768	<.001
25–29	.272 − .621	<.001	.389 − .729	<.001
30–34	-.325 − .021	.085	-.200 − .137	.712
35-39	-1.32 − -.970	<.001	-1.22 − -.882	<.001
40-44	-2.37 − -2.02	<.001	-2.32 − -1.99	<.001
45-49	-2.51 − -2.14	<.001	-2.75 − -2.39	<.001
50≦	-1.23 − -.604	<.001	-2.05 − -1.42	<.001
Seasons				
Spring	.008 − .054	.009	-.044 − .003	.086
Summer	-.063 − -.016	.001	-.118 − -.070	<.001
Autumn	-.029 − .019	.698	-.063 − .014	.002
Year				

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2016	Reference		Reference	
2017	-.086 − -.039	<.001	.002 − .011	.004

CI, confidence interval

*p values of all factors except year were assessed using χ^2 or Student's t-tests.

†Adjusted for age of women, seasons, year, and correlations within the same person.

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Appendix 9. Additional Analysis With Multiple Regression Analysis (Corresponding to Table 2) for Data Restricted to Cycles of 15–45 Days

Characteristics	Pearson's correlation	*p* value*	Adjusted Std. coefficeints *Beta*†	*p* value*	VIF
Menstrual cycle length days (n = 320,067)					
age of subjects	-.203	<.001	-.203	<.001	1.00
average temperature	-.007	<.001	-.016	<.001	2.18
precipitation amount	-.004	<.001	-.003	.165	1.37
sunshine hours	.001	.418	.009	<.001	1.83
Menstrual cycle length days restricted to 15-45 days (n = 307,249)					
age of subjects	-0.23	<.001	-0.23	<.001	1.00
average temperature	-0.012	<.001	-0.019	<.001	2.15
precipitation amount	-0.007	<.001	0	0.838	1.40
sunshine hours	-0.002	0.141	0.01	<.001	1.82

CI, confidence interval; VIF, variance inflation factor

*p values of all factors except year were assessed using $\chi 2$ or Student's t-tests.

†Standardized partial regression coefficient adjusted for confounding factors.

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