Longitudinal and Secular Trends in Blood Pressure Among Women and Men in Birth Cohorts Born Between 1905 and 1977

The Tromsø Study 1979 to 2008

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Abstract—High blood pressure is a modifiable risk factor for cardiovascular disease. Previous studies showing a blood pressure decline in recent decades lack data to follow individuals born in different decades from early and middle adulthood to older age. We investigated changes in age-specific blood pressure by repeated measurements in 37 973 women and men born 1905 to 1977 (aged 20–89 years) examined ≤5× between 1979 and 2008 in the population-based Tromsø Study. Mixed models were used to estimate time trends. Mean systolic and diastolic blood pressure decreased from 1979 to 2008 in both genders in the age groups 30 to 89 years. The decrease was similar in the 80th percentile and the 20th percentile of the population blood pressure distribution. The decrease in systolic blood pressure in age group 40 to 49 years was 10.6 mm Hg in women and 4.5 mm Hg in men. Systolic blood pressure increased with age in women and men born 1920 to 1949, whereas a decrease or flattening of curve was observed in the younger birth cohorts. Thus, we found both time periodic and cohort effects, and trends were more pronounced in women than in men. The findings suggest changes in blood pressure in the population rather than an effect of treatment of high-risk individuals. **(*Hypertension*. 2015;66:496-501. DOI: 10.1161/HYPERTENSIONAHA.115.05925.)** • **Online Data Supplement**

Key Words: antihypertensives ■ blood pressure ■ cardiovascular diseases ■ epidemiology ■ hypertension ■ longitudinal studies

Hypertension is a modifiable risk factor for cardiovascular disease (CVD). Although blood pressure levels have decreased in recent decades, most pronounced in Western countries and in high-income groups,[1] high blood pressure is still the leading risk factor for global disease burden.[2] A blood pressure decrease in the population is likely to cause a reduction in CVD. Correspondingly, parallel decreases in systolic blood pressure (SBP) and coronary heart disease mortality are observed in observational studies.[3]

Previous population studies of secular trends in blood pressure[1,4,5] lack data to follow individuals born in different decades from early and middle adulthood to older age. In the present analysis from the population-based Tromsø Study we included 37 973 men and women born between 1905 and 1977 who participated in repeated surveys conducted from 1979 to 2008. Blood pressure and other CVD risk factors were recorded. The study design allowed analyses of secular trends in individuals aged 20 to 89 years as well as longitudinal trends with repeated measurements from individuals belonging to birth cohorts born early and late in the 20th century. Furthermore, this allowed us to study the changes in the whole blood pressure distribution and the impact of hypertension treatment.

Methods

Study Population

The Tromsø Study is an ongoing population-based cohort study in the municipality of Tromsø, Northern Norway, with a population of 72 000 inhabitants. The study design includes 6 surveys (Tromsø 1: 1974, Tromsø 2: 1979–1980, Tromsø 3: 1986–1987, Tromsø 4: 1994–1995, Tromsø 5: 2001, and Tromsø 6: 2007–2008) to which total birth cohorts and representative samples of the population were invited.[6] Response rates were between 66% and 79%. A total of 40,051 women and men participated. The Regional Committee of Medical and Health Research Ethics and the Norwegian Data Protection Authority has approved the Tromsø Study.

Received May 29, 2015; first decision June 8, 2015; revision accepted July 1, 2015.

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The online-only Data Supplement is available with this article at http://hyper.ahajournals.org/lookup/suppl/doi:10.1161/HYPERTENSIONAHA.115.05925/-/DC1.

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Participants in at least one of the surveys conducted from 1979 to 2008 (Tromsø 2–6, n=39 059) were eligible for these analyses. We excluded the first survey (Tromsø 1) because it included men only and because of different procedures of measuring blood pressure. We excluded subjects who did not consent to research (n=228), subjects born before 1905 (n=25), subjects who in Tromsø 3 attended without invitation or were <20 years of age (n=792), and subjects who did not have any blood pressure measurements (n=41). Altogether 37 973 subjects (51% women) aged 20 to 89 years were included in the analyses. A total of 41% had 1 measurement, 22% had 2, 17% had 3, 12% had 4, and 8% had 5 repeated blood pressure measurements.

Measurements

Blood pressure was measured on the participant's right upper arm with a properly sized cuff based on arm circumference. Trained personnel performed all measurements. In Tromsø 2, blood pressure was measured twice with a mercury sphygmomanometer (ERKAmeter; ERKA, Bad Tölz, Germany) and stethoscope after 1-minute seated rest. The first and fifth Korotkoff phases were registered as SBP and diastolic blood pressure (DBP) respectively, and read to the nearest integer of mm Hg. The mean of the readings was used in the analysis. In the other 4 surveys, blood pressure was measured 3× with an oscillometric digital automatic device (in Tromsø 3–5: Dinamap Vital Signs Monitor; Critikon Inc, Tampa, FL, and in Tromsø 6: Dinamap ProCare 300 monitor, GE Healthcare, Oslo, Norway), measurements being separated by a 1-minute interval after 2-minute seated rest. The mean of the 2 final readings were used in the analysis. Validation studies show systematic slightly lower blood pressure values when measured with Dinamap as compared with ERKAmeter with a linear relation (correlation coefficients of 0.9 for SBP and 0.8 for DBP), and therefore, Dinamap measurements were transformed to ERKAmeter values in accordance with previously validated methods.[7] In each

Table 1. Population Mean Systolic and Diastolic Blood Pressure by Sex, Survey, and Age Group

Age Group	Tromsø 2 1979–1980, n=16548	Tromsø 3 1986–1987, n=20498	Tromsø 4 1994–1995, n=26750	Tromsø 5 2001, n=8032	Tromsø 6 2007–2008, n=12906	*P* Value*
Systolic blood pressure, mm Hg						
Women						
20–29 y	119.5	120.0	120.8	…	…	0.0009
30–39 y	121.8	120.4	121.3	115.9	113.9	<0.0001
40–49 y	129.3	126.6	126.8	121.5	118.7	<0.0001
50–59 y	…	134.6	137.3	134.6	128.8	<0.0001
60–69 y	…	…	150.1	142.7	141.7	<0.0001
70–79 y	…	…	160.3	152.4	152.6	<0.0001
80–89 y	…	…	169.4	157.0	159.3	<0.0001
Men						
20–29 y	130.9	131.3	133.0	…	…	<0.0001
30–39 y	131.3	131.3	132.8	127.8	128.6	0.19
40–49 y	133.7	133.3	134.2	129.2	129.2	<0.0001
50–59 y	138.2	139.0	139.6	137.3	135.6	0.051
60–69 y	…	142.6	148.3	142.3	142.5	0.0007
70–79 y	…	…	153.6	149.8	147.4	<0.0001
80–89 y	…	…	155.3	150.8	152.9	0.38
Diastolic blood pressure, mm Hg						
Women						
20–29 y	76.2	75.7	75.0	…	…	<0.0001
30–39 y	79.3	78.4	76.8	75.7	75.9	<0.0001
40–49 y	83.8	82.0	80.3	79.8	78.0	<0.0001
50–59 y	…	84.8	84.0	83.4	79.9	<0.0001
60–69 y	…	…	86.2	84.2	80.6	<0.0001
70–79 y	…	…	87.7	85.2	80.5	<0.0001
80–89 y	…	…	90.3	84.2	81.3	<0.0001
Men						
20–29 y	79.3	76.9	77.2	…	…	<0.0001
30–39 y	83.7	81.2	80.3	77.9	80.9	<0.0001
40–49 y	86.7	84.8	84.1	82.6	83.2	<0.0001
50–59 y	89.2	87.4	87.0	86.6	85.5	<0.0001
60–69 y	…	87.9	88.4	86.1	85.3	<0.0001
70–79 y	…	…	87.6	85.3	83.2	<0.0001
80–89 y	…	…	85.3	84.5	82.2	0.004

The Tromsø Study 1979 to 2008.
**P* value for linear trend using linear mixed models.

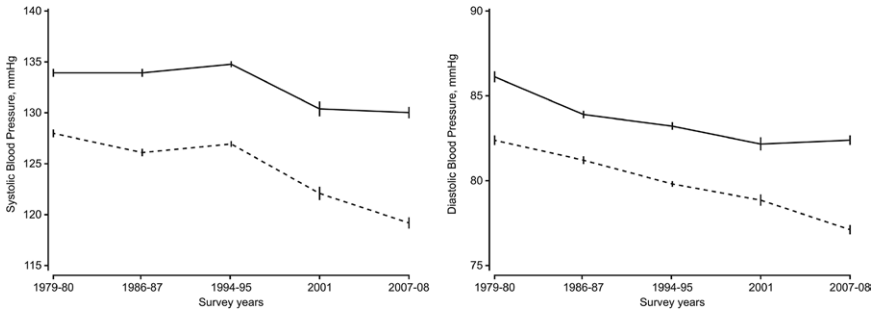

Figure 1. Trends in age-adjusted mean systolic and diastolic blood pressure in women (dotted line) and men (solid line) aged 30 to 59 years, with 95% confidence intervals (vertical lines). The Tromsø Study 1979 to 2008.

survey, information about the use of antihypertensive medication was obtained from questionnaires.

Statistics

Linear mixed models for continuous variables and generalized estimation equation for binary variables were used to test for linear trend over surveys within each 10-year age group (Table 1; Table S1 in the online-only Data Supplement). An unstructured covariance matrix was specified to control for dependencies between repeated measures. Furthermore, we estimated trends in age-adjusted (standardized at age 42.4, the overall mean age for age group 30–59) mean SBP and DBP for men and women aged 30 to 59 years (Figure 1).

We calculated sex-specific 20th, 50th, and 80th centiles of the blood pressure distribution in Tromsø 2 to 6 for each 10-year age group (Tables S2 and S3). We also calculated differences of SBP between Tromsø 4 and Tromsø 6 in mean, 20th, 50th, and 80th centiles to track changes of the blood pressure distribution (Table 2) as described by Tunstall-Pedoe et al.[5] Furthermore, we created SBP kernel density distribution curves for Tromsø 4 and Tromsø 6 for each sex and age group (Figure 2) using the kde procedure[8] in SAS, which is based on Gaussion function and use automatic band with selection.

The use of antihypertensives was calculated as percent in sex-specific analyses according to strata of surveys (Tromsø 2—Tromsø 6) and 10-year age groups (Table S4).

To assess longitudinal trends over time, sex-specific means of SBP and DBP and the use of antihypertensive medication were calculated in 10-year birth cohorts according to survey or attained age within each survey (Figure 3; Figure S1). Tests of interaction between age and sex (age×sex) for those born before 1950, and between age and birth cohort (born before or after 1950×age) were assessed by including these cross product terms, and their main effects in linear mixed models.

The vast majority of the participants are white, thus ethnic-specific analyses were not performed. Statistical analyses were performed using SAS 9.4 (SAS Institute, Cary, NC) and STATA 12 (StataCorp LP, College Station, TX).

Results

Secular Time Trends

The cross-sectional data showed a secular decrease in mean DBP from 1979 to 2008 in all age groups and in SBP for all aged ≥30 years (Table 1 ; Table S1 for number of observations). The decrease in SBP in age group 40 to 49 years was 10.6 mm Hg in women and 4.5 mm Hg in men. Throughout the period, men had higher blood pressure than women up to the age of 70 years. For those aged 30 to 59 years, the age-adjusted drop in SBP per decade from 1994 to 2008 was 5.9 mm Hg in women and 3.7 mm Hg in men (Figure 1).

Both the 20th and 80th centiles of the blood pressure distribution decreased between 1979 and 2008 in both sexes and all age groups except for the youngest age group (Tables S2 and S3). The SBP decrease from 1994–1995 to 2007–2008 was slightly higher in the 20th centile compared with the 80th centile in the youngest age groups (aged 30–59 years; Table 2). However, in men and women aged 60 to 79 years, the SBP decline was higher in the 80th centile compared with the 20th centile (Table 2). In all age groups and centiles (20th, 50th, and 80th), the decline was higher in women than in men.

Figure 2 shows SBP kernel density distributions in Tromsø 4 and Tromsø 6 by sex and age groups. All distributions indicate a downward shift in the entire blood pressure distribution from 1994–1995 to 2007–2008.

Longitudinal Trends

SBP trends with age differed by birth cohort (Figure 3A and 3B). Mean longitudinal SBP increased with age in women and men born 1920 to 1949, with a steeper slope in women compared with men ($P<0.0001$). By contrast, in the younger birth cohorts born 1950 to 1977, a smaller increase or decrease in SBP with age was observed ($P<0.0001$). In men, there was a nonlinear relationship between mean DBP and age, peaking at 50 to 60 years for birth cohorts born 1920 to 1949 (Figure 3D), whereas in women the differences between birth cohorts were more pronounced than in men (Figure 3C). Results remained unchanged when excluding subjects with only 1 measurement (data not shown).

Use of Antihypertensives

The use of antihypertensives increased in all age groups in both genders during 1979 to 2008, and with age in all birth cohorts

Table 2. Differences in Systolic Blood Pressure (mm Hg) Between 1994 to 1995 and 2007 to 2008 by Sex and Age Group

Age Group	Mean	SD	20th Centile	50th Centile	80th Centile	Difference 80th 20th Centile
Women						
30–39 y	−7.4	1.2	−8.2	−7.7	−7.5	0.7
40–49 y	−8.1	0.9	−9.7	−8.2	−7.3	2.4
50–59 y	−8.5	0.0	−9.2	−8.7	−7.3	1.9
60–69 y	−8.4	−1.8	−7.3	−6.3	−11.1	−3.9
70–79 y	−7.7	−0.1	−6.3	−8.2	−10.2	−3.9
Men						
30–39 y	−4.3	1.2	−5.6	−5.3	−3.9	1.7
40–49 y	−5.0	1.5	−6.8	−5.8	−3.4	3.4
50–59 y	−3.9	1.4	−5.8	−3.9	−1.9	3.9
60–69 y	−5.9	−1.4	−4.8	−4.4	−6.8	−1.9
70–79 y	−6.3	−0.4	−4.4	−6.1	−7.7	−3.4

The Tromsø Study 1979 to 2008.

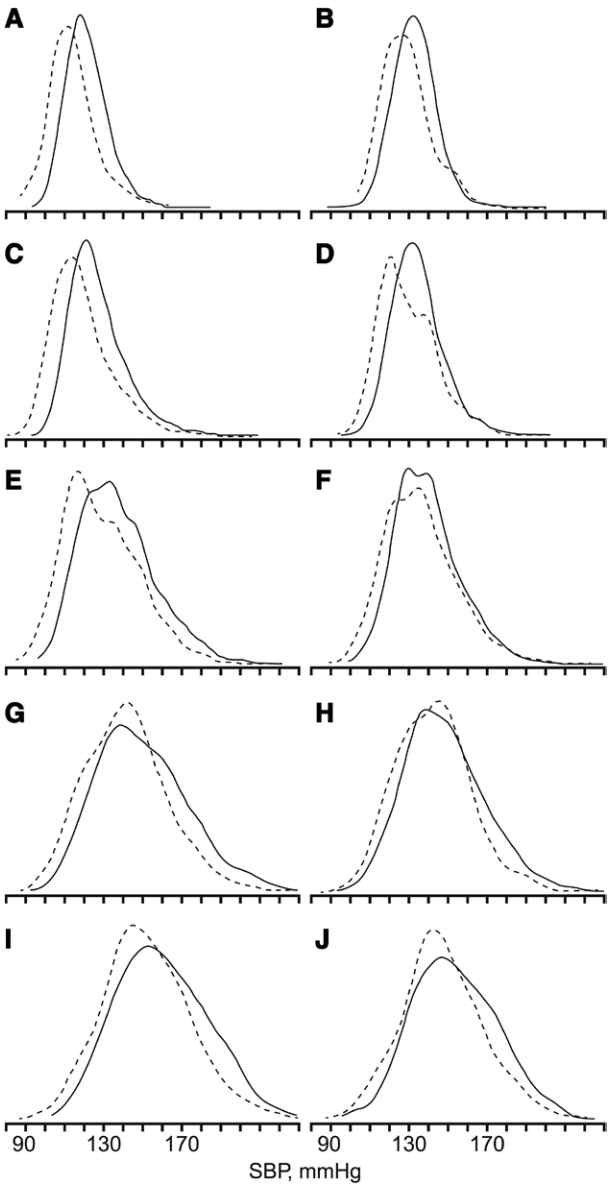

Figure 2. Population systolic blood pressure distribution density curves for Tromsø 4 (solid lines) and Tromsø 6 (dotted lines) for women (**A**, **C**, **E**, **G**, and **I**) and for men (**B**, **D**, **F**, **H**, and **J**) in age group 30 to 39 years (**A** and **B**), 40 to 49 years (**C** and **D**), 50 to 59 years (**E** and **F**), 60 to 69 years (**G** and **H**), and 70 to 79 years (**I** and **J**). The Tromsø Study 1994 to 2008. SBP indicates systolic blood pressure.

(Table S4 and Figure S1). Among women and men <50 years, the use of antihypertensives was <7.5% in all surveys. The use was similar among women and men, but more common among women aged 80 to 89 years (from 1994 and onwards).

Discussion

We found a secular decrease in blood pressure in age groups (time periodic effect), an increase in blood pressure with age in older birth cohorts and a smaller increase or decrease with age in younger birth cohorts (cohort effect). The secular decrease was observed in both ends of the blood pressure distribution. Both the time periodic effect and the cohort effect were stronger for women than for men.

Secular Trends

The observed secular decrease in blood pressure is consistent with findings from large cross-sectional surveys.[1,4,5] The size of the mean drop in blood pressure per decade was higher in our study compared with previously reported. Pooled analysis of 38 populations aged 35 to 64 years showed a decline of blood pressure at all levels from the mid-1980s to the mid-1990s in the World Health Organization (WHO) Multinational Monitoring of Trends and Determinants in Cardiovascular Disease (MONICA) project.[5] In this study, the mean drop in SBP over 1 decade was 3.3 mm Hg in women and 2.2 mm Hg in men.[5] A systematic analysis of 5.4 million participants in studies worldwide between 1980 and 2008 observed the largest SBP drop in women in Europe and Australasia of 3.5 mm Hg, and men in high-income North America with 2.8 mm Hg per decade.[1] Furthermore, a study from the National Health Examination Survey and the National Health and Nutrition Examination Survey I–III including birth cohorts born between 1890 and 1990, demonstrated that at any given age in the period from 1960 to 2008, lower SBP was observed for younger compared with older birth cohorts.[4]

Longitudinal Trends

Previous longitudinal studies have been scarce and restricted to limited age groups.[9–11] A study from the Florida Geriatric Research Program with repeated measurements from 1917 community-dwelling individuals aged 65 to 98 showed a cohort effect with lower blood pressure increase with age in the younger cohorts.[10] Results from the Fels Longitudinal Study showed no cohort effects in blood pressure trends among 970 individuals born 1920 to 1979 in analyses restricted to age 18 to 40 years.[9]

Sex Differences

Longitudinal data from 30 372 individuals from 8 population-based and occupational cohorts in the United Kingdom[11] found a steeper SBP increase with age among women compared with men, consistent with our findings. The United Kingdom study did not have information on DBP.[11] We observed a DBP peak at middle age among men (and to a lesser extent among women), consistent with previous observations in a cross-sectional study without sex stratification.[12] A more pronounced decrease in secular blood pressure trends among women than men has been reported in 2 large cross-sectional studies with pooled analysis.[1,5]

Time Period, Cohort, and Age

The unique contribution of period, cohort, and age to the changes in blood pressure is difficult to estimate.[13] The observed decrease in blood pressure can be because of both early life experience and to exposures in later life. A flattening of the age–blood pressure relationship in older ages can also be because of survival bias.[14] A Norwegian health-screening program of 40 to 42 year olds reported a substantial decline in blood pressure between 1994 to 1996 and 1997 to 1999 that could not be explained by lifestyle or methodological factors.[15]

The Blood Pressure Distribution

A secular decrease in the entire range of blood pressure in the population indicates that the decline must be influenced

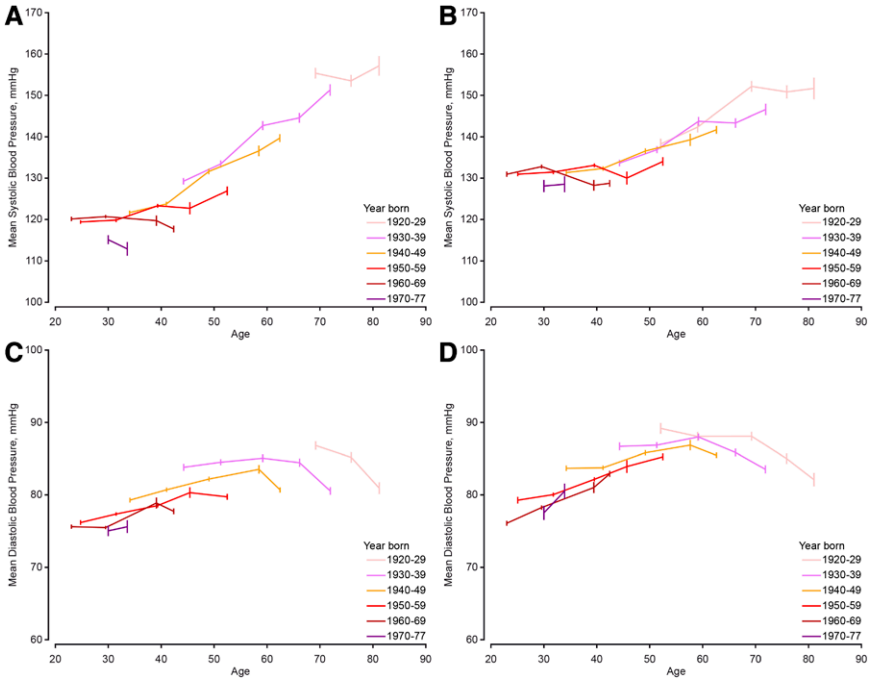

Figure 3. Observed longitudinal systolic (**A** and **B**) and diastolic (**C** and **D**) blood pressure trends among women (**A** and **C**) and men (**B** and **D**), over age (20–89 years) in 10-year birth cohorts (born 1920–1977), with 95% confidence intervals (vertical lines). The Tromsø Study 1979 to 2008.

by factors that shift the distribution curve to the left. This points to a mass population effect rather than a treatment effect of individuals with hypertension. However, in women and men aged ≥60 years the 80th SBP centile showed a larger decline from 1994–1995 to 2007–2008, indicating a possible treatment effect. Similar analysis from the MONICA study showed no difference between age groups and concluded that an improved hypertension control is not the cause of the overall population blood pressure decline.[5]

The Impact of Lifestyle Factors

Several blood pressure–associated lifestyle factors changed in the Tromsø Study population during the study period 1979 to 2008. Mean body weight and the proportion of obese subjects increased in both genders and in every birth cohort and age group between 1979 to 1995, a trend continuing to 2001[16] and further to 2008 within all levels of socioeconomic status.[17] Smoking prevalence has decreased substantially.[18] Leisure-time physical activity was stable but work-time physical activity decreased.[18] Coffee consumption decreased between 1979 and 1986 and then stabilized, whereas frequency of alcohol consumption changed little.[18] We assume consistency with national trends for other diet-specific trends during this period, including an increased fruit and vegetable consumption and decreased salt intake.[19] For the latter, the limited information available indicates a slight decrease from 1980 to 2006.[20,21] In Norway, transfat was removed from margarine during the late 1990s.[19] Large multisite studies reporting a decline in blood pressure during this time period were unable to point out what causes the trend.[1,5,12] They emphasize the beneficial effects of reduced salt and increased fruit and vegetable intake; however, adverse trends are reduced physical activity and increase in body mass index.[1,5,12]

Parallel Trends in CVD

The CVD incidence in the Tromsø Study has declined in parallel with the observed blood pressure trends during the 3 decades. Acute myocardial infarction incidence and case-fatality declined during 1974 to 2004.[22] Ischemic stroke incidence declined during 1995 to 2010 and case-fatality declined in men but not in women.[23] Intracerebral hemorrhage incidence showed no time trends during 1995 to 2010.[24] CVD risk factor reduction, mainly through decrease in total cholesterol, blood pressure, and prevalence of smoking, explain more than half of the reduction in coronary heart disease mortality observed in Norway's neighboring countries, Finland[25] and Sweden,[26] from the 1980s and onwards.

Strengths and Limitations

A significant strength of our study is that we followed individual trends in blood pressure and associated risk factors by repeated measurements in the same individual with follow-up over several decades in a large adult population sample across all ages and both genders. A limitation is that 41% of the participants contributed with only 1 blood pressure measurement.

Perspectives

We found time period effects with a secular decrease in blood pressure during the past 3 decades. Longitudinal data showed cohort effects with an increase in blood pressure with age in older birth cohorts and a smaller increase or decrease with age in younger birth cohorts. The time periodic effect and the cohort effect were stronger for women than for men. Similar declines in the upper and lower end of the blood pressure distribution are attributable to a population effect rather than a treatment effect of high-risk individuals. It is likely that the blood pressure decline has contributed to the observed decline in CVD in this population.

Sources of Funding

L.A. Hopstock receives a research grant from Norwegian Health Association's board in Troms County.

Disclosures

None.

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Novelty and Significance

What Is New?

- This population-based study allows analysis of the whole blood pressure distribution, and secular and longitudinal trends of men and women over 3 decades from early adulthood into older age in individuals born early and late in the 20th century. Such data are lacking in previous studies.

What Is Relevant?

- Mean blood pressure decreased from 1979–1980 to 2007–2008 in both sexes and all ages.
- Systolic blood pressure increased with age in the older birth cohorts and decreased with age in the younger birth cohorts.
- The results indicate changes in blood pressure distribution in the population rather than an effect of treatment of hypertension.

Summary

During 1979–1980 to 2007–2008, blood pressure decreased in both ends of the blood pressure distribution with both time periodic and cohort effects.

Hypertension
Journal of the American Heart Association

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Hypertension. 2015;66:496-501; originally published online July 20, 2015;
doi: 10.1161/HYPERTENSIONAHA.115.05925
Hypertension is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231

Print ISSN: 0194-911X. Online ISSN: 1524-4563

ONLINE SUPPLEMENT

Longitudinal and secular trends in blood pressure among women and men in birth cohorts born between 1905 and 1977: The Tromsø Study 1979-2008.

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Table S1. Number of observations corresponding to Table 1 of population mean systolic and diastolic blood pressure by sex, survey and age group. The Tromsø Study 1979-2008.

Age group	Tromsø 2 1979-80	Tromsø 3 1986-87	Tromsø 4 1994-95	Tromsø 5 2001	Tromsø 6 2007-08
Women					
20-29 years	3102	2860	1780	.	.
30-39 years	3143	3509	3576	419	295
40-49 years	1858	2571	3365	743	1898
50-59 years	.	1191	2197	717	1287
60-69 years	.	.	1620	1451	2101
70-79 years	.	.	1222	1083	980
80-89 years	.	.	384	147	331
Men					
20-29 years	2491	2462	1497	.	.
30-39 years	3127	3284	3173	277	210
40-49 years	1908	2551	3274	600	1649
50-59 years	919	1720	2212	363	1143
60-69 years	.	350	1479	1241	1988
70-79 years	.	.	922	876	834
80-89 years	.	.	194	115	190

Table S2. Population 20th and 80th percentiles of systolic blood pressure (mmHg) by sex, survey and age group. The Tromsø Study 1979-2008.

Age group	Tromsø 2 1979-80 n=16548	Tromsø 3 1986-87 n=20498	Tromsø 4 1994-95 n=26750	Tromsø 5 2001 n=8032	Tromsø 6 2007-08 n=12906
			Women		
20th percentile					
20-29 years	110.0	111.4	112.4	.	.
30-39 years	111.0	111.4	112.4	106.6	104.2
40-49 years	116.0	114.3	115.3	109.5	105.6
50-59 years	.	119.2	121.1	118.2	111.9
60-69 years	.	.	129.8	125.0	122.5
70-79 years	.	.	139.5	134.6	133.2
80-89 years	.	.	149.2	139.5	137.6
80th percentile					
20-29 years	128.0	127.9	128.8	.	.
30-39 years	131.0	128.8	129.8	124.0	122.3
40-49 years	141.0	137.6	137.6	131.7	130.3
50-59 years	.	149.2	152.1	149.2	144.8
60-69 years	.	.	169.5	160.8	158.4
70-79 years	.	.	181.1	170.5	170.9
80-89 years	.	.	192.7	176.3	180.1
			Men		
20th percentile					
20-29 years	120.0	122.1	124.0	.	.
30-39 years	120.0	121.1	124.0	119.2	118.4
40-49 years	121.0	122.1	123.0	119.2	116.3
50-59 years	123.0	124.0	125.9	123.0	120.1
60-69 years	.	127.9	130.8	125.9	125.9
70-79 years	.	.	134.6	132.7	130.3
80-89 years	.	.	133.7	133.7	133.9
80th percentile					
20-29 years	140.0	140.5	142.4	.	.
30-39 years	141.0	140.5	141.4	136.6	137.6
40-49 years	145.0	143.4	144.3	139.0	140.9
50-59 years	151.0	152.1	152.1	152.1	150.1
60-69 years	.	157.9	164.7	156.9	157.9
70-79 years	.	.	172.4	166.6	164.7
80-89 years	.	.	174.3	164.7	172.9

Table S3. Population 20th and 80th percentiles of diastolic blood pressure (mmHg) by sex, survey and age group. The Tromsø Study 1979-2008.

Age group	Tromsø 2 1979-80 n=16548	Tromsø 3 1986-87 n=20498	Tromsø 4 1994-95 n=26750	Tromsø 5 2001 n=8032	Tromsø 6 2007-08 n=12906
			Women		
20th percentile					
20-29 years	69.0	70.8	70.0	.	.
30-39 years	71.0	73.1	70.8	70.0	70.2
40-49 years	76.0	75.3	73.8	73.1	71.9
50-59 years	.	77.6	76.8	76.1	73.8
60-69 years	.	.	77.6	76.1	74.2
70-79 years	.	.	78.3	76.1	73.4
80-89 years	.	.	79.8	76.8	73.8
80th percentile					
20-29 years	83.0	80.6	79.8	.	.
30-39 years	86.0	83.6	82.1	80.6	80.6
40-49 years	91.0	88.1	86.6	85.9	83.6
50-59 years	.	91.9	91.2	90.4	85.9
60-69 years	.	.	94.2	91.2	87.0
70-79 years	.	.	96.4	93.4	87.0
80-89 years	.	.	100.2	91.9	88.5
			Men		
20th percentile					
20-29 years	71.0	71.5	71.5	.	.
30-39 years	76.0	75.3	74.6	72.3	75.3
40-49 years	78.0	78.3	77.6	76.1	77.2
50-59 years	80.0	80.6	79.8	79.8	79.1
60-69 years	.	81.3	79.8	79.1	79.5
70-79 years	.	.	79.1	76.8	76.8
80-89 years	.	.	76.1	76.8	75.7
80th percentile					
20-29 years	88.0	82.1	82.9	.	.
30-39 years	91.0	86.6	85.9	84.4	85.9
40-49 years	95.0	91.2	90.4	88.1	88.9
50-59 years	98.0	94.2	93.4	92.7	91.5
60-69 years	.	93.4	95.7	92.7	91.5
70-79 years	.	.	95.7	93.4	89.6
80-89 years	.	.	94.2	91.9	88.5

Table S4. Population proportion (%) of antihypertensive medication use by sex, survey and age group. The Tromsø Study 1979-2008.

Age group	Tromsø 2 1979-80 n=16548	Tromsø 3 1986-87 n=20498	Tromsø 4 1994-95 n=26750	Tromsø 5 2001 n=8032	Tromsø 6 2007-08 n=12906	p-value*
Women						
20-29 years	0.0	0.0	1.2	.	.	0.0002
30-39 years	0.7	0.8	1.8	2.6	5.4	<0.0001
40-49 years	3.8	2.8	4.0	4.8	7.4	<0.0001
50-59 years	.	7.6	9.7	16.3	17.1	<0.0001
60-69 years	.	.	22.1	25.2	32.2	<0.0001
70-79 years	.	.	29.9	36.1	45.5	<0.0001
80-89 years	.	.	29.4	43.5	54.1	<0.0001
Men						
20-29 years	0.3	0.2	0.6	.	.	0.30
30-39 years	1.1	0.7	1.2	1.4	4.3	0.013
40-49 years	3.8	2.5	4.7	3.3	7.0	<0.0001
50-59 years	8.6	9.1	12.1	15.7	19.9	<0.0001
60-69 years	.	17.1	21.4	26.5	32.4	<0.0001
70-79 years	.	.	26.1	37.3	41.6	<0.0001
80-89 years	.	.	22.7	41.7	40.5	0.0002

*p-values are linear trend using GEE models.

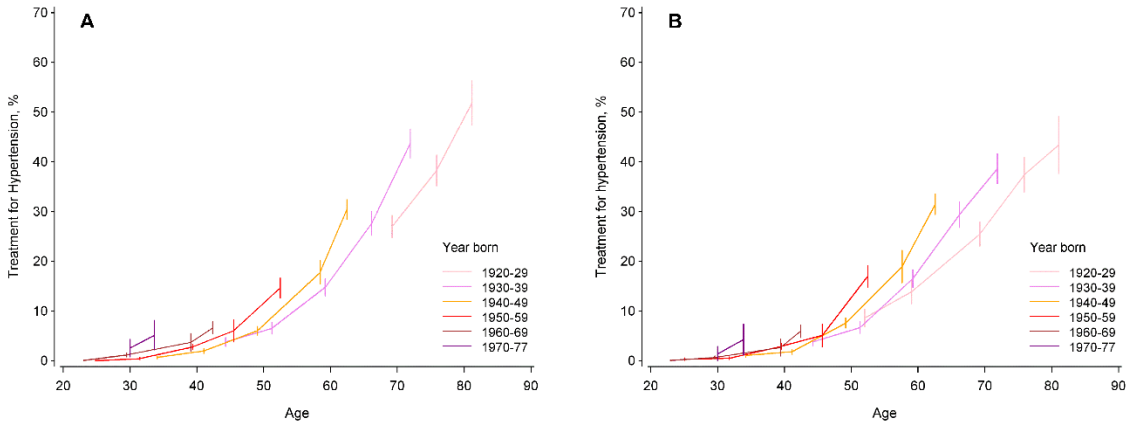

Figure S1. Observed longitudinal trends in use of antihypertensive medication among women (A) and men (B), over age (20-89 years) in 10-year birth cohorts (born 1920-1977), with 95% confidence intervals (vertical lines). The Tromsø Study 1979-2008.