Pre-Hypertension is a Common Phenomenon: National Database Study*

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Abstract

Background: Recently the Joint National Committee (7th report) introduced the term "pre-hypertension." Little is known on its prevalence in the general population.

Objectives: To assess the prevalence of pre-hypertension in a large national cohort.

Methods: We analyzed the database of all ≥ 18 year old members of Leumit Health Services, one of the four health management organizations in Israel, from which we retrieved the recorded blood pressure levels. Pre-hypertension was defined according to the JNC-7 criteria.

Results: Of the 426,033 subjects 18.6% had a diagnosis of hypertension or used antihypertensive medications. Only 40.8% of the other 346,799 subjects had had their BP measured in the preceding 2 years. BP recording rates were higher in females than in males (45.1% vs. 36.3%) and higher in elderly subjects than in young subjects (56% aged 66–75 years vs. 32% aged 18–25). Pre-hypertension was observed in 80,625 (23.2%) of the 346,799 while only 56,113 (16.2%) had normal BP records. The prevalence of pre-hypertension increased with age (13.3% aged 18–25 vs. 44.8% aged 66–75), and was more prevalent in men than in women (24.0% vs. 22.5%).

Conclusions: BP levels among young people are low, even though the prevalence of pre-hypertension in this population may be high. Thus, more emphasis should be given to routine BP measurements and confirmation of the findings in all age groups.

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Hypertension, defined as systolic blood pressure of 140 mmHg or greater and/or diastolic BP of 90 mmHg or higher, is a major modifiable risk factor for cardiovascular morbidity and mortality [1]. The cardiovascular risk increases as the blood pressure levels increase [2]. Lowering BP can reduce cardiovascular morbidity and mortality dramatically, yet about 50% of hypertensive patients are not diagnosed. It was recently shown that even subjects with high normal BP levels are at increased cardiovascular risk [3]. Therefore, the Joint National Committee (7th report) introduced the term pre-hypertension for blood pressure levels of 120–139/80–89 mmHg [4]. It was also recently shown that pre-hypertension is associated with a high prevalence of other cardiovascular risk factors [5] and with a higher rate of hospitalization [6]. Data from the United states show that pre-hypertension exists in almost one-third of the population [5,7]. The prevalence in other parts of the world, however, is unknown. The present study was designed to assess the rate of BP recording in primary care clinics and to assess the prevalence of pre-hypertension in a large cohort.

Patients and Methods

We analyzed the database of all members of Leumit Health Services, one of the four HMOs in Israel. With about 695,000 members countrywide, representing all sectors of the Israeli population, Leumit has been using a central computerized personal medical file for several years, which contains the members' demographic, clinical and laboratory data, as well as their medications. These files are available for all Leumit members, covering all prescriptions purchased in the HMO pharmacies and more than 95% of patient-physician encounters. The community pharmacies used by the HMO are fully computerized and report to a central repository. All prescriptions that were used by Leumit members that had actually been purchased during this period were documented. Similar to the other HMOs, Leumit members pay a nominal co-payment for medications. Thus, patients do not usually buy their medications outside the HMO, which ensures that all filled prescriptions are documented.

We included in our analysis only those members who were

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JNC-7 = Joint National Committee 7th report
BP = blood pressure
HMO = health management organization

18 years old in the year 2003, had no diagnosis of hypertension (one of the diagnoses in the category 401 of the ICD-9) and did not use antihypertensive medications. For each subject we retrieved the following data: age group, gender, and the last BP value measured, if available. BP was measured by a nurse or physician as part of regular clinic visits in the previous 2 years. The collection of data for the study was in conformity with the Helsinki Declaration.

Statistical analysis

Blood pressure levels were categorized according to the JNC-7 as normal values (< 120/80 mmHg), pre-hypertension (systolic BP 120–139 and/or diastolic BP 80–89 mmHg), and hypertension (systolic BP ≥ 140 and/or diastolic BP ≥ 90 mmHg) [4].

SPSS for Windows was used to analyze the data. Categories of BP were divided according to age and gender. Pre-hypertension prevalence was calculated as the proportion of patients with pre-hypertension from the total relevant population. The prevalence of BP recordings and pre-hypertension was compared in the various age groups and in both genders by the chi-square test. $P < 0.05$ was considered significant.

Results

We analyzed the data of 426,033 subjects who were older than 18. We identified the records of 79,234 (18.6%) who had the diagnosis of hypertension or used antihypertensive medications. Among the 346,799 subjects without documentation of hypertension (the study group), 172,517 (49.7%) were males. Most subjects were in the age range 18–55 years.

Blood pressure recordings

Only 141,356 of the 426,033 subjects (40.8%) had their BP levels recorded in the last 2 years. The rate of BP recordings was higher in females than males (45.1% vs. 36.3%, $P < 0.001$) and higher in elderly subjects aged ≤ 75 than in young subjects (56% in those aged 66–75 vs. 32% in those aged 18–25; $P < 0.001$) [Figure 1].

Prevalence of hypertension and pre-hypertension in previously undiagnosed patients

Pre-hypertension was observed in 80,625 (23.2%) of the 346,799 study subjects, while only 56,113 (16.2%) had normal BP records. The prevalence of pre-hypertension increased with age (13.3% in the age group 18–25 years vs. 44.8% in the 66–75 year age group, $P < 0.001$). Pre-hypertension was more prevalent in men than women (24.0% vs. 22.5%, $P < 0.001$) but the gender differences were inconsistent through the age groups [Figure 2]. Most subjects (69,679 of 80,625; 86.5%) had both systolic and diastolic BP levels in the pre-hypertension range, 3656 (4.5%) had only systolic and 7290 (9%) had only diastolic.

Blood pressure levels in the hypertensive range were observed in 4618 (1.3%) of the 346,799 subjects who had no previous diagnosis of hypertension and were not taking antihypertensive medications. Figure 3 summarizes the prevalence of hypertension, suspected hypertension and pre-hypertension according to age group in the 426,033 subjects who were older than 18.

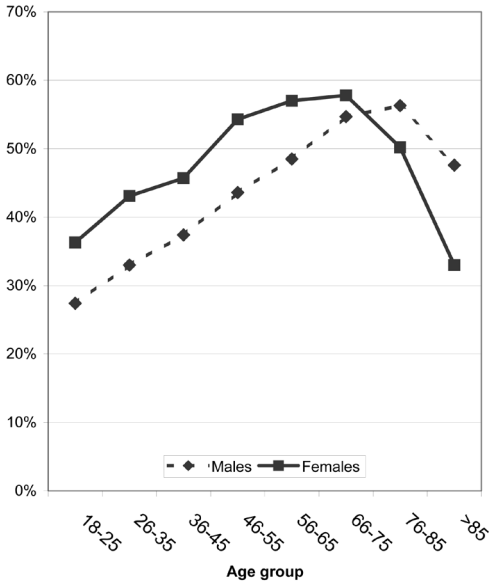


Figure 1. Rate of blood pressure measurements in the studied population (346,779 subjects), according to age group and gender

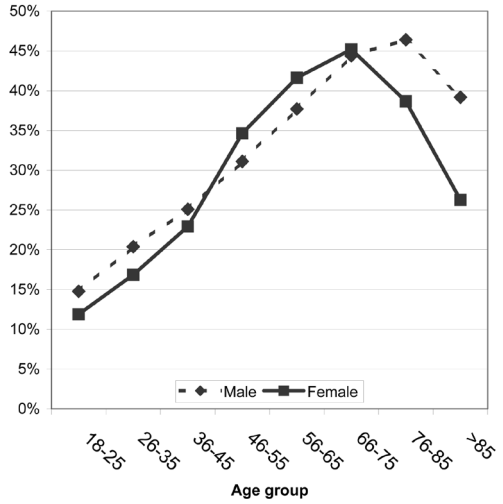
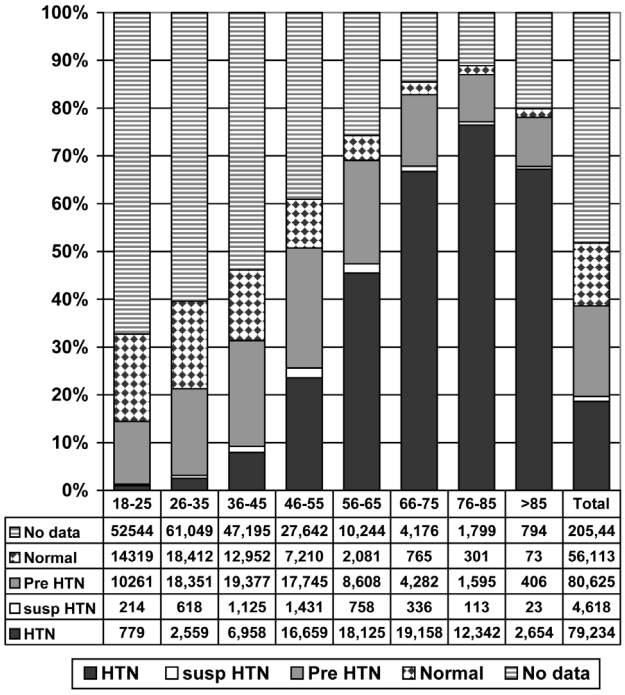


Figure 2. Rate of pre-hypertension in the studied population (346,779 subjects), according to age group and gender

Discussion

In this large nationwide cohort the prevalence of known hypertension was 18.6%. This rate is lower than expected [2], but it includes only those who were diagnosed or treated for hypertension. Blood pressure levels in the hypertensive range were observed in 4618 of 141,356 subjects who did not have a history of hypertension in their records. Applying this rate of hypertension to 205,443 subjects whose BP was not measured in the last 2 years will identify 6574 more subjects with BP levels in the hypertensive range. This calculation allows us to estimate



	18-25	26-35	36-45	46-55	56-65	66-75	76-85	>85	Total
No data	52544	61,049	47,195	27,642	10,244	4,176	1,799	794	205,44
Normal	14319	18,412	12,952	7,210	2,081	765	301	73	56,113
Pre HTN	10261	18,351	19,377	17,745	8,608	4,282	1,595	406	80,625
susp HTN	214	618	1,125	1,431	758	336	113	23	4,618
HTN	779	2,559	6,958	16,659	18,125	19,158	12,342	2,654	79,234

Figure 3. Rate of hypertension, suspected hypertension and pre-hypertension, according to age group in the entire cohort (426,033 subjects)

that the prevalence of hypertension in Israel is about 21%, which is still lower than in most western countries [2].

An additional 23.2% of the population who did not have a diagnosis of hypertension had measurements in the pre-hypertension range. This figure may represent only the tip of the iceberg, especially in the younger age groups where the rate of BP measurement was low. On the other hand, patients who visited a physician and had their BP measured may represent a sicker subpopulation. Our study shows that pre-hypertension may be very common in the population, even in young subjects. Since the risk for cardiovascular morbidity and mortality is linearly related to blood pressure levels starting from 115 systolic and 75 mmHg diastolic [9], identifying subjects with pre-hypertension is important. Implementing lifestyle modifications may prevent the development of hypertension in these subjects.

In a recent report the prevalence of pre-hypertension was 31% and was more common in men than in women [5]. While repeated blood pressure measurements are necessary to establish the diagnosis of hypertension or pre-hypertension, even one elevated measurement is significant and requires further follow-up. Moreover, we recently showed in a group of young pilots that even one elevated blood pressure measurement predicts the development of hypertension [8].

Progression from pre-hypertension to stage 1 hypertension was found to be positively related to age, male gender, higher waist circumference, and having parents with hypertension [9]. Regression from pre-hypertension to normal was more common in females and in the younger age groups [9].

The rate of blood pressure recordings was low overall (40.8%), the lowest rate being in young subjects. This may be related either to the fact that young subjects are usually healthy and do not come to the clinic, or to the belief that hypertension is very rare in the young population and that measuring BP is therefore not necessary. In addition, most young patients visit the clinic because of trivial inter-current diseases, and the time allotted for the appointment is not sufficient for BP measurement.

Our findings emphasize the need for BP measurements even in young so-called healthy subjects. Only a case-finding approach that will require BP measurement in every young subject who comes to the clinic will increase the rate of BP recordings. The rate of BP recordings was higher in females than in males and higher in elderly subjects than in young subjects. This may reflect the higher rate of visits to family physicians for women than for men as well as a higher rate for the elderly than for the young [10]. However, even in elderly women the rate of BP recordings was unsatisfactory. In the elderly, it may be related to time-consuming BP measurements since many elderly patients are very slow in their movements. Alternatively, many elderly patients, especially the very old, are unable to come to the clinics and therefore there is no record of blood pressure in their charts.

Limitations

The diagnosis of pre-hypertension was based on one measurement in the clinic and may be an overestimation of the true prevalence of pre-hypertension, and on some occasions can be attributed to the "white coat" effect. On the other hand, one measurement of normal blood pressure does not ensure normotension.

Our blood pressure measurements represent unequally the "healthy" population and patients with chronic diseases. Because of this we expect that there will be a bias to measure and document pre-hypertension in patients with diabetes, ischemic heart disease and other cardiovascular diseases.

Conclusions

Pre-hypertension may be very common even in young subjects. Whatever the reason, the rate of BP measurements is low and should be improved. We recommend the implementation of a program that will emphasize routine BP measurements and confirmation of the findings in recurrent measurements in all age groups in primary care clinics. Such a program may identify subjects with pre-hypertension and target them for treatment to prevent the development of hypertension and cardiovascular diseases.

References

1. The sixth report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. *Arch Intern Med* 1997;157:2413–46.
2. Wolf-Maier K, Cooper RS, Banegas JR, et al. Hypertension prevalence and blood pressure levels in 6 European countries, Canada, and the United States. *JAMA* 2003;289:2363–9.
3. Vasan RS, Larson MG, Leip EP, et al. Impact of high-normal

blood pressure on the risk of cardiovascular disease. N *Engl J Med* 2001;345:1291–7.
4. Chobanian AV, Bakris GL, Black HR, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA* 2003;289:2560–72.
5. Greenlund KJ, Croft JB, Mensah GA. Prevalence of heart disease and stroke risk factors in persons with prehypertension in the United States, 1999-2000. *Arch Intern Med* 2004;164:2113–18.
6. Russell LB, Valiyeva E, Carson JL. Effects of prehypertension on admissions and deaths: a simulation. *Arch Intern Med* 2004;164: 2119–24.
7. Wang Y, Wang QJ. The prevalence of prehypertension and hypertension among US adults according to the new Joint National Committee Guidelines: new challenges of the old problem. *Arch Intern Med* 2004;164:2126–34.
8. Grossman A, Grossman C, Barenboim E, et al. Pre-hypertension is common and predicts the development of hypertension in young active males. *Am J Hypertens* 2004;17:39A.
9. Chiu YH, Wu SC, Tseng CD, Yen MF, Chen TH. Progression of pre-hypertension, stage 1 and 2 hypertension (JNC 7): a population-based study in Keelung, Taiwan (Keelung Community-based Integrated Screening No. 9). *J Hypertens* 2006;24:821–8.
10. Schappert SM, Nelson C. National Ambulatory Medical Care Survey: 1995-96 summary. *Vital Health Stat* 13 1999;142:1–122.

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