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

Eliezer Kitai MD1,2**, Shlomo Vinker MD2**, Lea Halperin3, Avraham Meidan MD1 and 
Ehud Grossman MD4

1 Department of Family Medicine, Leumit Health Services, Tel Aviv, Israel
2 Department of Family Medicine, Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel
3 Medical Informatics Unit, Leumit Health Services, Tel Aviv, Israel
4 Department of Internal Medicine D and Hypertension Unit, Sheba Medical Center, Tel Hashomer, and Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel

Key words: hypertension, pre-hypertension, prevalence, blood pressure

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.

IMAJ 2007;9:8–11

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
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 (1.6%) 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 1–55 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 \( \leq 75 \) 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.

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

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

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

![Figure 3. Prevalence of hypertension, suspected hypertension and pre-hypertension according to age group in the 426,033 subjects who were older than 18](image)
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


Correspondence: Dr. S. Vinker, P.O. Box 1423, Ashdod 77042, Israel.

To understand the heart and mind of a person, look not at what he has already achieved, but at what he aspires to

Kahlil Gibran (1833-1931), Lebanese mystic, poet and artist

Capsule

Viral host exploitation

Human immunodeficiency virus type-1 (HIV-1) is a retrovirus and uses reverse transcription to generate DNA, which enters the nucleus to integrate with the host DNA. The latter process is catalyzed by a virally encoded integrase enzyme, and this latent reservoir represents a major obstacle to the treatment of HIV disease. The transcriptional co-activator LEDGF/p75 (p75) binds the HIV-1 integrase protein and protects it from degradation by the cell’s proteasomal machinery. Llano and colleagues (Science 2006;314:461) show that p75 plays a crucial role in viral integration by acting as tether between the integrase and chromatin. For the case of baculovirus replication, Goley et al. (p. 464) now find that this process requires the redistribution of the actin cytoskeleton into the nucleus of infected cells. Autographa californica induces nuclear actin assembly by recruiting the host actin-nucleating Arp2/3 complex into the nucleus and activating it with p78/83, a Wiskott-Aldrich syndrome (WASP)-like viral protein. This unanticipated role for the assembly of actin in the nucleus may play a role in the action of other pathogens.

Eitan Israeli

Applications for 5th Annual Nash Family Foundation Medical Fellowships Now Available

Nash Family Foundation (NFF) is accepting applications for its 2007 Medical Training Fellowship. The program is designed to support Israeli hospitals and medical centers by providing short-term (1-3 months) professional training to English-speaking Israeli physicians for continued study at North American medical centers.

Applications must be postmarked by March 15, 2007. Applications and instructions may be downloaded from our website: www.nashff.org or www.nashfamilyfoundation.org. You may also contact Nash Family Foundation to obtain an application.

Email: info@nashff.org; Telephone: (212) 221-9491.