

primary prevention of hypertension, and have begun to apply these findings for therapeutic and preventive purposes. These significant achievements are aspects of the legacy of George Pickering.

2. If the findings and inferences presented here are sound, then we do indeed have a significant body of knowledge about environmental factors causing high blood pressure. May I ask you therefore to consider: Is it correct to continue to call most cases of high blood pressure essential hypertension, that is, hypertension of unknown cause? Has not the time come to retire this term, a term that binds and limits us, for -- after all -- what can we really do to break links in the chain of causation when causation is unknown?! I suggest for your consideration the term primary hypertension, that is, hypertension without demonstrable causative organ system abnormalities -- and an end to the term essential hypertension.

those in Group I needing antihypertensive drugs, and in contrast to those in Groups II and III.

Next slide please. For those Group I persons off treatment throughout the four years of the trial, mean diastolic and systolic pressures were well within the normotensive range, but about 4 mm Hg higher than for Group III.

These data, in our judgement, lend strong support to the concept that practical nutritional measures have an important role to play in the long-term management of persons with hypertension, especially the most frequent form of hypertension, DBP 90-104 mm Hg.

Finally, on the "question of questions", ability of nutritional-hygienic measures to contribute to the primary prevention of hypertension: Our first experience in this regard was in the already cited Chicago Coronary Prevention Evaluation Program -- next slide please. At the end of its months-long control period, 70 men in this cohort had high-normal diastolic pressures (80-89 mm Hg) and were overweight. They were active in the Program for at least five years. Again, sustained moderate weight loss with a fat-modified diet and slowing of the pulse were associated with a sustained fall in blood pressure. In the absence of a randomly assigned control group, relationships between these changes were assessed by regression analysis. Both change in weight and change in pulse were significantly and independently related to change in blood pressure.

Several years ago our group launched a randomized controlled trial on the primary prevention of hypertension by nutritional-hygienic means. This research involves 201 people age 30-44 at entry, assessed to be hypertension-prone because of high-normal mean DBP, overweight, rapid

13 mm Hg for systolic and 10 mm Hg for diastolic on the average. However, caution is indicated: the trial involved no randomly assigned control group. The best that could be done under that circumstance to assess relationship of intervention changes to blood pressure was a within-group regression analysis. This showed a strong significant relationship of change in weight to change in blood pressure, but not change in pulse.

Encouraged by these findings, our group -- primarily at the initiative of Rose Stamler -- in 1979 undertook a long-term randomized controlled trial on ability to treat established hypertension by nutritional means. This Hypertension Control Program involved hypertensive people in Chicago and Minneapolis who at that time had just completed their years-long participation in the Hypertension Detection and Follow-up Program. The design of our new 2-center trial is shown in the next slide: 189 people were randomized to 3 groups -- group I, the active intervention group, counselled in regard to weight reduction, decreased sodium intake, and avoidance of heavy drinking, and, after two months, taken off antihypertensive drugs; Group II -- a control for group I -- also taken off drugs two months after randomization, but with no nutritional recommendations; Group III -- another control group -- continued on HDFP drug regimen, without nutritional counselling; Groups I and II monitored closely and returned to drug treatment if blood pressure rose to hypertensive levels (clearly defined). Intervention goals for Group I were moderate: reduction of weight by 10 lbs; decrease in sodium intake to <1800 mg/day; no more than 2 drinks/day.

Next slide please. As expected, randomization produced groups closely comparable at baseline. The normal baseline blood pressure levels of

electrolyte homeostasis were essentially, centrally, significantly, and independently involved in the etiology and pathogenesis of hypertension. Next slide please. I aligned myself then with the Yellow Emperor, with Ambard and Beaujard, Allen, and others -- and to this day remain so aligned. The problems of decisively demonstrating this relationship in our general populations have been and remain formidable, given that everyone is exposed to high sodium intake, and further that valid quantitative assessment of degree of habitual exposure is difficult. Given these problems, I deem as highly relevant -- next slide please -- the several sets of data on the virtual absence of increase of blood pressure with age and the virtual absence of hypertension among preliterate isolated populations who retain the traditional human habit of our food gatherer-hunter pre-history, that is, they do not add salt to food, a habit first acquired -- necessarily, for food preservation -- with the Neolithic Revolution, that is, with the invention of agriculture and animal husbandry (food production), about 10,000 years ago. A previous slide showed the favourable blood pressure distribution for nomads in Kenya, ingesting low levels of sodium. These data from the Solomon Islands, collected by Lot Page and colleagues, are in my judgement also very illuminating. Only among the Lau, of six Solomon Island preliterate groups, was there any hypertension -- the Lau, who cooked their food in brackish water from the Pacific lagoon, the only group with other than a low sodium intake.

I share the judgement that 1-4 million years of human evolution adapted our species to sodium conservation. Consequently, most of us are not optimally adapted for the ready and innocuous handling of a high intake of sodium added to food, day after day, repeatedly three or more times every day.

armamentarium -- for people on antihypertensive medication, for others to control elevated blood pressure without drugs, and for the population at large, to shift the entire distribution of blood pressure and other major risk factors downward, as illustrated in the next slide (I am indebted to Professor Geoffrey Rose for this slide). That is, nutritional-hygienic measures involving the whole population are essential for a total attack on the blood pressure problem that includes as a basic goal its ultimate solution, the primary prevention of high blood pressure.

Inevitably these considerations bring us to George Pickering's theme of the "...influence of environmental factors, which ... seem to be of great importance ... ", i.e., the specifics of nutritional-hygienic approaches, and the scientific foundation we presently have for using them -- the second topic of this presentation. Given the time available here today, I will deal only with three nutrition-related variables -- variables that in my judgement are established as risk factors for high blood pressure and can be safely addressed for purposes of the primary and secondary prevention of hypertension in the general population. The next slide please. The first is caloric imbalance and resultant overweight. In country after country in the modern world, industrialized and developing, the greater the relative weight, by whatever index, the greater the prevalence of hypertension. The slide illustrates with baseline data from the Chicago Heart Association Detection Project in Industry--a multifactorial analysis showing that relative weight was related strongly and significantly to prevalence of hypertension, for both sexes and two age groups, independent of several other variables. Pulse also was significantly related to hypertension -- a matter I will return to later. Next slide please. Prospective data further

persons with high blood pressure, as data from placebo-controlled trials of drug treatment for so-called "mild" hypertension have clearly demonstrated. May I have the next slide please. These are typical data, from the U.S. Public Health Service Hospitals Trial of persons in young adulthood and early middle age with uncomplicated "mild" hypertension at baseline, followed for 7-10 years. Fully 46% of those assigned to the placebo group had one or another morbid event -- subclinical or clinical -- while on placebo. This high overall risk was meaningful not only because a proportion of it involved clinical illness, hospitalization, etc. In addition, all of it -- including development of severe hypertension, of ECG abnormalities, etc. -- entailed shift to a new and higher level of risk. And once that shift has taken place, optimal control of blood pressure cannot reduce risks of major catastrophic events to the lower level prevailing for persons with hypertension treated before target organ damage has occurred. The next slide -- from the HDFP -- typically documents this important fact.

To conclude on this first point, the facts are:

1. Even with so-called "mild" blood pressure elevations, long-term risks of premature catastrophic events are substantial.
2. With no treatment for years, a high proportion of people with so-called "mild" hypertension experience morbid events that shift them to new, higher, and only partially reversible levels of risk.
3. Risks are compounded in the majority of people with elevated blood pressure by other life-style-related risk factors, particularly hypercholesterolemia and cigarette smoking.

the largest set of standardized blood pressure measurements from a prospective study. May I have the next slide please. These are data resulting from the recruitment effort of the Multiple Risk Factor Intervention Trial, primary screening at 22 centres across the United States, involving over 361,000 men age 35-57, 351,000 of them free at baseline of a history of hospitalization for myocardial infarction and of drug treatment for diabetes. These are data on the relationship of baseline diastolic pressure to 5-year mortality from coronary disease. The population was divided into quintiles of diastolic pressure, about 70,000 men per quintile. Note that the cut point for the lowest quintile was 75 mm Hg, and that for all other quintiles the 5-year CHD death rate was progressively higher than for the first -- by 22%, 33%, 75%, and 152% for quintiles 2, 3, 4, and 5 respectively. The findings were similar for the cardiovascular diseases and all causes mortality end points, and applied also when the independent variable was systolic pressure. These data unequivocally confirm that the problem of blood pressure levels higher than optimal is a population-wide problem among our adults, a problem of the great majority -- not just of a minority with definite hypertension by current clinical criteria.

With these large numbers, it was also possible to examine in depth the impact of other major risk factors on prognosis for persons with high blood pressure -- next slide please. For the men with baseline DBP equal to or greater than 90 mm Hg (100,000 of the cohort of 350,000), risk of death from CHD was strongly related to serum cholesterol level, over the range of the quintiles of serum cholesterol -- increased for quintiles 2, 3, 4, and 5 by 30%, 91%, 100%, and 213% respectively compared to quintile 1. The findings

"A restatement of the facts would define essential hypertensives as that group of the population with arterial pressure exceeding a certain value arbitrarily selected and in whom no specific cause can be detected to account for the high pressure. It is suggested that the factors causing it are factors operating generally on the population. Of these factors the contributions of age, sex, and inheritance can be defined approximately. The influence of environmental factors, which seem by exclusion to be of great importance, remains to be explored."

My presentation here today deals with three areas directly related to the seminal concepts of Sir George:

1. The population distribution of blood pressure, the relationship of blood pressure to risks of morbidity and mortality, and the need for nutritional-hygienic approaches to the control -- and to the primary prevention -- of hypertension;
2. Contemporary knowledge about environmental factors influencing blood pressure, and implications for nutritional-hygienic approaches to treatment and prevention of hypertension;
3. Experiences in trials on nutritional-hygienic approaches to treatment and prevention of hypertension.

During the last 25 years, prospective epidemiologic studies in populations in many countries have abundantly confirmed Pickering's basic concepts that blood pressure is unimodally distributed in the general population, and that the relationship of blood pressure to risk is a continuous one, so that any