Hypertension Risk Prediction
An Important But Complicated Assessment

Daniel T. Lackland

Hypertension has been recognized for decades as a major predictor of adverse outcomes, including stroke, heart failure, end-stage renal disease, heart disease, and peripheral vascular disease. These disease risk estimates are the key components for the development and implementation of prevention, treatment, and control guidelines with a general theme of lower blood pressure levels associated with less adverse events.\(^1\) The public health burden from high blood pressure and the process to design interventions are further complicated by the high proportion of the population affected (=1 in 3 adults), a linear increase with age, and disproportionately higher rates for segments of the population, such as blacks and Hispanics.\(^2\)

Changes in awareness, treatment, and control of hypertension can be assessed and monitored in the population with a series of cross-sectional observational studies. Although these prevalence rates can be determined from single measurements in time, hypertension management and prevention strategies are dependent on incidence rates and the disease progression. These evidence-based guidelines are dependent on incidence and progression rates of high blood pressure derived from longitudinal cohort studies. For example, the residual lifetime risk for developing hypertension for 55- to 65-year-old subjects determined from the Framingham Heart Study cohort is 90%.\(^3\) Thus, interventions should be designed to delay the onset of elevated blood pressure, and the methods of determining the risk of hypertension are important in the development of intervention strategies.

In this issue of Hypertension, Muntner et al\(^4\) present the comparison of 2 models for determining risk prediction of hypertension. The investigators used the cohort from the well-designed Multi-Ethnic Study of Atherosclerosis, concluding that the Framingham Heart Study prediction model for estimating hypertension risks for an individual was not significantly better than using systolic blood pressure alone. These results provide valuable information in support of aggressive individual and population-based approaches to lower systolic blood pressure. In addition, the authors have applied the models to different race and ethnic groups.

However, the study has a significant limitation: nearly half of the Multi-Ethnic Study of Atherosclerosis cohort \((n=6814)\) was excluded from the current analyses as having hypertension at the baseline measurements. The exclusion because of existing high blood pressure was disproportional by race, with 49% of the white Multi-Ethnic Study of Atherosclerosis participants and 49% of Asians included in the analyses compared with only 31% of the blacks in the cohort.\(^5\) The disparities in the exclusion rates are indicative of the earlier onset of hypertension and higher rates for blacks. These findings might also be attributable in part to a faster progression to higher blood pressures. Likewise, these individuals may have developed hypertension at a younger age and, thus, would have functioned with elevated blood pressure for a longer period of time with increased risks of complications.

Nonetheless, the progression rates for these high-risk individuals are essential in the design of intervention and high blood pressure management protocols. As an example, recommendations regarding the frequency of blood pressure measurement in the clinic setting are dependent on an accurate estimate of hypertension incidence.\(^6\) For nonhypertensive individuals, the rate of high blood pressure progression will determine the frequency of assessment. Thus, the application of an incidence rate for all nonhypertensives might direct an inadequate frequency of measurements for a high-risk individual.

Further complicating the assessment of elevated blood pressure progression is the age for determining the incidence of hypertension. Muntner et al\(^4\) recommend future studies in populations <45 years of age to validate the hypertension prediction model. Although this is an appropriate recommendation, more specific age groups need to be defined. Significant prevalence rates of prehypertension and hypertension have been reported in adolescents.\(^7\) Rosner et al\(^8\) completed a pooled analysis of children and adolescents \(\approx17\) years of age and found hypertension in 6% and prehypertension in another 15% of the study population. The racial disparities in prevalence rates found in adult blood pressures were also evident in this younger group. Furthermore, adult and adolescent blood pressure levels have been proposed as having origins in fetal and early life.\(^9\) Therefore, the determination of high blood pressure progression rates by different age groups and different high-risk groups should be assessed to have a comprehensive understanding of the population hypertension risks.

Muntner et al\(^4\) have identified a relatively simple model for determining hypertension risks but have also determined the need for additional critical data that is complicated to obtain. High blood pressure intervention and prevention interventions require accurate estimates of hypertension incidence and progression. However, because these rates must be determined for different age and demographic groups, the magnitude of completing such assessments is logistically and economically chal-
lenging for the establishment of the number of new cohort studies needed. These important assessments might rather be used in existing studies with longitudinal measurements, such as the Multi-Ethnic Study of Atherosclerosis.

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