The development of effective pharmacological strategies for lowering blood pressure was one of the major success stories of the 20th century in medical science. Blood pressure was proven beyond doubt to be causally and continuously related to future risk of cardiovascular events, and lowering blood pressure was proven to reduce that risk. Pooled data from randomized trials collectively showed that lowering systolic blood pressure by 10 mm Hg reduced coronary heart disease risk by approximately one quarter and risk of stroke by approximately one third, irrespective of previous disease history, initial blood pressure level, or the type of agent used. These studies also demonstrated that more intensive blood pressure lowering resulted in additional risk reduction, with the benefits proportional to the size of the fall in pressure.

The opinion expressed in this article are not necessarily those of the editors or of the American Heart Association.

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Editorial

Blood Pressure Management in the 21st Century
Maximizing Gains and Minimizing Waste

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In the face of such impressive evidence, it is perhaps both surprising and disappointing that elevated blood pressure today remains the leading cause of the global disease burden:

>9 million people die each year from this cause. Although population-level blood pressure values have been declining in some high-income countries, the size of that decline is modest and highly variable by region. More worryingly, however, is the observation that blood pressure levels seem to increase in most low- and middle-income countries. Additionally, the clinical management of high blood pressure remains less than adequate in most countries, rich and poor. Recent global estimates suggest that less than half of those who have elevated blood pressure (defined as blood pressure >140/90 mm Hg) are aware of it, and, of those who are receiving pharmacological treatment, only one third have blood pressure levels <140/90 mm Hg. In view of such profound shortcomings in the control of high blood pressure and its associated cardiovascular risks, it is important to reconsider the prevailing strategies for clinical management.

The question of how to manage continuous risk factors, such as blood pressure, to gain maximal benefits for individuals as well as societies has been a matter of debate ever since the British epidemiologist Geoffrey Rose published an article entitled “Sick Individuals and Sick Populations” in 1985. He argued that targeting interventions to whole populations would prevent more adverse events than treating smaller groups of high-risk individuals. This is because single risk factors are rarely accurate enough in predicting future risk for individuals. For example, for a binary risk marker to provide good discrimination between those who will suffer an event from those who will not, the odds ratio of that marker with the outcome would need to be greater than 9, which is of course not the case for any usual definition of elevated blood pressure. A related issue is that blood pressure is not a binary risk factor. The risk of cardiovascular disease increases progressively as blood pressure levels increase, with no apparent threshold beyond which one could safely classify individuals as normotensive or hypertensive. On average, although people who have higher blood pressure levels are more likely to suffer an event, a very large proportion of events will still occur in those with so-called normal blood pressure simply because there are so many more of them. Consequently, if we were able to reduce blood pressure levels modestly across the whole population, we would potentially prevent more events than if we were to focus our efforts on intensive management of a small group of hypertensive patients.

The principal of Rose’s argument for treating populations as opposed to individuals is still as relevant today as it was 30 years ago. In fact, this population-based strategy remains the most viable option for many important public health interventions, such as policies designed to reduce tobacco use, trans fatty acid intake, and salt consumption, which target individuals only indirectly. However, for drug-based interventions, the merits of population-based interventions are less certain because side effects are not infrequent, and many, if not most, would be unconvinced by the expected absolute benefits for any one individual. So, if pharmacological treatment of whole populations is not an option, then we need alternative strategies by which to decide whom to screen and whom to treat.

Approaches to the selection of at-risk individuals are wide ranging, from crude and simple rules that would result in recommendations to treat all above a certain age to highly precise algorithms that would provide treatment to a very small group of high-risk individuals.

In this issue of Circulation, Sussman et al report a simulation study in which they compare the effect of two strategies for selection and treatment of at-risk patients along the spectrum of risk. The first strategy is the widely recommended treat-to-target (TTT) approach in which antihypertensive treatment for hypertensive patients is initiated and titrated toward a fixed blood pressure target of 140/90 mm Hg (unless...
As disutility increases, in a risk-based approach less people will be exposed to treatment and hence the superiority of BTT becomes more pronounced. Other changes to the model inputs, such as increasing the accuracy of blood pressure measurement or lowering the drug-adherence rates (in both strategies), similarly did not change the relative superiority of BTT substantially either.

So what are the implications of this simulation study for clinical practice and research? This study, together with evidence from previous research, supports the concept of treating cardiovascular risk as opposed to individual risk factors, such as blood pressure and cholesterol. The findings are very timely given that some of the international blood pressure guidelines have departed recently from such risk-based strategies. With ever-increasing accuracy and precision in the estimation of disease risks and treatment benefits, we can expect risk-based management strategies to become even more powerful. For example, randomized comparisons (eg, from large individual patient data meta-analyses) will provide more granular information about the safety and efficacy of specific antihypertensive drugs in specific subgroups of patients for different types of outcomes. Conversely, large-scale observational studies investigating the utility of new biomarkers, both phenotypic and genotypic, will help improve the accuracy of existing risk calculators. However, the challenge of maximizing benefits of preventive therapies for individuals as well as societies will not be solved by developing better risk engines alone, even if these are recommended by clinical practice guidelines.

Previous research suggests that cardiovascular risk calculators are not widely used, partly because many clinicians find risk calculation too time consuming and remain unconvinced of the value of the information derived. The use of innovative technologies and processes, such as automated data-capture systems and better techniques for risk visualization, could minimize user burden and facilitate communication of risks and uncertainties to patients and their families.

Similar tools could also make information directly accessible to consumers, which might well increase their engagement, as well as that of their healthcare providers. Ultimately, a scenario could be envisaged in which there was seamless linkage between data capture, risk and benefit estimation, and clinical practice guidelines, resulting in the routine provision of personalized guidance for care that is both evidence based and cost effective. However, given that the introduction of such innovative models in complex healthcare environments can have multiple intended and unintended effects, appropriately designed studies are needed next to evaluate the actual effects of such system changes before more general recommendations are made.

The findings of Sussman et al will challenge current blood pressure guidelines and their recent departure from risk-based approaches. The case to move on from blood pressure targets to risk-based targets is (and has always been) compelling, but bringing about actual change in the clinic requires much more work. An important part of this involves the development of innovative strategies by which to more effectively incorporate risk-based management approaches into usual clinical practice.
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Disclosures

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References


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