Developing Hypertension Guidelines: An Evolving Process

Theodore A. Kotchen

Hypertension guidelines provide up-to-date information and recommendations for hypertension management to healthcare providers, and they facilitate translation of new knowledge into clinical practice. Guidelines represent consensus statements by expert panels, and the process of guideline development has inherent vulnerabilities. Between 1977 and 2003, under the direction of the National Institutes of Health (NIH), the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC) issued 7 reports. The evolution of the JNC recommendations reflects the acquisition of observational and clinical trial data and the availability of newer antihypertensive drugs. Despite 5 years in preparation, NIH did not release a JNC 8 report and recently made the decision to withdraw from issuing guidelines. The responsibility for issuing hypertension-related guidelines was transferred to the American Heart Association (AHA) and the American College of Cardiology. Without the endorsement of the NIH or the AHA, JNC 8 committee members recently published their guideline report. Notably, there have been discrepancies of JNC recommendations over time as well as discrepancies with recommendations of other professional organizations. The Institute of Medicine recently recommended criteria for “trustworthy” guidelines. Criticisms of the guideline process, and of the guidelines themselves, should not obscure their likely contribution to improved hypertension control and to decreases of mortality rates of stroke and cardiovascular disease over the past several decades. Nevertheless, translation of guidelines into clinical practice remains a challenge.

Keywords: blood pressure; clinical guidelines; evaluation and treatment of hypertension; hypertension; JNC.

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EVALUATION OF JNC REPORTS

The first JNC report was issued in 1977.1 Based on limited clinical trial data, JNC 1 recommended that “virtually all persons with a diastolic blood pressure ≥105 mm Hg be treated with antihypertensive drug therapy.” For persons with diastolic blood pressures of 90–104 mm Hg, the recommendation was to individuate drug therapy, giving consideration to other risk factors. The report emphasized that the benefits of treatment of systolic blood pressure are unclear,” and in the early JNC reports there were no recommendations for classifying or treating systolic blood pressure (Table 2). The recommended drug strategy was a “stepped-care” approach, ordinarily beginning with a “thiazide-type diuretic” and subsequently adding additional available drugs, as necessary.

Subsequent JNC reports have modified guidelines for defining and treating hypertension, based on newer understandings of pathophysiology, actuarial considerations of the life insurance industry, studies of blood pressure in diverse populations, consideration of the interaction of blood pressure with comorbid conditions, and the development of effective antihypertensive agents. The updated reports have recommended progressively more rigorous criteria for defining and treating hypertension.

In patients with moderate and severe hypertension, the early reports acknowledged that a more limited blood pressure goal might have to be accepted. In JNC 2, drug therapy was ordinarily beginning with a “thiazide-type diuretic” and subsequently adding additional available drugs, as necessary.
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was advocated for persons with diastolic blood pressures >104 mm Hg and possibly for patients with “mild hypertension” (diastolic blood pressure 90–104 mm Hg) in the presence of target organ disease or increased cardiovascular risk. A stepped-care approach, similar to that recommended in JNC 1, was advocated. At each step, the recommendation was to gradually increase the dose of agents until blood pressure control was attained, “intolerable” side effects occurred, or the maximum dose was achieved.

JNC 3 continued to define therapeutic goals on the basis of diastolic blood pressure, reporting that “…evidence for elevated levels of systolic blood pressure awaits the results of ongoing clinical trials.” Nevertheless, classification of blood pressure acknowledged the importance of systolic blood pressure (Table 3). Nonpharmacological therapy was advocated for patients with diastolic blood pressure of 90–94 mm Hg who were otherwise at low cardiovascular risk. For patients with diastolic blood pressure >94 mm Hg, a stepped-care approach for antihypertensive drugs, beginning with either a diuretic or beta blocker, was again recommended. An additional recommendation was to individualize drug therapy for individuals with diastolic blood pressures of 90–94 mm Hg (despite lifestyle interventions) and individuals with isolated systolic hypertension.

For patients with persistent diastolic blood pressures of 90–94 mm Hg after nonpharmacological therapy, JNC 4 allowed some flexibility about initiating drug therapy; however, drug therapy was recommended for patients with target organ disease or increased cardiovascular risk. Similar to earlier JNC reports, JNC 4 also recommended a stepped-care approach. However, following nonpharmacological approaches, the initial step for drug therapy was more flexible (diuretic, beta blocker, calcium antagonist, or angiotensin-converting enzyme (ACE) inhibitor) than JNC 3. The new emphasis was to individualize the selection of an initial drug, based on patient demographics, comorbidities, and other risk factors. An additional recommendation was to combine small doses of antihypertensive drugs with different mechanisms of action, using the stepped-care approach, to maximize effectiveness and minimize the potential for dose-dependent side effects. In part, this strategy reflected the increasing availability of newer agents and the recognition that the goal of therapy is not simply to lower blood pressure, but also to protect organ function.

JNC 5 proposed a new classification system for hypertension (Table 4).

### Table 1. Blood pressure goals for hypertension control, JNC 1–JNC 7

<table>
<thead>
<tr>
<th>Report number (year of publication)</th>
<th>Committee chair</th>
<th>BP Goal (mm Hg)</th>
<th>Examples of seminal studies/influential reports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (1977)</td>
<td>Marvin Moser</td>
<td>DBP &lt;90</td>
<td>8</td>
</tr>
<tr>
<td>2 (1980)</td>
<td>Iqbal Krishan</td>
<td>a. DBP &lt;90</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. DBP 90–100</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>for individuals with moderate or severe hypertension</td>
<td></td>
</tr>
<tr>
<td>5 (1993)</td>
<td>Ray Gifford</td>
<td>BP &lt;140/90</td>
<td>18, 19</td>
</tr>
<tr>
<td>6 (1997)</td>
<td>Sheldon Sheps</td>
<td>BP &lt;140/90 and “lower if tolerated”</td>
<td>20–24</td>
</tr>
<tr>
<td>7 (2003)</td>
<td>Aram Chobanian</td>
<td>a. BP &lt;140/90</td>
<td>25, 26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b. &lt;130/80 in patients with diabetes or renal disease</td>
<td></td>
</tr>
</tbody>
</table>

**Abbreviations:** BP, blood pressure; DBP, diastolic blood pressure; JNC, Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure.

### Table 2. JNC 2 classification of hypertension

<table>
<thead>
<tr>
<th>Classification</th>
<th>Diastolic blood pressure (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratum 1 (mild)</td>
<td>90–104</td>
</tr>
<tr>
<td>Stratum 2 (moderate)</td>
<td>105–114</td>
</tr>
<tr>
<td>Stratum 3 (severe)</td>
<td>≥115</td>
</tr>
</tbody>
</table>

**Abbreviation:** JNC, Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure.

### Table 3. JNC 3 and JNC 4 classification of hypertension

<table>
<thead>
<tr>
<th>Classification</th>
<th>BP Range (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diastolic</td>
<td></td>
</tr>
<tr>
<td>Normal BP</td>
<td>&lt;85</td>
</tr>
<tr>
<td>High normal BP</td>
<td>85–89</td>
</tr>
<tr>
<td>Mild hypertension</td>
<td>90–104</td>
</tr>
<tr>
<td>Moderate hypertension</td>
<td>105–114</td>
</tr>
<tr>
<td>Severe hypertension</td>
<td>≥115</td>
</tr>
<tr>
<td>Systolic, when diastolic BP &lt;90</td>
<td></td>
</tr>
<tr>
<td>Normal BP</td>
<td>&lt;140</td>
</tr>
<tr>
<td>Borderline isolated systolic hypertension</td>
<td>140–159</td>
</tr>
<tr>
<td>Isolated systolic hypertension</td>
<td>≥160</td>
</tr>
</tbody>
</table>

**Abbreviations:** BP, blood pressure; JNC, Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure.
Table 4. JNC 5 classification of hypertension

<table>
<thead>
<tr>
<th>Classification</th>
<th>Systolic BP (mm Hg)</th>
<th>Diastolic BP (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt;130</td>
<td>&lt;85</td>
</tr>
<tr>
<td>High normal</td>
<td>130–139</td>
<td>86–89</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1 (mild)</td>
<td>140–159</td>
<td>90–99</td>
</tr>
<tr>
<td>Stage 2 (moderate)</td>
<td>160–179</td>
<td>100–109</td>
</tr>
<tr>
<td>Stage 3 (severe)</td>
<td>180–209</td>
<td>110–119</td>
</tr>
<tr>
<td>Stage 4 (very severe)</td>
<td>≥210</td>
<td>≥120</td>
</tr>
</tbody>
</table>

Abbreviations: BP, blood pressure; JNC, Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure.

“When systolic and diastolic pressures fall into different categories, the higher category should be selected to classify the individual’s blood pressure status.”

The design of studies completed before 1988. Based in part on the results of clinical trials, JNC 5 also emphasized the importance of systolic hypertension. JNC 5 also emphasized the importance of target organ damage and, in addition to controlling blood pressure, concurrently controlling other modifiable cardiovascular risk factors. Drug therapy was recommended for patients with systolic blood pressure of 140–149 mm Hg and diastolic blood pressure of 90–94 mm Hg after introducing lifestyle modifications and who also had target organ disease or other risk factors. As in earlier JNC reports, in the absence of target organ disease and other risk factors, “flexibility” about initiating drug therapy was advised for patients with blood pressures in these ranges. Also, similar to previous JNC reports, a stepped-care approach to drug therapy was recommended. However, in contrast to the more flexible step 1 strategy in JNC 4, JNC 5 recommended either a diuretic or beta blocker as the preferred step 1 choice, following the introduction of lifestyle modifications. As in JNC 4, the blood pressure goal was <140/90 mm Hg, with emphasis on early initiation of antihypertensive drug therapy in individuals with target organ damage and/or other risk factors. “Further reduction to levels of 130/85 mm Hg may be pursued, with due regard for cardiovascular function, especially in older persons.”

Classification of hypertension in JNC 6 was slightly different from that in JNC 5 (Table 5). Expanding on earlier JNC reports, JNC 6 placed more emphasis on absolute risk and benefit and used risk stratification as part of the treatment strategy. In persons with high normal blood pressure deemed to be at high risk (target organ damage/clinical cardiovascular disease and/or diabetes with or without other risk factors), initiation of drug therapy was recommended if blood pressure remained >140/90 mm Hg after lifestyle modifications. The report again recommended starting pharmacological therapy with diuretics or beta blockers for patients with uncomplicated hypertension but provided “compelling indications” for other specific agents in certain clinical situations (e.g., diabetes, congestive heart failure and systolic dysfunction, myocardial infarction, chronic renal insufficiency).

Table 5. JNC 6 classification of hypertension

<table>
<thead>
<tr>
<th>Classification</th>
<th>Systolic BP (mm Hg)</th>
<th>Diastolic BP (mm Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal</td>
<td>&lt;120</td>
<td>AND &lt;80</td>
</tr>
<tr>
<td>Normal</td>
<td>&lt;130</td>
<td>AND &lt;85</td>
</tr>
<tr>
<td>High normal</td>
<td>130–139</td>
<td>OR 80–89</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>140–159</td>
<td>OR 90–99</td>
</tr>
<tr>
<td>Stage 2</td>
<td>160–179</td>
<td>OR 100–109</td>
</tr>
<tr>
<td>Stage 3</td>
<td>≥180</td>
<td>OR ≥110</td>
</tr>
</tbody>
</table>

Abbreviations: BP, blood pressure; JNC, Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure.

Claude Lenfant, then director of NHLBI, commissioned JNC 7 to incorporate updated information about hypertension; provide “new, clear, and concise guidelines” for clinicians; and “simplify” the classification of blood pressure (Table 6). Due to the absence of clinical trial data, in contrast to JNC 6, JNC 7 did not use global risk assessment in making treatment decisions. Drug therapy was recommended for persons with blood pressure >140/90 mm Hg after lifestyle interventions and for blood pressure >130/80 mm Hg for persons with diabetes or chronic kidney disease. Thiazide diuretics were recommended as initial therapy for most patients with hypertension, unless there was a “compelling indication” for beginning with an agent of another class. The report suggested that most patients would require 2 or more agents to achieve blood pressure goals and recommended initiating therapy with 2 agents if blood pressure was >20/10 mm Hg above goal.

Throughout their evolution, the JNC reports have provided progressively more detailed information regarding patient evaluation, including recommendations for assessment of overall cardiovascular risk, target organ damage, and, in the later reports, suggestions for home blood pressure monitoring and ambulatory blood pressure monitoring. Over time, although recommendations for health-promoting lifestyle modifications have become more prominent, only scant information has been provided concerning strategies for implementing these recommendations.

Since the publication of JNC 7, a number of professional societies have developed recommendations for hypertension management. For example, in 2007, the American Heart Association (AHA) recommended a target blood pressure goal <130/80 mm Hg among those at high risk for coronary artery disease and individuals with diabetes, chronic kidney disease, or coronary artery disease or increased risk for coronary artery disease. In a “consensus statement” regarding goal blood pressure for hypertension control in blacks, the International Society for Hypertension in Blacks recommended a blood pressure goal of <135/85 mm Hg for primary prevention and a goal of <130/80 mm Hg for secondary prevention (individuals with target organ damage and/or additional cardiovascular disease risk factors). However, these recommendations for lower blood pressures have been criticized on the basis of insufficient evidence to
support them. In collaboration with several other professional societies, the American College of Cardiology (ACC) and the AHA jointly issued a “consensus document” on hypertension in the elderly. That report states, “Typically, formal recommendations are not provided in expert consensus documents as these documents do not formally grade the quality of evidence.” Nevertheless, this consensus document recommended a less aggressive target for blood pressure control (<145/90 mm Hg) in individuals aged >80 years.

**COMPARISON WITH EUROPEAN AND CANADIAN GUIDELINES**

To illustrate the nuances and complexities of guideline development, it is instructive to compare the evolution of JNC reports with hypertension guidelines jointly developed by other professional societies. In the 1970s, the World Health Organization (WHO)/International Society of Hypertension (ISH) began issuing guidelines, with periodic updates. The aim was to offer “balanced information” to guide clinical decision making rather than “rigid rules” to clinicians. Initially, similar to JNC, WHO/ISH also recommended a stepped-care approach to drug therapy, beginning with a diuretic. However, subsequent WHO/ISH reports expanded the recommendation for an initial drug to 1 of 5 different classes of antihypertensive agents (diuretic, beta blocker, ACE inhibitor, calcium antagonist, alpha blocker).

Prior to 2003, the WHO/ISH guidelines were endorsed by the European Society of Hypertension (ESH) and the European Society of Cardiology (ESC). However, suggesting that universal guidelines may not be reliable because countries vary in the availability of healthcare and economic resources, the ESH/ESC issued their first guideline statement in 2003. The intent was to be “informative and educational” rather than prescriptive. ESH/ESC issued updated guidelines in 2007, a reappraisal of these guidelines in 2009, and a new guideline statement in 2013. For the first time, the 2013 guidelines provided information about the strength of evidence supporting its various recommendations.

Similar to the JNC reports, the ESH/ESC guidelines recommend specific lifestyle interventions for prevention and treatment of hypertension. To a greater extent than JNC7, the ESH/ESC guidelines base clinical decision making on overall cardiovascular risk and target organ damage, including evidence of subclinical cardiovascular disease. In the 2003 guidelines, classification of hypertension was similar to that in JNC 7, and indications for ambulatory blood pressure monitoring and measurement of home blood pressure were suggested. Compared to 2003 guidelines, classification of hypertension changed only slightly in 2007, with no subsequent change in 2013. Although this classification is based on office blood pressure measurements, in these updates, ambulatory blood pressure monitoring and home blood pressure measurements received increasing attention as “adjuncts” for predicting cardiovascular risk.

In contrast to the JNC 7 recommendation that a diuretic be used as the initial drug in most hypertensive patients, the ESH/ESC guidelines indicate that major classes of antihypertensive drugs (diuretics, beta blockers, calcium antagonists, ACE inhibitors, angiotensin receptor blockers) are “suitable for initiation and maintenance of therapy.” The ESH/ESC guidelines emphasize that the benefit of antihypertensive therapy is primarily related to a reduction in blood pressure and that differences of cardiovascular morbidity and mortality among different classes of antihypertensive agents are small. Indications and contraindications for different classes of agents are reviewed, and the advantage of low-dose combination therapy with 2 agents is emphasized. Specific combinations of agents are recommended.

In the 2003 and 2007 guidelines, the goal of therapy was blood pressure <140/90 mm Hg and lower if tolerated. In 2003, the goal for diabetic patients was <130/80 mm Hg, and in 2007, this lower goal was also recommended for patients with a history of stroke, myocardial infarction, or renal dysfunction. However, the most recent ESH/ESC guidelines recommend a systolic blood pressure goal of <140 mm Hg for most patients, including patients with diabetes, previous stroke or transient ischemic attack, coronary heart disease, or chronic kidney disease. In individuals aged >80 years, a systolic blood pressure of 140–150 mm Hg is recommended. Also in the latest guidelines, a diastolic target of <90 mm Hg is always recommended, except in patients with diabetes, in whom values <85 mm Hg are recommended. The 2007 guidelines had recommended antihypertensive drug treatment for “high-risk” persons (because of diabetes, cardiovascular, or renal disease) with high normal blood pressures. In contrast, the 2013 guidelines recommend only lifestyle interventions for these groups of patients.

The Canadian Hypertension Education Program (CHEP) was established in 1999 by a group of national societies (headed by the Canadian Hypertension Society, the Heart and Stroke Foundation of Canada, the Canadian Coalition for High Blood Pressure Prevention and Control, and Health Canada) to maintain annually updated recommendations for hypertension management and to provide greater opportunities for their implementation into clinical practice. In contrast to JNC 7 recommendations to institute drug treatment for patients with stage 1 hypertension, CHEP currently recommends initiating drug therapy when blood pressure is >160/100 mm Hg in patients without target organ damage or other cardiovascular risk factors. However, medications are strongly suggested for patients with blood pressures >140/90 mm Hg who also have macrovascular target organ damage or other cardiovascular risk factors. Separate blood pressure targets are recommended for patients with diabetes (<130/80 mm Hg) and patients with noninsulin-dependent chronic kidney disease (<140/90 mm Hg). Also, in contrast
to JNC 7, diuretics are not necessarily favored as the initial drug, even among patients without compelling indications for other classes of antihypertensive agents.

**PROCESS OF GUIDELINE DEVELOPMENT**

All of the JNC, European, and Canadian reports represent consensus documents written by panels of experts. JNC committees have been appointed by NIH and have included representatives of professional organizations and healthcare agencies. Inevitably, recommendations of guideline committees reflect the expertise and judgments of the experts writing the recommendations. However, both for hypertension guidelines and for guidelines for other disease entities, concerns have been raised about their reliability and the process involved in guideline development. In a 1993 editorial written in response to JNC 5 and WHO/ISH guidelines, as well as guidelines issued by several other national bodies, John Swales wrote, “The multiplicity and diversity of ‘expert guidelines’ emphasize some of the concerns that have been expressed about the impact of such official advice even when the authors state expressly that their objective is simply to provide guidance rather than instruction.”

There is concordance among guidelines for many aspects of hypertension management. Guideline disparities may be due to insufficient relevant data and/or uncertain interpretation as well as disagreement about whether cost should be taken into account in developing guidelines. In addition to the difficulty of keeping abreast of the explosion of new information, guideline developers have been criticized for failing to adequately control for conflicts of interest, for issuing guidelines of variable quality, and for issuing contradictory guidelines that leave clinicians feeling confused and vulnerable. One recent review has concluded that “…widespread financial conflicts of interest among the authors and sponsors of clinical practice guidelines have turned many guidelines into marketing tools of industry. Financial conflicts of interest are pervasive, under-reported, influential in marketing, and uncurbed over time.” Notably, despite ongoing efforts, JNC has not issued updated guidelines since publication of JNC 7 in 2003. This delay has been attributed to the desire of the JNC Committee to make recommendations based on exhaustive scrutiny of available evidence. In contrast the ESH/ESC has maintained a more pragmatic approach to issuing guidelines, with a willingness to “reappraise” or amend the guidelines as new information becomes available.

In response to the concerns and the changing landscape of guideline development, in 2011 the Institute of Medicine (IOM) issued 2 related reports, one on standards for systematic reviews and the second on standards for the development of trustworthy guidelines. Although these 2 activities are distinct, the IOM emphasized that they are related and require careful intersection and coordination. Specifically, “clinical practice guideline developers should use systematic reviews that meet standards [and should interact with] the systematic review teams regarding the scope, approach, and output of both processes.” Subsequently, the leadership of NHLBI announced that it will “refocus our health education agenda on our core mission of knowledge generation and synthesis by supporting and producing rigorous systematic reviews that can then be used by other collaborating organizations to generate guideline products that serve the public interest….History has taught us that there are very few immutable practices in science or medicine; and the time has come for a change in the NHLBI practice of generating clinical guidelines.”

More recently, NHLBI has “asked the American Heart Association (AHA) and the American College of Cardiology, jointly, to assume the governance and management of (their) preventive guidelines (five including hypertension) and to ensure their completion and dissemination to the public.” The AHA and ACC have accepted this responsibility and have invited all chairs and members of current writing panels to continue to work together with them to finalize the hypertension guidelines. These guidelines are expected in late 2014.

In the interim, there has recently been a flurry of guideline activity. The AHA, the ACC, and the Centers for Disease Control and Prevention published a “scientific advisory” for an effective approach to high blood pressure control. The report describes successful healthcare system approaches (e.g., Kaiser Permanente) and hypertension treatment algorithms based on current guidelines. Additionally, the AHA/ACC recently released the following 4 cardiovascular prevention guidelines: for treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults; for lifestyle management to reduce cardiovascular risk; for management of overweight and obesity in adults; and for assessment of cardiovascular risk.

The American Society of Hypertension and the International Society of Hypertension have jointly issued guidelines for the management of hypertension in the community. Drug treatment is recommended for patients with blood pressure >140/90 mm Hg in whom lifestyle modifications have not been effective. Due to insufficient clinical trial evidence, blood pressure targets of <140/90 mm Hg are generally not recommended for patients with diabetes, chronic kidney disease, or coronary artery disease. For persons aged >80 years, the recommended threshold for starting drug therapy is blood pressure >150/90 mm Hg. The recommended choice of an initial antihypertensive agent is dependent on age, ethnicity, and comorbidities.

An additional guideline statement has recently been published by the panel members appointed to the eighth JNC (JNC 8). The primary difference from JNC 7 is that this report raises target systolic blood pressure goals from 140 mm Hg to 150 mm Hg in persons aged ≥60 years, while eliminating recommendations for tighter control in persons with diabetes or chronic kidney disease. The stated rationale for these changes is based on insufficient randomized clinical trial data to support earlier recommendations. Notably, the authors indicate that this is not an NHLBI sanctioned report and does not reflect the views of NHLBI. Gary Gibbons, NHLBI director, issued a similar statement, indicating that the newer report has not been sanctioned by NHLBI. The AHA has expressed concerns about the panel’s recommendations. Elliott Antman, AHA president elect, stated, “We are concerned that relaxing the recommendations may expose
more persons to the problem of inadequately controlled blood pressure. Additionally, five members of the JNC8 panel have recently issued a minority report, also expressing disagreement with the panel’s recommendation to increase the target systolic blood pressure from 140 to 150 mm Hg in persons ≥60 years of age without diabetes or chronic kidney disease.

**IMPACT OF GUIDELINES**

Between 1950 and 1996, the age-adjusted mortality rates for stroke and cardiovascular disease in the United States declined by 70% and 60%, respectively. These declines began at least 1 to 2 decades before the appearance of JNC 1, and the favorable trends have continued. Between 1999 and 2009, the relative rates of death attributable to stroke and cardiovascular disease declined by 37% and 33%, respectively. Although it is difficult to evaluate their relative contributions, these declines have been attributed to improvements in cardiovascular risk factors and medical treatments. In addition to hypertension-related guidelines, recommendations for lifestyle modifications and aggressive targets for cholesterol and glucose have been developed and promulgated for both primary and secondary prevention.

Since publication of JNC 1 guidelines in 1977, in the US rates of hypertension control have improved considerably. Based on NHANES data, between 1976 and 1980 and between 2009 and 2010, there have been progressive increases in the rates of hypertension awareness (51%–82%), treatment (31%–76%), and control (10%–53%). Overall, these beneficial trends reflect increased recognition of the benefits of hypertension control, increased availability of antihypertensive drugs, the impact of government-sponsored public health programs, and a variety of education programs for healthcare providers for the public at large, developed and implemented by professional societies. It is difficult to evaluate the specific impact of guidelines on the improved rates of hypertension control. In a survey of physicians before and 1 year after dissemination of JNC 3, despite being familiar with the recommendations, respondents reported that their practice behaviors were not significantly changed by the guidelines.

Despite favorable trends in hypertension treatment and control, the high prevalence of uncontrolled hypertension, especially among minority groups, remains a challenge. A number of observers, including a former director of NHLBI, have expressed concern about the slow diffusion of treatment guidelines into clinical practice. In addition to “physician inertia,” it is likely that uncontrolled hypertension is also related to a variety of other factors, including patient behaviors, complexity or difficulty of achieving recommended blood pressure targets, and/or deficiencies in the system of healthcare. Both physicians and asymptomatic patients may be satisfied with less than “optimum” blood pressure control and may consider that the potential added benefits of more rigorous control do not warrant the added investment of time, energy, money, and potential for adverse side effects. Indeed, there may be skepticism about the scientific validity of guidelines recommended by expert panels. Nevertheless, the high rate of uncontrolled hypertension remains to be addressed. Guidelines and recommendations alone will not be sufficient. Innovative strategies to improve hypertension control are more apt to be successful if they are responsive to the factors that contribute to the gap (or chasm) between knowledge and clinical practice.

**CONCLUSION AND PERSPECTIVES**

In conclusion, guidelines are consensus reports developed by panels of experts. Undoubtedly, provision of up-to-date information and guidelines for hypertension control has contributed to improved hypertension control and reduced death rates attributable to cardiovascular diseases over the past half century. Not unexpectedly, guidelines change over time, based on new information and the development and increased availability of effective antihypertensive agents. Nevertheless, the rates of uncontrolled hypertension remain unacceptably high, and cardiovascular diseases remain the leading cause of mortality in the United States, accounting for approximately 34% of all deaths annually.

According to a recent IOM report, “most guidelines used today suffer from shortcomings in development.” The delay in producing an up-to-date revision of JNC 7 guidelines reflects a vulnerability of the guideline process. In contrast to the NIHs historical involvement in directing the JNC reports, European and Canadian guidelines have been directed by professional societies rather than by a funding agency. Both Europeans and Canadians approaches have been more pragmatic than the JNC reports in their approaches to guideline development, in terms of frequency of reports, a willingness to “reappraise” earlier recommendations, flexibility of recommendations for clinical care, and emphasis on implementation strategies. The recent decision by NHLBI to transfer the responsibility for guideline development to the AHA and ACC is a reasonable step. However, the current discrepant recommendations by different professional groups highlights the difficulty of translating science into public policy. Although critical appraisal of current science may expose ambiguities and uncertainties, conflicting recommendations may confuse the public and potentially undermine the credibility of all recommendations. A challenge to all professional groups is to be more sensitive to the potential adverse impact of discrepant or conflicting recommendations.

The following additional strategies might be considered to enhance the impact of guidelines:

- Guideline committees might recommend research strategies to resolve uncertainties or differences of opinion regarding hypertension management. The goal would be resolution by evidence rather than by consensus. This would require collaboration with funding agencies.
- The association of hypertension with other cardiovascular disease risk factors has been known for decades. As suggested in a recent editorial by Peterson et al., an integrated approach for prevention, detection, evaluation, and treatment of overall cardiovascular disease might have a greater impact than discrete guidelines for each risk factor.
- From a clinical perspective, the primary impediments to hypertension control may be related to the failure of both

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providers and patients to implement recommendations rather than to the guidelines themselves. In the lengthy guideline documents, surprisingly little space is devoted to a consideration of strategies for overcoming these implementation barriers. Addressing these thorny issues will require collaboration with disciplines and patient groups that historically have not been involved in guideline development.

In the final analysis, based on objective review of the evidence, guidelines currently serve an important educational function. However, they should not be considered as rigid prescriptions for action but rather serve to allow the healthcare provider to make informed clinical judgments regarding the treatment of individual patients.

DISCLOSURE
The author declared no conflict of interest.

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