



# Consistency of Recommendations for Evaluation and Management of Hypertension

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## Abstract

**IMPORTANCE** Hypertension is very common, but guideline recommendations for hypertension have been controversial, are of increasing interest, and have profound implications.

**OBJECTIVE** To systematically assess the consistency of recommendations regarding hypertension management across clinical practice guidelines (CPGs).

**DESIGN, SETTING, AND PARTICIPANTS** This cross-sectional study of hypertension management recommendations included CPGs that had been published as of April 2018. Two point-of-care resources that provided graded recommendations were included for secondary analyses. Discrete and unambiguous specifications of the population, intervention, and comparison states were used to define a series of reference recommendations. Three raters reached consensus on coding the direction and strength of each recommendation made by each CPG. Three independent raters reached consensus on the importance of each reference recommendation.

**MAIN OUTCOMES AND MEASURES** The main outcomes were rates of consistency for direction and strength among CPGs. Sensitivity analyses testing the robustness were conducted by excluding recommendation statements that were described as insufficient evidence, excluding single recommendation sources, and stratifying by importance of recommendations.

**RESULTS** The analysis included 8 CPGs with a total of 71 reference recommendations, 68 of which had clear recommendations from 2 or more CPGs. Across CPGs, 22 recommendations (32%) were consistent in direction and strength, 18 recommendations (27%) were consistent in direction but inconsistent in strength, and 28 recommendations (41%) were inconsistent in direction. The rate of consistency was lower in secondary analyses. When insufficient evidence ratings were excluded, there was still substantial inconsistency, and a leave-one-out sensitivity analysis suggested the inconsistency could not be attributed to any single recommendation source. Inconsistency in direction was more common for recommendations deemed to be of lower importance (11 of 20 recommendations [55%]), but 17 of 48 high-importance recommendations (35%) had inconsistency in direction.

**CONCLUSIONS AND RELEVANCE** Hypertension is a common chronic condition with widespread expectations surrounding guideline-based care, yet CPGs have a high rate of inconsistency. Further investigations should determine the reasons for inconsistency, the implications for recommendation development, and the role of synthesis across recommendations for optimal guidance of clinical care.

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## Key Points

**Question** How consistent are recommendations from clinical practice guidelines regarding the diagnosis and management of hypertension?

**Findings** This cross-sectional study of 8 clinical practice guidelines found notable inconsistency in recommendations. The inconsistency could not be explained by any single source, importance of recommendations, or by areas of insufficient evidence.

**Meaning** These findings suggest that individual clinical practice guidelines are poor proxies for a universally accepted source of truth; instead, classifying the consistency of recommendations across guidelines may help better categorize recommendations for clinical practice, and shared decision-making support is preferred over recommendations for preference-sensitive decisions.

## + Supplemental content

Author affiliations and article information are listed at the end of this article.

## Introduction

The recommendation from the American College of Cardiology, American Heart Association, and accompanying organizations<sup>1</sup> to lower the blood pressure threshold for the diagnosis of hypertension in their clinical practice guideline (CPG) has been controversial, especially because adhering to such guidance would result in classifying nearly half the US population as unwell and subjecting them to treatment.<sup>2</sup> Moreover, the diagnostic classifications and blood pressure thresholds deemed to be normal vary across CPGs.<sup>1,3-9</sup>

When independent groups have reviewed the same evidence, considered various key factors, such as values and preferences, and come to the same conclusions regarding a recommendation, the credibility of the recommendation is increased. This is comparable to research results in which the replication of findings by repeated experiments increases their credibility. However, when groups reach inconsistent conclusions about a recommendation, the inconsistency can create confusion. If combined with lack of clarity, inaccuracy, or poor alignment with the context of clinical practice, inconsistent recommendations have the potential for undesirable consequences, such as wasting resources and contributing to worse clinical outcomes.

Hypertension is the most common specific primary diagnosis for ambulatory care visits among adults in the United States,<sup>10</sup> and more than 65 currently active CPGs are available worldwide for the diagnosis and treatment of hypertension.<sup>11,12</sup> We sought to determine the consistency of recommendations for evaluation and management of hypertension across prominent CPGs. In the absence of an existing method for such an evaluation, we developed a method to complete our study.

Research about CPGs is often conducted by CPG developers and methodologists, and interpretation may lack public and patient perspectives. We initially sought to involve patient and public representatives in our study, and their interests led to additional assessments of the CPGs for evidence of public and patient involvement, patient-facing information, and shared decision-making tools.

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## Methods

This study is reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline. This study did not involve any human subject testing or use of patient data and is thus exempt from institutional review board approval.

### Search and Selection

In current clinical practice, many clinicians use electronic point-of-care (POC) resources to find CPGs or instead of directly reading CPGs. Two POC resources, DynaMed Plus (DMP)<sup>13</sup> and UpToDate (UTD),<sup>14</sup> provide lists of CPGs and explicit recommendations based on CPGs. In April 2018, we searched the full lists of CPGs from 5 sources: DMP,<sup>13</sup> UTD,<sup>14</sup> Guidelines International Network, National Guideline Clearinghouse, and Turning Research into Practice. Nine of us (B.S.A., A.P., E.J.v.Z., Z.F., A.F.S., P.O., G.E., A.Q., and I.K.) developed inclusion criteria by consensus to select the CPGs most likely to be informing current practice and be practical for analysis. We selected CPGs that were currently active, publicly available, produced or updated in or after 2010, published in and intended for a target audience with an official language of English, considered to be used as the primary source of guidance for clinical care by a large population of health care practitioners, and relevant to the general management of hypertension (eg, addressing blood pressure treatment thresholds or medication selections in patients with or without comorbidities and not limited solely to patients with specific comorbidities).

## Recommendation Specification

We identified the recommendations regarding evaluation and management of hypertension in the selected CPGs, DMP,<sup>13</sup> and UTD.<sup>14</sup> Differences in population, intervention, and comparator concepts precluded direct analysis of consistency in simple forms, so we needed to create a reference standard to compare recommendations against. We generated reference recommendations using population-intervention-comparison (PIC) combinations to provide a consistent framework to disambiguate the frames of reference for expressing recommendations. We combined or separated reference recommendations (ie, PIC specifications) iteratively during consistency mapping and agreed by consensus of all coders (B.S.A., A.P., E.J.v.Z., Z.F., A.F.S., and M. Mayer) to derive the final reference recommendations.

## Coding Direction and Strength of Recommendations

To minimize bias, for each reference recommendation a recommendation coder (A.P., E.J.v.Z., Z.F., or M. Mayer) independently coded the direction and strength of recommendation from each recommendation source. A recommendation code reviewer (A.P., E.J.v.Z., Z.F., A.F.S., or M. Mayer) independently checked the coding of the recommendation coder. Three investigators with clinical experience in hypertension management (A.F.S., B.S.A., and M. Mayer) reviewed the ratings from both the recommendation coder and reviewer, and we considered final codes confirmed when we had full consensus. Individuals who served in more than 1 role throughout this process (A.P., E.J.v.Z., Z.F., A.F.S., and M. Mayer) only served in 1 role for any given reference recommendation and recommendation source pair.

For each recommendation and CPG pair, the coding team assessed 3 factors. First, we assessed whether the CPG addressed the recommendation to an extent that allowed consistency mapping. If it did not, we considered the recommendation out of scope for that source and applied no further coding.

Second, the direction of recommendation was assessed as *for* if the source recommended the intervention over the comparison, *against* if the source recommended the comparison over the intervention, *insufficient* if the source did not recommend for or against the intervention but the PIC specification was within the scope to be addressed, or *different* if the source assertion could not be clearly classified as *for*, *against*, or *insufficient*. In the absence of a statement of insufficient evidence to recommend for or against, we coded a discussion of the relevant evidence as *insufficient* rather than *out of scope*. Ratings of *different* became candidates for realignment of PIC specifications as described previously.

Third, we assessed the strength of recommendation. A *strong* rating was coded if the source rated the recommendation as strong, rated the recommendation at the highest degree of certainty, or used definitive language implying the highest degree of obligation or expectations for following the recommendation. A *weak* rating was used if the source rated the recommendation at less than the highest degree of certainty or used nondefinitive language implying a lower degree of obligation or expectation for following the recommendation. A *different* rating was used if the recommendation could not be clearly classified as *strong* or *weak* but the intention was clear, such as strong for one subpopulation and weak for another subpopulation. Ratings of *different* triggered consideration of clarification of the PIC specifications and recoding across the reference recommendation. Additionally, a recommendation was rated as *unclear* if it was not clear enough to imply whether the assertion was strong or weak, but the direction was clear; or *none* for recommendations for which the direction was neither for nor against.

After we coded all reference recommendations across the CPGs, we assessed the rate of consistency for direction and strength. We did not include recommendations coded as *out of scope* or *different* in any of the analyses for consistency. We only applied consistency assessments if 2 or more CPGs provided a direction rating of *for*, *against*, or *insufficient*.

For assessments of consistency in direction, if all recommendations were for, all recommendations were against, or all recommendations were insufficient, we considered the

reference recommendation consistent in direction. If any recommendation was for and any other recommendation was against, then we considered the reference recommendation inconsistent in direction. If 1 or more recommendations were for or against and 1 or more recommendations were insufficient, then we considered the reference recommendation consistent in direction if 80% or more of the recommendations agreed; otherwise we considered the reference recommendation inconsistent in direction. We added this criterion to modify the definition of consistency in direction in response to prepublication peer review.

For assessments of consistency in strength, we did not rate consistency in strength if the reference recommendation was inconsistent in direction. If all recommendations were strong or all recommendations were weak, then we considered the reference recommendation consistent in strength. If any recommendation was strong and any other recommendation was weak, we considered the reference recommendation inconsistent in strength. For any reference recommendations we considered consistent in direction but had any ratings of insufficient, we considered these weak for assessment of consistency of strength of recommendations.

### Updates After April 2018 Search

Hypertension Canada<sup>8</sup> published an updated guideline online in March 2018 and in print in May 2018. Compared with the previous version of the guideline, the 2018 guideline was the same for all reference recommendations, so we report Hypertension Canada's guideline as the 2018 guideline.

The European Society of Cardiology (ESC) and European Society of Hypertension (ESH) published updated guidelines online ahead of print on August 25, 2018.<sup>9</sup> All main and sensitivity analyses used the ESH and ESC guidelines from 2013<sup>7</sup> according to our specified protocol and date limitations. However, 4 of us (B.S.A., A.P., Z.F., and M. Mayer) applied single coding for the 71 reference recommendations using the 2018 CPG from the ESC and ESH<sup>9</sup> to determine if it would have appreciable effects on the overall analysis.

### Patient and Public Involvement

Four patient and public research partners (U.G., D.D.C., M. Mittelman, and C.B.-N.), along with 2 academic authors (A.P. and E. J.v.Z.), coded the 8 CPGs and 2 POC resources for evidence of patient and public involvement, patient-facing information, and shared decision-making tools. Next, they appraised and commented on the draft paper without the discussion or conclusion so their included recommendations could be informed by a fresh perspective.

### Sensitivity Analysis

We conducted a sensitivity analysis that excluded insufficient ratings from the analysis. We also conducted a leave-one-out sensitivity analysis assessing rates of consistency with each CPG excluded one at a time. Finally, we repeated the analyses using the same methods but treating DMP<sup>13</sup> and UTD<sup>14</sup> functionally as additional CPGs. We conducted an additional sensitivity analysis that stratified the reference recommendations by importance. For each PIC specification, the chair and 2 members of the Finnish National Guideline Panel on Hypertension rated the importance of giving a recommendation. It was considered important to give a recommendation if the recommendation was needed for patient care to benefit patients. If it was unlikely that a recommendation about the PIC would benefit patients, then it was not considered important to give a recommendation. The raters were instructed not to consider the direction of the recommendation or their agreement with the recommendation when they completed their ratings. The raters did not know which guidelines were included in the study, and they were blinded to the results of the rating for consistency in direction and strength. The raters originally rated the importance as *high*, *moderate*, or *low* independently, and then discussed to reach consensus on recommendations for cases for which their independent ratings disagreed. In the final reporting, the moderate and low importance groups were combined to create a lower importance group. Analyses were conducted using Excel spreadsheet software (Microsoft Corp).

## Results

### Selection and Data Extraction

The initial search yielded 75 CPGs. We excluded 67 of these based on our selection criteria (eTable 1 in the [Supplement](#)), with the remaining 8 CPGs (**Table 1**) coming from the United States,<sup>1,5,15,16</sup> Australia,<sup>6</sup> Canada,<sup>8</sup> Europe,<sup>7</sup> and the United Kingdom.<sup>4</sup> From these 8 CPGs and 2 POC resources (DMP<sup>13</sup> and UTD<sup>14</sup>), we generated 71 reference recommendations with discrete and unambiguous specifications of the population, intervention, and comparison (**Table 2**) (eTable 2 in the [Supplement](#)) and completed ratings as described (eTable 3 in the [Supplement](#)). We also reported classifications stratified by blood pressure thresholds (**Figure**).

### Primary Analysis

Three reference recommendations were addressed clearly by only 1 CPG, so 68 reference recommendations were evaluated for our primary analysis. Considering all 8 CPGs, we found consistency in both direction and strength for 22 reference recommendations (32%) (**Table 3**; eTable 4 and eTable 5 in the [Supplement](#)). Recommendation sources consistently provided strong recommendations concerning some of the methods of measuring blood pressure (eg, the use of appropriate cuff size, patient position, and arm at heart level), having more than 1 measurement prior to diagnosing hypertension, some lifestyle changes for cardiovascular risk reduction, the use of angiotensin-converting-enzyme inhibitors and  $\beta$ -blockers in patients with heart failure, and the use of  $\beta$ -blockers in patients with recent myocardial infarction.

We found another 18 reference recommendations (26%) to be consistent in direction but inconsistent in strength (Table 3; eTable 4 and eTable 5 in the [Supplement](#)). For example, sources varied in the strength of recommendation regarding the use of ambulatory blood pressure monitoring for diagnosis of hypertension, inclusion of serum uric acid test results in the initial evaluation of hypertension, and the use of specific medications as options for first-line pharmacotherapy in patients without comorbidities and in patients with specific comorbidities.

We found consistency in direction regardless of strength for 40 reference recommendations (59%) (Table 3; eTable 4 and eTable 5 in the [Supplement](#)). This gives a 41% (28/68) rate of

**Table 1. Recommendation Sources Meeting Inclusion Criteria<sup>a</sup>**

Full Title	Represented Entity
Hypertension in Adults: Diagnosis and Management <sup>4</sup>	National Institute for Health and Care Excellence
2013 ESH/ESC Guidelines for the Management of Arterial Hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC) <sup>7</sup>	European Society of Hypertension and European Society of Cardiology
2014 Evidence-Based Guideline for the Management of High Blood Pressure in Adults: Report From the Panel Members Appointed to the Eighth Joint National Committee (JNC 8) <sup>15</sup>	Panel Members Appointed to the Eighth Joint National Committee
VA/DoD Clinical Practice Guideline for the Diagnosis and Management of Hypertension in the Primary Care Setting <sup>5</sup>	Department of Veterans Affairs and Department of Defense
Guideline for the Diagnosis and Management of Hypertension in Adults <sup>6</sup>	National Heart Foundation of Australia and National Heart Foundation of Australia - National Blood Pressure and Vascular Disease Advisory Committee
2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: a Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines <sup>1</sup>	American College of Cardiology, American Heart Association, American Academy of Physician Assistants, Association of Black Cardiologists, American College of Preventive Medicine, American Geriatrics Society, American Pharmacists Association, American Society of Hypertension, American Society for Preventive Cardiology, National Medical Association, and Preventive Cardiovascular Nurses Association
Pharmacologic Treatment of Hypertension in Adults Aged 60 Years or Older to Higher vs Lower Blood Pressure Targets: a Clinical Practice Guideline from the American College of Physicians and the American Academy of Family Physicians <sup>16</sup>	American College of Physicians and the American Academy of Family Physicians
Hypertension Canada's 2018 Guidelines for Diagnosis, Risk Assessment, Prevention, and Treatment of Hypertension in Adults and Children <sup>8b</sup>	Hypertension Canada

<sup>a</sup> Recommendation sources are listed in ascending order of date of publication or update.

of 2018. Therefore, we included the 2018 version in the analysis instead of the previous release.

<sup>b</sup> These guidelines were published in print in May of 2018, after the initial search described in the Methods section; however, the online version was published in March

Table 2. Reference Recommendations Considered

Recommendation No.	Short Description of Reference Recommendation
1	In all patients, BP should be measured with appropriate cuff size, with the patient calm, seated, and with arm supported at heart level vs measuring BP without specific measurement parameters
2	In all patients with suspected hypertension, diagnosis using office BP should be based on $\geq 2$ measurements per office visit at $\geq 2$ office visits vs a single measurement
3	In all adults with suspected hypertension, diagnosis based on nonautomated office BP should be SBP $>140$ mm Hg or DBP $>90$ mm Hg vs a different cutoff
4	In adults with suspected hypertension and without diagnostic uncertainty or BP variability, use ABPM for diagnostic confirmation vs diagnosing based on clinic BP alone
5	In adults with suspected hypertension and without diagnostic uncertainty or BP variability, use HBPM for diagnostic confirmation vs diagnosing based on clinic BP alone
6	In adults with suspected hypertension and without diagnostic uncertainty or BP variability, use ABPM vs HBPM for diagnostic confirmation
7	In adults with suspected hypertension with diagnostic uncertainty, use ABPM vs not using ABPM
8	In adults with suspected blood pressure variability, use ABPM vs not using ABPM
9	In adults with newly diagnosed hypertension, perform a baseline routine blood chemistry analysis vs not performing it
10	In adults with newly diagnosed hypertension, perform a fasting blood glucose test vs not performing a fasting blood glucose test
11	In adults with newly diagnosed hypertension, obtain a fasting lipid profile vs no lipid testing
12	In adults with newly diagnosed hypertension, perform a urine dipstick analysis for blood a protein vs no urine testing
13	In adults with newly diagnosed with hypertension, perform an ECG vs not performing an ECG
14	In adults with newly diagnosed hypertension, perform a hemoglobin or hematocrit analysis vs not performing a hemoglobin or hematocrit analysis
15	In adults with newly diagnosed hypertension, perform a serum calcium analysis vs no calcium testing
16	In adults with newly diagnosed hypertension, perform a serum uric acid analysis vs no uric acid testing
17	In adults with newly diagnosed hypertension, perform urine testing for albumin to creatinine ratio vs no testing for quantified urine albumin
18	In adults with newly diagnosed hypertension, perform a 24-hour urine analysis for albumin content vs no testing for quantified urine albumin
19	In adults with newly diagnosed hypertension, perform urine testing for albumin to creatinine ratio vs a 24-hour urine test for albumin content
20	In adults with newly diagnosed hypertension, conduct targeted screening for suspected causes of secondary hypertension vs not conducting any such testing
21	In adults with newly diagnosed hypertension with suspected structural heart disease, perform an ECG vs not performing an ECG
22	In adults with hypertension and overweight or obesity, counsel regarding weight loss vs not providing such counseling
23	In adults with hypertension, counsel regarding dietary changes (general concept), including fat restriction or increasing fruit and vegetable intake, vs not providing any such counseling
24	In adults with hypertension, counsel regarding physical activity (which may include aerobic exercise) vs not providing any such counseling
25	In adults who smoke and have hypertension, counsel patients to quit smoking vs not providing any such counseling
26	In adults with hypertension, counsel regarding salt restriction or reducing sodium intake vs not providing any such counseling
27	In adults with hypertension and heavy alcohol use, counsel to moderate alcohol consumption vs not providing any such counseling
28	In adults aged 18-60 y with hypertension, no diabetes, no coronary artery disease, and no chronic kidney disease, target a BP of $\leq 140/90$ mm Hg vs another BP
29	In adults aged 60-80 y with hypertension, no diabetes, no coronary artery disease, and no chronic kidney disease, target a BP of $\leq 140/90$ mm Hg vs another BP
30	In adults aged $>50$ y with increased cardiovascular risk, target an SBP of $<120$ mm Hg vs another SBP
31	In adults aged $>75-80$ y with hypertension, target a BP of $\leq 150/90$ mm Hg vs a lower BP target
32	In adults with hypertension and diabetes, target a BP of $<140/90$ mm Hg vs another BP
33	In adults with hypertension and chronic kidney disease without proteinuria and without diabetes, target a BP of $<140/90$ mm Hg vs another BP
34	In adults with hypertension and chronic kidney disease with proteinuria, target a BP of $<130/80$ mm Hg vs another BP
35	In adults with hypertension, chronic kidney disease, and diabetes, target a BP of $<130/80$ mm Hg vs another BP
36	In adults aged $<55$ y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider a thiazide-type diuretic as a therapeutic option vs not considering a thiazide-type diuretic as a therapeutic option
37	In adults aged $>55$ y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider a thiazide-type diuretic as a therapeutic option vs not considering a thiazide-type diuretic as a therapeutic option
38	In adults with hypertension and no comorbidity requiring specific initial pharmacotherapy, use a thiazide-type diuretic as the preferred therapeutic option vs another medication being used in preference over a thiazide-type diuretic
39	In adults aged $<55$ y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider an ACE-I as a therapeutic option vs not considering an ACE-I as a therapeutic option
40	In adults aged $>55$ y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider an ACE-I as a therapeutic option vs not considering an ACE-I as a therapeutic option
41	In adults with hypertension and no comorbidity requiring specific initial pharmacotherapy, use an ACE-I as the preferred therapeutic option vs another medication being used in preference over an ACE-I
42	In adults aged $<55$ y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider an ARB as a therapeutic option vs not considering an ARB as a therapeutic option

(continued)

Table 2. Reference Recommendations Considered (continued)

Recommendation No.	Short Description of Reference Recommendation
43	In adults aged >55 y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider an ARB as a therapeutic option vs not considering an ARB as a therapeutic option
44	In adults with hypertension and no comorbidity requiring specific initial pharmacotherapy, use an ARB as the preferred therapeutic option vs another medication being used in preference over an ARB
45	In adults aged <55 y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider a CCB as a therapeutic option vs not considering a CCB as a therapeutic option
46	In adults aged >55 y with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider a CCB as a therapeutic option vs not considering a CCB as a therapeutic option
47	In adults with hypertension and no comorbidity requiring specific initial pharmacotherapy, use a CCB as the preferred therapeutic option vs another medication being used in preference over a CCB
48	In adults with hypertension and no comorbidity requiring specific initial pharmacotherapy, consider a $\beta$ -blocker as a therapeutic option vs not considering a $\beta$ -blocker as a therapeutic option
49	In adults with hypertension and no comorbidity requiring specific initial pharmacotherapy, use a $\beta$ -blocker as the preferred therapeutic option vs another medication being used in preference over a $\beta$ -blocker
50	In adults with hypertension and diabetes, consider an ACE-I or ARB as a therapeutic option for first-line therapy vs not considering an ACE-I or ARB as a therapeutic option for first-line therapy
51	In adults with hypertension and diabetes, use an ACE-I or ARB as the preferred therapeutic option vs another medication being used in preference over an ACE-I or ARB
52	In adults with hypertension and chronic kidney disease, consider an ACE-I as a therapeutic option for first-line therapy vs not considering an ACE-I as a therapeutic option for first-line therapy
53	In adults with hypertension and chronic kidney disease, use an ACE-I as the preferred therapeutic option vs an ARB being considered equally or more preferred
54	In adults with hypertension and chronic kidney disease without microalbuminuria, use an ACE-I as the preferred therapeutic option vs a medication other than an ACE-I or ARB being considered equally or more preferred
55	In adults with hypertension and chronic kidney disease with microalbuminuria, use an ACE-I as the preferred therapeutic option vs a medication other than an ACE-I or ARB being considered equally or more preferred
56	In adults with hypertension and chronic kidney disease who are intolerant to ACE-I, consider an ARB as a therapeutic option for first-line therapy vs not considering an ARB as a therapeutic option for first-line therapy
57	In adults with hypertension and chronic kidney disease who are intolerant to ACE-I, use an ARB as the preferred therapeutic option vs another medication being used in preference over an ARB
58	In adults with hypertension and coronary artery disease (ie, ischemic heart disease) and no prior myocardial infarction, consider an ACE-I as a therapeutic option for first-line therapy vs not considering an ACE-I as a therapeutic option for first-line therapy
59	In adults with hypertension and prior myocardial infarction, consider an ACE-I as a therapeutic option for first-line therapy vs not considering an ACE-I as a therapeutic option for first-line therapy
60	In adults with hypertension and coronary artery disease (ie, ischemic heart disease) but no prior myocardial infarction, use an ACE-I as the preferred therapeutic option vs an ARB being considered equally or more preferred
61	In adults with hypertension and prior myocardial infarction, use an ACE-I as the preferred therapeutic option vs an ARB being considered equally or more preferred
62	In adults with hypertension and coronary artery disease (ie, ischemic heart disease) but no prior myocardial infarction, use an ACE-I as the preferred therapeutic option vs a medication other than an ACE-I or ARB being considered equally or more preferred
63	In adults with hypertension and prior myocardial infarction, use an ACE-I as the preferred therapeutic option vs a medication other than an ACE-I or ARB being considered equally or more preferred
64	In adults with hypertension and coronary artery disease (ie, ischemic heart disease) but no prior myocardial infarction who are intolerant to ACE-I, consider an ARB as a therapeutic option for first-line therapy vs not considering an ARB as a therapeutic option for first-line therapy
65	In adults with hypertension and prior myocardial infarction who are intolerant to ACE-I, consider an ARB as a therapeutic option for first-line therapy vs not considering an ARB as a therapeutic option for first-line therapy
66	In adults with hypertension and coronary artery disease (ie, ischemic heart disease) but no prior myocardial infarction who are intolerant to ACE-I, use an ARB as the preferred therapeutic option vs another medication being used in preference over an ARB
67	In adults with hypertension and prior myocardial infarction who are intolerant to ACE-I, use an ARB as the preferred therapeutic option vs another medication being used in preference over an ARB
68	In adults with hypertension and recent myocardial infarction, use a $\beta$ -blocker vs not using a $\beta$ -blocker
69	In adults with hypertension and heart failure, use an ACE-I vs not using an ACE-I
70	In adults with hypertension and heart failure, use a $\beta$ -blocker vs not using a $\beta$ -blocker
71	In adults with hypertension and heart failure who are intolerant to ACE-I, use an ARB vs not using an ARB

Abbreviations: ABPM, ambulatory blood pressure monitoring; ACE-I, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; BP, blood pressure; CCB, calcium channel blocker; DBP, diastolic blood pressure; ECG, electrocardiogram; HBPM, home blood pressure monitoring; SBP, systolic blood pressure.

inconsistency in direction. These included such recommendations as specific cutoffs for the diagnosis of hypertension, blood pressure treatment goals, and the use of specific medications as options or preferred options for first-line pharmacotherapy in patients without comorbidities and in patients with specific comorbidities.

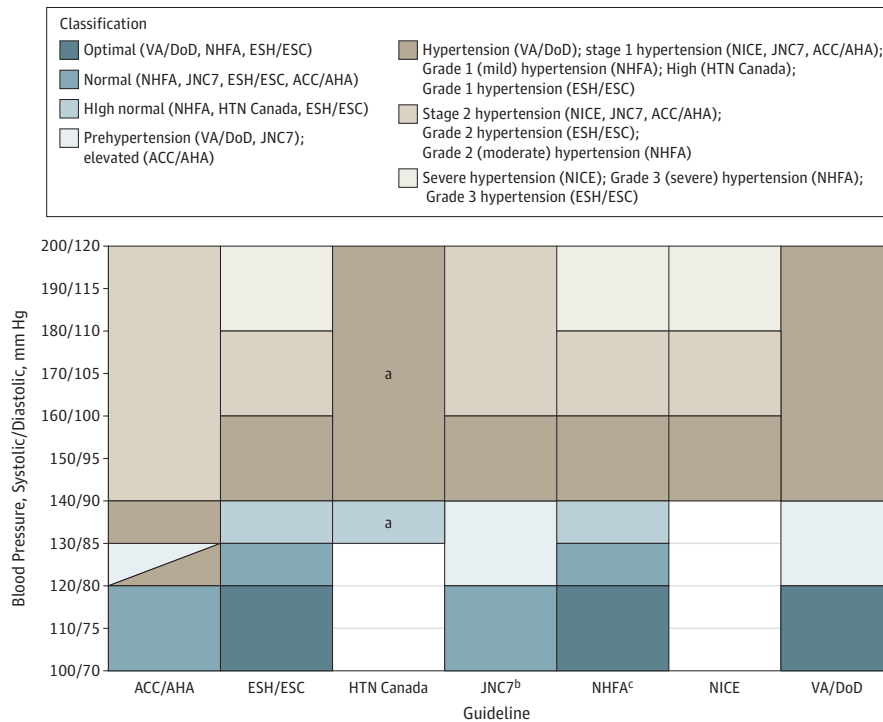
Sensitivity Analyses

Rates of inconsistency remained high when we removed insufficient ratings from consideration. Across CPGs, we found 28 reference recommendations (42%) were consistent in direction and strength, 14 reference recommendations (21%) were consistent in direction but not strength, and 25 reference recommendations (37%) were inconsistent in direction (Table 3) (eTable 4 and eTable 5 in the Supplement).

The results of a leave-one-out sensitivity analysis suggested that no single recommendation source could explain the inconsistency (eTables 5-13 in the Supplement). Consistency in direction rates changed by an absolute 0% to 6.4%, and consistency in direction and strength rates changed by an absolute -0.1% to 9.4% (Table 3). If also excluding insufficient ratings, the consistency in direction rates changed by an absolute 3.9% to 14.6%, and consistency in direction and strength rates changed by an absolute 9.4% to 18.3% (eTable 5 in the Supplement).

The ratings from the Finnish guideline panel yielded 48 high-importance reference recommendations and 20 lower-importance reference recommendations. Of the 48 high-importance reference recommendations, 20 (42%) were consistent in direction and strength, 11 (23%) were consistent in direction but inconsistent in strength, and 17 (35%) were inconsistent in

Figure. Classifications by Blood Pressure Thresholds in Clinical Practice Guidelines



Thresholds displayed are based on blood pressure measured in a clinic setting. Many guidelines emphasize the importance of out-of-clinic measurements (ie, home or ambulatory measurements) to establish diagnosis of hypertension. American College of Physicians and American Academy of Family Physicians guidelines are not shown because they did not address diagnostic thresholds. ACC/AHA indicates American College of Cardiology, American Heart Association, American Academy of Physician Assistants, Association of Black Cardiologists, American College of Preventive Medicine, American Geriatrics Society, American Pharmacists Association, American Society of Hypertension, American Society for Preventive Cardiology, National Medical Association, and Preventive Cardiovascular Nurses Association; ESH/ESC, European Society of Hypertension and European Society of Cardiology; HTN Canada, Hypertension Canada; JNC7, Panel Members Appointed to the Seventh Joint National Committee; NHFA, National Heart Foundation of Australia and National Heart Foundation of Australia-

National Blood Pressure and Vascular Disease Advisory Committee; NICE indicates National Institute for Health and Care Excellence; and VA/DoD, Department of Veterans Affairs and Department of Defense.

<sup>a</sup> If measured using a nonautomated office blood pressure device; if using an automated office blood pressure device, systolic blood pressure greater than 135 mm Hg is considered high.

<sup>b</sup> The panel members appointed to the Eighth Joint National Committee focused on management, not reaffirming or redefining thresholds; therefore, thresholds from JNC7 were used.

<sup>c</sup> Not shown is isolated systolic hypertension, defined as systolic blood pressure greater than 140 mm Hg and a diastolic blood pressure less than 90 mm Hg.



direction. Of 20 lower-importance reference recommendations, 2 (10%) were consistent in direction and strength, 7 (35%) were consistent in direction but inconsistent in strength, and 11 (55%) were inconsistent in direction (Table 3) (eTable 14 and eTable 15 in the [Supplement](#)).

## Secondary Analysis

International variation is not a substantial explanation for inconsistency. The primary analysis limited to the 4 CPGs from the United States (American College of Cardiology et al,<sup>1</sup> American College of Pharmacists and American Academy of Family Physicians,<sup>16</sup> Panel Members Appointed to the Eighth Joint National Committee,<sup>15</sup> and US Department of Veterans Affairs and Department of Defense<sup>5</sup>) found 50 recommendations addressed by 2 or more guidelines, with 15 reference recommendations (30%) consistent in direction and strength, 17 reference recommendations (34%) consistent in direction but inconsistent in strength, and 18 reference recommendations (36%) inconsistent in direction.

Repeating the analyses with DMP<sup>13</sup> and UTD<sup>14</sup> included as recommendation resources provided similar rates of consistency in direction but further reductions in consistency in strength of recommendations across recommendation sources (eTables 16-27 in the [Supplement](#)). Across 10 recommendation sources with 71 reference recommendations, we found consistency in both direction and strength for 12 reference recommendations (17%) (eTable 28 in the [Supplement](#)). We found 28 reference recommendations (39%) to be consistent in direction but inconsistent in strength. We found consistency in direction regardless of strength for 40 reference recommendations (56%). This means 31 reference recommendations (44%) had inconsistency in direction. With sensitivity analysis removing insufficient ratings from consideration, across all recommendation sources, we found 17 reference recommendations (24%) consistent in direction and strength, 26 reference recommendations (37%) consistent in direction but not strength, and 28 reference recommendations (39%) inconsistent in direction. The results of a leave-one-out sensitivity analysis suggested that no single recommendation source could explain the inconsistency. Consistency in direction rates changed by an absolute -0.6% to 5.7% (or 11.3% if excluding insufficient ratings), and consistency in direction and strength rates changed by an absolute 0% to 11.7% (or 21.3% if excluding insufficient ratings) (eTable 28 in the [Supplement](#)).

The results from consideration of the 2018 ESC and ESH updates are shown in eTable 29 in the [Supplement](#). The 2018 updates resulted in 13 changes in coding from the 2013 guidelines, but none changed the consistency ratings for direction or strength in the primary analysis.

**Table 3. Consistency in Direction and Direction and Strength Across Clinical Practice Guidelines**

Analysis	Reference Recommendations, No.	Consistency, No. (%)	
		Direction	Direction and Strength
Primary analysis	68	40 (58.8)	22 (32.4)
Primary analysis excluding insufficient ratings	67	42 (62.7)	28 (41.8)
Excluding			
American College of Cardiology <sup>a</sup>	66	43 (65.2)	24 (36.4)
American College of Physicians <sup>b</sup>	68	40 (58.8)	22 (32.4)
European Society of Hypertension <sup>c</sup>	65	41 (63.1)	24 (36.9)
Hypertension Canada	65	39 (60.0)	21 (32.3)
Eighth Joint National Committee	68	40 (58.8)	28 (41.2)
National Heart Foundation of Australia <sup>d</sup>	67	40 (59.7)	22 (32.8)
National Institute for Health and Care Excellence	68	44 (64.7)	22 (32.4)
Department of Veterans Affairs <sup>e</sup>	67	40 (59.7)	28 (41.8)
Considering recommendations			
High-importance	48	31 (64.6)	20 (41.7)
Lower-importance	20	9 (45)	2 (10)

<sup>a</sup> Full title, American College of Cardiology, American Heart Association, American Academy of Physician Assistants, Association of Black Cardiologists, American College of Preventive Medicine, American Geriatrics Society, American Pharmacists Association, American Society of Hypertension, American Society for Preventive Cardiology, National Medical Association, and Preventive Cardiovascular Nurses Association.

<sup>b</sup> Full title, American College of Physicians and the American Academy of Family Physicians.

<sup>c</sup> Full title, European Society of Hypertension and European Society of Cardiology.

<sup>d</sup> Full title, National Heart Foundation of Australia and National Heart Foundation of Australia-National Blood Pressure and Vascular Disease Advisory Committee.

<sup>e</sup> Full title, Department of Veterans Affairs and Department of Defense.

## Patient and Public Involvement

Of the 10 recommendation sources, 1 source (National Institute for Health Care Excellence<sup>4</sup>) reported patient or public involvement, either directly in coproducing recommendations or indirectly by providing feedback. Six sources (American College of Cardiology et al,<sup>1</sup> American College of Pharmacists and American Academy of Family Physicians,<sup>16</sup> DMP,<sup>13</sup> Hypertension Canada,<sup>8</sup> National Heart Foundation of Australia and National Heart Foundation of Australia,<sup>6</sup> and US Department of Veterans Affairs and Department of Defense<sup>5</sup>) included very general information about how to include patients in individual decision-making, and 3 sources (DMP,<sup>13</sup> National Institute for Health Care Excellence,<sup>4</sup> and UTD<sup>14</sup>) provided direct-to-patient guidance. Two sources made tools available to help patients participate in individual decision-making: Hypertension Canada suggested an existing tool, and DMP integrated the tool within the POC recommendation.

## Discussion

This cross-sectional study found a substantial amount of inconsistency across prominent recommendation sources for hypertension management, and the inconsistency could not be attributed to any particular source. The best possible outcome of inconsistency is adding nuance, but in our experience, this inconsistency more commonly leads to confusion and frustration among clinicians, who already face considerable demands in their day-to-day practice.

Clinical practice guidelines can influence outcomes in medical malpractice claims and can be used by plaintiffs alleging a breach of the standard of care or defendants asserting compliance with the standard of care.<sup>17</sup> The inconsistency across CPGs suggests a problem with asserting standards of care based on a CPG, even if the CPG being used seems well referenced with substantial underlying methodology.

To our knowledge, this is the first report providing a systematic approach to assessing the consistency of recommendations across CPGs. Strengths of this approach include a reproducible method for defining reference recommendations, coding consistency, and involvement of multiple raters with clinical and methodological expertise.

Reasons for inconsistency may result from different dates of publication and timing of evidence evaluation, different methods of evidence selection and interpretation, different factors considered when formulating recommendations, different values and preferences, and different types and degrees of stakeholder involvement. Further research is needed to investigate the causes of inconsistency, but that is beyond the scope of our analysis. There may be greater inconsistency in direction for reference recommendations considered to be of lower importance (11 of 20 reference

### Box. Criteria for Classification of Recommendations

#### Strong Guidance

All recommendation sources are consistent in direction and strong in strength:

- All recommendation sources provide strong recommendations (or the highest degree of certainty that desirable consequences outweigh undesirable consequences) for the action.
- There is a qualified rationale (ie, systematic review, nonconflicted multidisciplinary expertise, and explicit consideration of values and preferences).
- There is no discrepant opinion with a qualified rationale.

#### Weak Guidance

All recommendation sources are consistent in direction but consistently weak in strength or

inconsistent in strength:

- All recommendation sources provide recommendations for the action.
- Not all recommendation sources provide a strong recommendation.

#### Inconsistent Guidance

≥1 Of the following is present:

- ≥1 Recommendation source recommends for and ≥1 recommendation source recommends against the action; or
- ≥1 Recommendation source recommends for the action and ≥1 recommendation source declares insufficient evidence to recommend for or against the action.

recommendations [55%]) than for those considered highly important (17 of 48 recommendations [35%]). However, we still found substantial inconsistency in areas of high importance.

We propose a simple method to classify consistency in direction and strength of recommendations (**Box**). Of note, only a minority of the reference recommendations (ie, those consistent in direction and strength) would be considered strong guidance. These recommendations could perhaps be considered a standard of care for hypertension management or could at least be considered strong guidance with a global perspective. Conversely, most recommendations, even those presented as strong recommendations in certain CPGs, should not be considered a true or stable standard of care, as one can easily find opposing standards from reputable sources. For reference recommendations consistent in direction but inconsistent in strength, we propose these be considered weak guidance from a global perspective with general agreement that such actions warrant consideration but no expectation or obligation for use in most patients.

We found inconsistent guidance for a disconcertingly high proportion of reference recommendations. This suggests that clinicians evaluating and treating hypertension are often faced with impossible expectations, in that following one guideline's recommendations would mean going against recommendations from another guideline.

Regardless of measures taken to improve CPG development, a high degree of consistency and strong guidance may be unrealistic in hypertension management. The direct evidence for precise actions is often limited, the thresholds for action are often more continuous than binary, and the relative importance of benefits and harms is sensitive to an individual patient's values and preferences.

### Patient and Public Perspectives

Our patient and public research partners also read and coded the guidelines, so they were able to see inconsistencies for themselves. They were concerned that an ideal trial population might respond very differently to an intervention than real people with comorbidities and that the recommendation sources had minimal guidance concerning adverse effects. They agreed this is an area in which clinicians and patients might need guidance the most for realistic shared decision-making.

Our patient and public research partners also had multiple recommendations, such as an international protocol for hypertension with room for clinician variance but with strict reporting for guideline variance or inconsistencies, including conflicts of interest (eg, who might benefit financially if a population that would have been considered within normal ranges the previous year population would now be recommended a given intervention because they are no longer considered within normal ranges). They recommended the guidelines link to patient-facing information and detail how the guidelines were informed by end users. To individualize the information, the benefits, risks, alternatives, and what happens if I do nothing (also known as the BRAN approach) information approach might be used, as this could form a foundation for patients needing to make decisions about an intervention. This could be accompanied by a calculator for individual risk when available, which patients could use to evaluate the tradeoffs with their values and preferences. The development of a decision tree or visual infographic using *if no or yes, then what* arguments could be a useful visual aid. The decision aid would provide or link to information on adverse reactions, including effects on comorbidities and the duration of adverse effects. An online decision aid could be used before an appointment, so patients could process new medical information and be better prepared for the clinical appointment.

Consideration of a patient's values and preferences is a fundamental part of practicing evidence-based medicine.<sup>18</sup> Therefore, public and patient involvement is encouraged in CPG development,<sup>19,20</sup> just as shared decision-making is encouraged in clinical practice.<sup>21-24</sup> With a substantial proportion of hypertension management guidance being weak or inconsistent, shared decision-making could replace algorithmic instructions as a primary framework for an approach to health care, but this will require development of patient decision aids and workflow support tools to make it practical.<sup>22</sup>

## Limitations

This study had some limitations, including that, to our knowledge, there was no previously established method for objectively evaluating and reporting the consistency of recommendations. This is the first analysis using this method, so it may not be predictive of the rate of consistency across recommendation sources for conditions other than hypertension. Additionally, we transformed all recommendations to a dichotomous strength rating, so some inconsistency may result as an artifact of converting recommendations with 3 or more strength classifications to a dichotomous system. However, we do not believe this is a substantial or spurious contributor to the inconsistency found across recommendations.

## Conclusions

This cross-sectional study found that current CPGs have substantial inconsistency in recommendations for management of hypertension. No single CPG reflects a universal standard for care.

### ARTICLE INFORMATION

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**Conflict of Interest Disclosures:** Dr Alper reported being the founder of DynaMed, an employee of EBSCO Information Services, which publishes DynaMed Plus, and a member of a working committee in the Guidelines International Network and the GRADE Working Group. Dr Price reported serving as editor of Research and Evaluation at *The BMJ*. Drs van Zuuren and Fedorowicz reported serving as a recommendation editor for DynaMed Plus and as a member of the GRADE Working Group. Dr Shaughnessy reported serving as an editor for Essential Evidence Plus and *American Family Physician*, as a recommendation editor for DynaMed Plus, and having developed a clinical practice guideline evaluation tool (G-TRUST). Dr Oettgen reported serving as the editor-in-chief of DynaMed Plus, an employee of EBSCO Information Services, and as a member of the GRADE Working Group. Dr Elwyn reported receiving personal fees from EBSCO during the conduct of the study. Dr Qaseem reported serving as vice president of Clinical Policy and the Center for Evidence Reviews at the American College of Physicians, as recommendation editor for DynaMed Plus, as a member of the GRADE Working Group, and on governance boards and committees of the National Quality Forums, Centers for Disease Control and Prevention, and the Guidelines International Network. Dr Kunnamo reported being employed by Duodecim Medical Publications, a company that produces Evidence-Based Medicine Guidelines, having an active business and collaborative relationship with EBSCO Information Services, and serving on the working committee in the Guidelines International Network and as a member of the GRADE Working Group. Dr Mayer reported serving as a member of the GRADE Working Group and an employee of EBSCO Information Services. No other disclosures were reported.

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## SUPPLEMENT

**eTable 1.** Excluded Clinical Practice Guidelines

**eTable 2.** Population-Intervention-Comparator Specifications of Reference Recommendations

**eTable 3.** Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines

**eTable 4.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines

**eTable 5.** Consistency of Direction and Direction and Strength Across Clinical Practice Guidelines With Sensitivity Analysis for Excluding Insufficient Ratings

**eTable 6.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding American College of Cardiology

**eTable 7.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding American College of Physicians

**eTable 8.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding European Society of Hypertension

**eTable 9.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding Hypertension Canada

**eTable 10.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding Eighth Joint National Committee

- eTable 11.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding National Heart Foundation of Australia
- eTable 12.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding National Institute for Health and Care Excellence
- eTable 13.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Excluding Department of Veterans Affairs
- eTable 14.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Among High Importance Recommendations
- eTable 15.** Consistency of Direction and Strength Ratings by Recommendation Across Clinical Practice Guidelines Among Lower Importance Recommendations
- eTable 16.** Direction and Strength Ratings by Recommendation Across All Recommendation Sources
- eTable 17.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources
- eTable 18.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding American College of Cardiology
- eTable 19.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding American College of Physicians
- eTable 20.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding DynaMed Plus
- eTable 21.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding European Society of Hypertension
- eTable 22.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding Hypertension Canada
- eTable 23.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding Eighth Joint National Committee
- eTable 24.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding National Heart Foundation of Australia
- eTable 25.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding National Institute for Health and Care Excellence
- eTable 26.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding UpToDate
- eTable 27.** Consistency of Direction and Strength Ratings by Recommendation Across All Recommendation Sources Excluding Department of Veterans Affairs
- eTable 28.** Consistency of Direction and Strength Ratings Across All Recommendation Sources, With Sensitivity Analysis for Excluding Insufficient Ratings
- eTable 29.** Changes from the 2013 to the 2018 guidelines from the European Society of Cardiology and European Society of Hypertension