Guidelines—similarities and dissimilarities: a systematic review of international clinical practice guidelines for pregnancy hypertension

Georgia Scott, MBChB; Tessa E. Gillon, MD; Anouk Pels, MD; Peter von Dadelszen, DPhil; Laura A. Magee, MD

OBJECTIVE: This study aimed to review pregnancy hypertension clinical practice guidelines to inform international clinical practice and research priorities.
STUDY ELIGIBILITY CRITERIA: Relevant national and international clinical practice guidelines, 2009-19, published in English, French, Dutch or German.
STUDY APPRAISAL AND SYNTHESIS METHODS: Following published methods and prospective registration (CRD42019123787), a literature search was updated. CPGs were identified by 2 authors independently who scored quality and usefulness for practice (Appraisal of Guidelines for Research and Evaluation II instrument), abstracted data, and resolved any disagreement by consensus.
RESULTS: Of note, 15 of 17 identified clinical practice guidelines (4 international) were deemed "clinically useful" and had recommendations abstracted. The highest Appraisal of Guidelines for Research and Evaluation II scores were from government organizations, and scores have improved over time. The following were consistently recommended: (1) automated blood pressure measurement with devices validated for pregnancy and preeclampsia, reflecting increasing recognition of the prevalence of white-coat hypertension and the potential usefulness of home blood pressure monitoring; (2) use of dipstick proteinuria testing for screening followed by quantitative testing by urinary protein-to-creatinine ratio or 24-hour urine collection; (3) key definitions and most aspects of classification, including a broad definition of preeclampsia (which includes proteinuria and maternal end-organ dysfunction, including headache and visual symptoms and laboratory abnormalities of platelets, creatinine, or liver enzymes) and a recognition that it can worsen after delivery; (4) preeclampsia prevention with aspirin; (5) treatment of severe hypertension, most commonly with intravenous labetalol, oral nifedipine, or intravenous hydralazine; (6) treatment for nonsevere hypertension when undertaken, with oral labetalol (in particular), methyldopa, or nifedipine, with recommendations against the use of renin-angiotensin-aldosterone inhibitors; (7) magnesium sulfate for eclampsia treatment and prevention among women with "severe" preeclampsia; (8) antenatal corticosteroids for preterm birth but not hemolysis, elevated liver enzymes, and low platelet count syndrome; (9) delivery at term for preeclampsia; (10) a focus on usual labor and delivery care but avoidance of ergometrine; and (11) an appreciation that long-term health complications are increased in incidence, mandating lifestyle change and risk factor modification. Lack of uniformity was seen in the following areas: (1) the components of a broad preeclampsia definition (specifically respiratory and gastrointestinal symptoms, fetal manifestations, and biomarkers), what constitutes severe preeclampsia, and whether the definition has utility because at present what constitutes severe preeclampsia by some guidelines that mandate proteinuria now defines any preeclampsia for most other clinical practice guidelines; (2) how preeclampsia risk should be identified early in pregnancy, and aspirin administered for preeclampsia prevention, because multivariable models (with biomarkers and ultrasonography added to clinical risk markers) used in this way to guide aspirin therapy can substantially reduce the incidence of preterm preeclampsia; (3) the value of calcium added to aspirin for preeclampsia prevention, particularly for women with low intake and at increased risk of preeclampsia; (4) emerging recommendations to normalize blood pressure with antihypertensive agents even in the absence of comorbidities; (5) fetal neuroprotection as an indication for magnesium sulfate in the absence of "severe" preeclampsia; and (6) timing of birth for chronic and gestational hypertension and preterm preeclampsia.
CONCLUSION: Consistent recommendations should be implemented and audited. Inconsistencies should be the focus of research.

Key words: classification, clinical practice guideline, pregnancy hypertension, prevention, treatment

From the Department of Women and Children's Health, King's College London, London, United Kingdom (Drs Scott, von Dadelszen, and Magee); Department of Obstetrics and Gynecology, Frauenklinik, Bürgerspital Solothurn, Solothurn, Switzerland (Dr Gillon); and Department of Obstetrics and Gynaecology, Amsterdam UMC, University of Amsterdam, Amsterdam, the Netherlands (Dr Pels).

Received June 3, 2020; revised July 15, 2020; accepted Aug. 10, 2020.

L.A.M., A.P., and P.v.D. were authors of the Society of Obstetricians and Gynaecologists of Canada guidelines. L.A.M. was an author of the International Society for the Study of Hypertension in Pregnancy guidelines. The other authors report no conflict of interest.

This paper is part of a supplement.

The findings of this study were presented at the 2020 Annual Academic Meeting of the Royal College of Obstetricians and Gynaecologists, London, England, February 28, 2020; the 2019 EuroISSHP Conference for the International Society for the Study of Hypertension in Pregnancy, Lund, Sweden, October 2, 2019; and the 2019 Annual Conference of the Global Women's Health Research Society, London, England, September 11, 2019.

Corresponding author: Laura A. Magee, MD. laura.a.magee@kcl.ac.uk

0002-9378/$36.00 • https://doi.org/10.1016/j.ajog.2020.08.018

Click Supplemental Materials under article title in Contents at ajog.org

Introduction

Hypertension is among the most common medical disorders in pregnancy, affecting up to 1 in 10 pregnancies worldwide.[1] Although some countries have recently achieved reductions in pregnancy hypertension–related maternal mortality, serious maternal and perinatal morbidity persists, maintaining pregnancy hypertension as a healthcare priority.[2]

There are many national and international clinical practice guidelines (CPGs) covering pregnancy hypertension classification, diagnosis, and management, generally, and preeclampsia prediction and prevention, specifically. In our 2014 systematic review,[3] we found that there were areas of consistency appropriate for auditable standards and areas of inconsistency to be addressed by future research.

We sought to update our previous systematic review of CPGs to summarize current thinking about pregnancy hypertension designed to inform clinical practice and future research.

Materials and Methods

The review was registered with the international prospective register of systematic reviews (reference, CRD42019123787). As a systematic review of published material, research ethics board approval was not required.

Literature search

We replicated the comprehensive search strategy of bibliographic databases as in Gillon et al,[3] updating the search from January 2013 to October 2019. Key words and medical subject headings, relating to the themes of "pregnancy," "hypertension," "hypertensive disorders of pregnancy," and "guidelines," were combined to search MEDLINE, Embase, the Cochrane Central Register of Controlled Trials, Health Technology Assessments, and the Database of Abstracts of Reviews of Effects. In addition, we searched "Guidelinecentral.com" and Google Scholar, applying the key words "hypertensive disorders of pregnancy," "hypertension during pregnancy," "hypertension in pregnancy," "preeclampsia," and "gestational hypertension," combined with "guideline" or "clinical practice guideline." For Google Scholar searches, the first 100 results were screened based on the assumption that the most relevant results would appear first. A manual search was conducted for the website of every society listed as a member of the International Federation of Gynecology and Obstetrics.[4] Finally, specific efforts were made to identify updates (be they comprehensive or only relating to certain aspects of the previous guideline) of CPGs included in Gillon et al,[3] by searching the websites of the relevant societies and utilizing personal contacts to ascertain if (and when) an update had occurred or was pending (Supplemental Table 1). Results were filtered according to our eligibility criteria.

Eligibility

We defined a CPG as an evidence-based document issued by a professional medical society, government body, or a similar organization that offered structured advice for healthcare professionals. As done previously,[3] we included multidisciplinary CPGs that were published within the last decade (2009–2019); covered diagnosis, assessment, and management of at least 1 hypertensive disorder of pregnancy (HDP); and were written in (or officially translated into) English, French, Dutch, or German (understood by the review authors). In addition, articles that were explicit updates to the CPGs in Gillon et al[3] were included. As done before,[3] we excluded publications that did not reference primary literature and so were not deemed to be evidence based, were adapted entirely from existing CPGs and so did not offer original information, or were local or regional in scope when there was a relevant national document.

Evaluation

CPG quality was assessed using the Appraisal of Guidelines for Research and Evaluation (AGREE) II tool[5] that has the following 6 domains (number of items): scope and purpose (n=3), stakeholder involvement (n=3), rigor of development (n=8), clarity of presentation (n=3), applicability (n=4), and editorial independence (n=2). Each reviewer assessed whether the guideline could be recommended for use; if so, the recommendations were abstracted. Previous AGREE II assessments[3] were carried forward if only 1 aspect of the CPG was updated and similar methods were used. If CPGs were published by a single issuer as separate documents intended for concurrent use, they were assessed collectively using the AGREE II tool. In addition, 2 authors (G.S. and either T.E.G., A.P., P.v.D., or L.A.M.) rated each CPG independently for quality, methods to grade evidence quality, and recommendation strength and content. Disagreements were resolved through discussion.

We used structured data tables from Gillon et al[3] to abstract CPG recommendations and related text from CPGs. Results are presented descriptively, for diagnosis, classification, prediction, prevention, and management. Expectant care was inferred when CPGs advised, "do not offer planned birth," "aim to prolong pregnancy," or "continue surveillance," and not just when a CPG recommended delivery at a certain gestational age.

Results

Our search strategy yielded 252 articles—192 from bibliographic database searches and 60 from other sources (Figure). After the duplicates were removed and the titles screened, 62 full-text articles were retrieved for closer scrutiny; 36 were excluded because they did not reference HDP literature (n=2),[6–8] were based entirely on preexisting CPGs (n=2),[9,10] did not satisfy our CPG definition (n=12),[11–22] were not in the prespecified languages (n=9, in Spanish,[23–26] Russian,[27] Lithuanian,[28] Danish,[29] Romanian,[30] and Polish[31] [for which there was an official English translation that was included]), were not the latest version of an included CPG (n=6),[32–37] or were too narrow in scope (n=4).[38–41] Of 13 CPGs in our previous review,[3] 6 were not considered because they were superseded by a national guideline[42–45] or publication before

AJOG at a Glance

Why was this study conducted?

To review pregnancy hypertension clinical practice guidelines (CPGs) to inform international practice and research.

Key findings

Key consistencies between CPGs include: blood pressure measurement, dipstick proteinuria testing with confirmation by protein:creatinine ratio, a broad definition of preeclampsia, preeclampsia prevention with aspirin, treatment of severe hypertension, antihypertensive agents used for any severity of hypertension, magnesium sulphate for eclampsia prevention and treatment (for "severe" preeclampsia), delivery for term preeclampsia, and acknowledgement of the long-term health consequences of hypertensive pregnancy. Key differences between CPGs include: definitions of preeclampsia severity, biomarkers for prediction or time-of-disease assessment, and normalization of blood pressure when non-severely elevated.

What does this add to what is known?

CPGs are increasingly evidence-based and their recommendations aligned. Consistent recommendations should be implemented and audited. Inconsistencies should guide research priorities.

2009,[46,47] and 4 because they had been updated and reissued[32–35]; 3 had been updated in part and were included.[48–50] The 17 included CPGs (26 publications) are listed in Table 1.

Characteristics of included clinical practice guidelines

Notably, 4 CPGs were intended for a multinational audience (the World Health Organization [WHO], the Society of Obstetric Medicine of Australia and New Zealand [SOMANZ], the International Society for the Study of Hypertension in Pregnancy [ISSHP], and the European Society of Cardiology [ESC]), and 13 were for national use—11 from high-income and 2 from upper–middle-income countries—across 5 continents. For the 6 non-English publications, 3 were reviewed in their original languages (Netherlands [NLD], Germany [DEU], Tunisia [TUN]) and 3 as official English translations (France [FRA], Norway [NOR], and Poland [POL]). Most CPGs were produced by professional societies, but 2 were produced by government organizations (National Institute for Health and Care Excellence [NICE], Ministry of Health, New Zealand [NZL]) and 1 by the WHO.

Most CPGs were published as a single document, but the number varied (1–11), and the pages were from 5 (Italy [ITA]) to 1139 (NICE) (median, 55) (Supplemental Table 2).

Quality of clinical practice guidelines

No CPG had an AGREE II score of ≥80% in all domains (Supplemental Table 2), but this high score was seen in 5 of 6 domains for governmental CPGs (NICE and NZL) and 4 of 6 domains for WHO. CPGs scored best on "scope and purpose" and "clarity of presentation," when 15 of 17 scored ≥50%; the lowest scores for presentation clarity resulted from not formulating key recommendations (ITA and SOMANZ). Poor scores were most commonly seen for applicability (14 CPGs scoring ≤50%), failure to report audit criteria (specified by the following 3 CPGs: WHO, SOMANZ, and NICE), and failure to report facilitators and barriers to recommendation implementation and proposed resource implications (10/17 and 11/17 CPGs scoring the minimum, respectively). Editorial independence from funders was poorly reported (11/17). Overall, all but ITA and NOR were deemed clinically useful (n=15) and their content was abstracted.

Quality of evidence and strength of recommendations

Using 9 different grading systems, 8 of 15 CPGs rated both the quality of evidence and strength of their recommendations (WHO, Canada [CAN], FRA, Brazil [BRA], NZL, ESC, POL, and TUN), 3 only the quality of evidence (NICE, NLD, United States [USA]), 1 just the strength of recommendations (DEU), and 3 neither (SOMANZ, Ireland [IRL], and ISSHP).

Practice recommendations

Hypertension and proteinuria: diagnosis and measurement

Hypertension and its severity were defined by all CPGs but the WHO (Table 2). Hypertension was defined as a systolic blood pressure (BP) of ≥140 mm Hg and a diastolic BP of ≥90 mm Hg (n=13/14). Most CPGs (n=10) recommended in-office repeat measurement for confirmation, and many acknowledged that out-of-office confirmation may be useful (n=8), although few (n=3) formally recommended this. Severe hypertension was defined as BP of ≥160/110 mm Hg (n=13/14) other than by SOMANZ that advocated ≥170/110 mm Hg.

Most CPGs provided recommendations about BP measurement. Of note, 9 CPGs specified that the woman should be rested before BP measurement, but rest time varied from a few minutes (BRA and POL) to "preferably greater than 10 minutes" (USA) or was unspecified. Advice on positioning always had the woman seated (n=11). Few CPGs commented on the choice of arm when interarm BP readings differ (n=6); all recommended using the arm with the higher value or the right arm if the difference was <10 mm Hg (NLD). Advice about the appropriate cuff size was common (n=13), but few CPGs specified that the cuff length should be 1.5 times the circumference of the patient's arm (n=4).

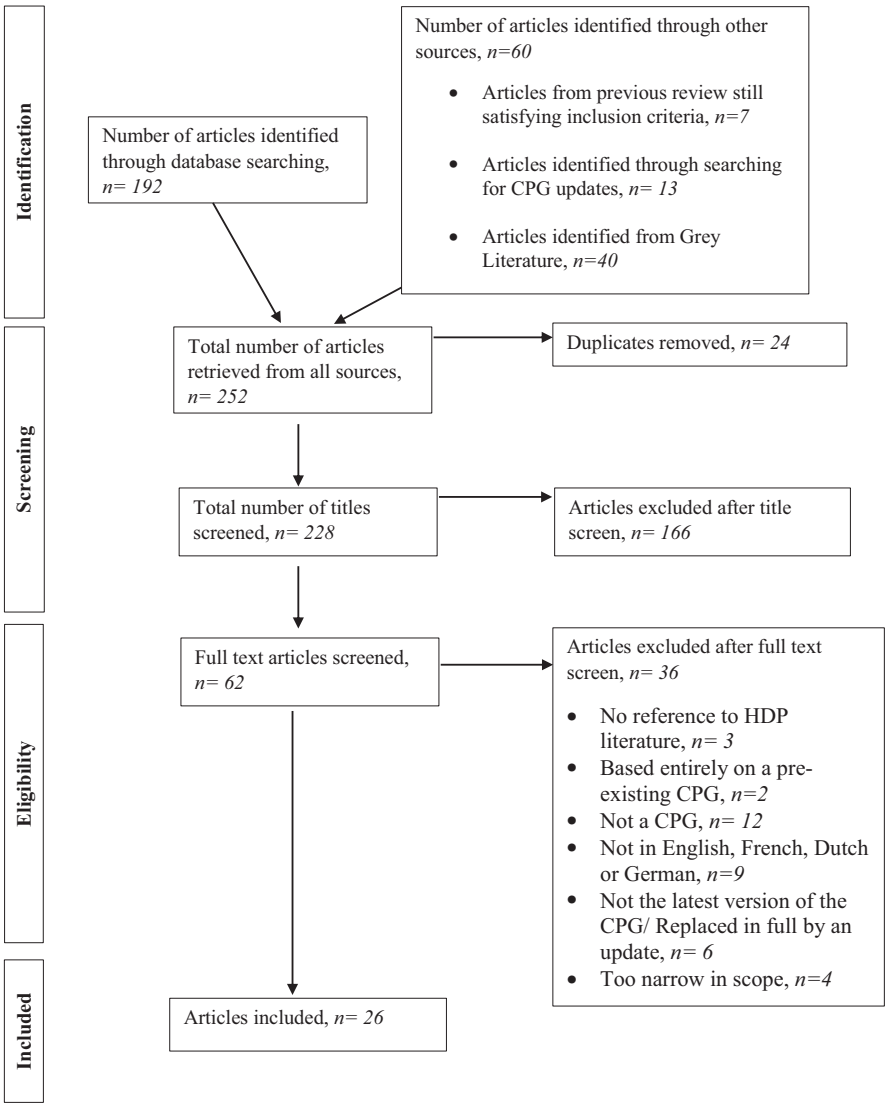
Most CPGs advised on BP devices that were acceptable (n=12), all recommending an automated device validated for use in pregnancy (n=12/12) with 5 recommending a reference website for specific devices as www.dableducational.org (CAN, FRA, ISSHP, and

ESC) or http://bhsoc.org/bp-monitors/bp-monitors (POL) and 2 stating specifically that wrist devices are not appropriate for use (FRA and DEU). If the use of a validated device is not possible, 7 CPGs highlighted that BP device should regularly be compared with and calibrated against a reference device (NLD, CAN, SOMANZ, IRL, FRA, BRA, and ISSHP). Most CPGs mentioned an acceptable use of the mercury sphygmomanometer (n=9/12) and fewer aneroid devices (n=6/12). Of the 10 CPGs that recommended nonautomated devices, most (n=8/10) advised on Korotkoff phase V for diastolic BP (with DEU also noting this), but some said that phase IV would be acceptable (n=5/10).

Most CPGs recommended that dipstick testing be used for initial detection of proteinuria (n=12), with a "positive" result usually designated as ≥1+ (n=10/12) rather than ≥2+ (n=1/12) or not defined (n=1/12). All CPGs recommended that a positive dipstick result should be confirmed by quantitative testing (n=12/12). If quantitative testing was not available, dipstick proteinuria testing considered diagnostic was usually specified (n=8) as ≥2+ by all but BRA that recommended that "a positive result in ≥2 samples" be considered diagnostic or repeated results ≥1+ (SOMANZ).

Proteinuria quantification method was usually specified (n=13)—usually urinary protein-to-creatinine ratio (PrCr) of ≥30 mg/mmol (n=11/13), but also 24-hour urinary protein of ≥0.3 g/d (n=8/13). Urinary albumin-to-creatinine ratio (ACR) was not often recommended (n=3/13) and significant levels varied from ≥8 mg/mmol (NICE) to ≥30 mg/mmol (BRA and ESC).

FIGURE
PRISMA flowchart



A PRISMA flowchart representing the results of literature search

PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-analyses.

Scott. Pregnancy hypertension guidelines—similarities and dissimilarities. Am J Obstet Gynecol 2022.

Classification of the hypertensive disorders of pregnancy

All CPGs defined chronic or "preexisting" hypertension and gestational hypertension (GH), other than the WHO that focused only on preeclampsia. Chronic hypertension was defined as hypertension detected before pregnancy or during pregnancy before 20 weeks' gestation by all relevant CPGs (n=14/14). Although 4 specified that hypertension must persist after delivery (ESC, USA, DEU, POL), 2 stipulated persistence beyond 6 weeks (ESC, POL), 1 for ≥12 weeks (DEU), and 1 for an unspecified time (USA). Few CPGs mentioned potential secondary causes of hypertension, however uncommon (CAN, SOMANZ, IRL, ISSHP, USA, NICE, and POL). (Superimposed preeclampsia is defined below.)

GH was defined as new-onset hypertension detected after 20 weeks' gestation for all but DEU that did not specify the gestational age of onset. In addition, 6 CPGs specified that GH must resolve after delivery, within 6 weeks (ESC and POL) or 12 weeks (NLD, SOMANZ, IRL, and NZL). Only CAN mentioned the potential for a secondary cause of hypertension.

Preeclampsia was defined by all CPGs, as hypertension after 20 weeks' gestation in association with at least 1 other target organ manifestation. A total of 3 CPGs defined preeclampsia traditionally and regarded proteinuria as mandatory

TABLE 1
Clinical practice guidelines included in this review

CPG abbreviation	Y[a]	CPG full name and references
International		
WHO	2011	World Health Organization 2011 with updates on calcium supplementation to prevent preeclampsia, management of severe hypertension, and timed delivery for severe preeclampsia[48,51–53]
SOMANZ	2014	Society of Obstetric Medicine of Australia and New Zealand (SOMANZ) 2014[71]
ESC	2018	European Society of Cardiology (ESC) 2018[65]
ISSHP	2018	International Society for the Study of Hypertension in Pregnancy 2018[54]
North America		
CAN	2014	Society of Obstetricians and Gynaecologists of Canada (SOGC) 2014 with update on antihypertensive therapy in partnership with Hypertension Canada[50,55]
USA	2019	American College of Obstetricians and Gynecologists (ACOG) 2019 in three publications on gestational hypertension and preeclampsia, chronic hypertension, and the Committee Opinion on emergent therapy of severe hypertension[56–58]
South America		
BRA	2016	Sociedade Brasileire de Cardiologia (SBC) 2016[59]
Europe		
ITA	2013	Italian Society of Hypertension (SIAA) 2013[60]
FRA	2016	French Society of Hypertension (SFH) 2016 (2016 English translation)[61]
NOR	2014	Norwegian Society of Obstetrics and Gynaecology (NGF) 2014 (2016 English translation)[62]
IRL	2016	Institute of Obstetricians and Gynaecologists Royal College of Physicians of Ireland (RCPI) 2016 in two publications about hypertensive disorders and severe preeclampsia and eclampsia[63,64]
NLD	2011	Nederlandse Vereniging voor Obstetrie en Gynaecologie (NVOG) 2011 with updates on BP measurement and aspirin for preeclampsia prevention[49,66,67]
DEU	2019	German Society of Gynecology and Obstetrics (DGGG) 2019[68]
UK	2019	National Institute for Health and Care Excellence (NICE) 2019[69]
POL	2019	Polish Society of Hypertension (PSH), Polish Cardiac Society and Polish Society of Gynecologists and Obstetricians 2019 (2019 English translation)[70]
Australasia		
NZL	2018	Ministry of Health, New Zealand 2018[72]
Africa		
TUN	2016	La Société Tunisienne de Gynécologie Obstétrique (STGO) 2016[73]

BRA, Brazil; *CAN*, Canada; *CPG*, clinical practice guideline; *DEU*, Germany; *FRA*, French Society of Hypertension; *IRL*, Ireland; *ITA*, Italy; *NLD*, Netherlands; *NOR*, Norway; *NZL*, New Zealand; *POL*, Poland; *TUN*, Tunisia; *UK*, United Kingdom; *USA*, United States of America.

[a] Year of publication refers to the date of the main document, even if there have been subsequent partial updates of information.

Scott. Pregnancy hypertension guidelines—similarities and dissimilarities. Am J Obstet Gynecol 2022.

(WHO, NLD, and FRA). Other CPGs defined preeclampsia "broadly," without proteinuria as mandatory (n=12), but among the many potential target organ manifestations, there was a widespread agreement that target organ involvement was defined by maternal symptoms of headache or visual disturbances (n=12/12), proteinuria (n=12/12), abnormal routine laboratory testing of low platelet count (all but DEU; n=11/12), raised serum creatinine (all but ESC; n=11/12), or elevated liver enzymes (n=12/12). However, there was no agreement on definitions that were often unspecified. Fetal manifestations were not widely endorsed; the most common criterion was fetal growth restriction (n=9/12), followed by abnormal umbilical artery Doppler (n=3/12), stillbirth (n=4/12), or abruption (n=2/12). Only CAN mentioned oligohydramnios or abnormal fetal heart rate.

Eclampsia was defined as seizures during pregnancy, associated with preeclampsia or another HDP; 3 CPGs specified that seizures must have no other cause (WHO, DEU, and USA).

Only 3 CPGs recommended biomarkers for preeclampsia diagnosis, so-

called "time-of-disease" assessment (ESC, NICE, and DEU), 2 as a "rule-out" test (ESC and NICE) and 1 as a "rule-in" test (DEU). ESC stated that a soluble fms-like tyrosine kinase-1-to-placental growth factor ratio of ≤38 could be used to exclude the onset of preeclampsia in the next week. NICE recommended the measurement of angiogenic markers on 1 occasion in women with GH[69] but formally adopted the ISSHP definition of preeclampsia that does not include angiogenic markers. DEU advised that preeclampsia can be diagnosed in the context of pregnancy hypertension if there are "abnormal findings of preeclampsia-specific markers, such as angiogenic factors," even if other target organ manifestations are absent.

"Severe" preeclampsia was not defined by 4 CPGs (SOMANZ, ESC, ISSHP, and DEU); ISSHP and SOMANZ stated specifically they had not done so to encourage cautious management of all women with preeclampsia that can progress unpredictably. Among the 3 CPGs with a restrictive definition of preeclampsia, "severe" preeclampsia was defined as the development of severe hypertension, worsening proteinuria, or other target organ manifestations (that defined any preeclampsia for other CPGs) (WHO, NLD, and FRA). Of the remaining 8 CPGs, "severe" preeclampsia was defined by the presence or development of usually graver manifestations. Only CAN had mutually exclusive criteria for preeclampsia and "severe" preeclampsia, considered to be an indication for delivery. The only manifestation that was almost uniformly designated as "severe" preeclampsia was severe hypertension (n=7/11; CAN, IRL, BRA, TUN, NZL, NICE, and POL).

Superimposed preeclampsia was defined by 8 CPGs, always as the development of preeclampsia (n=8; NLD, CAN, SOMANZ, IRL, FRA, ISSHP, USA, and POL) in a woman with preexisting hypertension. Notably, 3 CPGs specifically excluded a deterioration in BP control from the definition (SOMANZ, IRL, and ISSHP).

White-coat hypertension was defined by most CPGs (n=10) as a BP elevated in the clinic but normal outside the clinic, defined as <135/85 mm Hg (CAN, FRA, TUN, and ISSHP), <20/10 mm Hg lower than in the clinic (BRA), or undefined (SOMANZ, IRL, NZL, USA, and POL). Masked hypertension was defined by few CPGs (n=5) as a normal BP in the clinic but an elevated reading outside the clinic (CAN, SOMANZ, BRA, ISSHP, and POL).

Prediction of preeclampsia

A total of 14 CPGs presented risk factors for preeclampsia, either as a list without specifying associated risk (WHO, SOMANZ, TUN, ISSHP, and DEU) or stratified as "major" or other (CAN and NZL) or "high" or "moderate" (IRL, NLD, ESC, USA, NICE, and POL). "High" or "major" risk factors were consistently chronic hypertension, pregestational diabetes, and antiphospholipid antibody syndrome (n=8/8 relevant CPGs); previous preeclampsia (n=4/8), chronic kidney disease (n=5/8), systemic lupus (n=7/8), autoimmune disease (n=5/8), multiple pregnancy (n=2/8), and family history of preeclampsia (mother or sister, n=1/8) were endorsed less frequently. "Moderate" risk factors were consistently advanced maternal age, obesity, family history of preeclampsia, nulliparity, and interpregnancy interval of ≥10 years; all but the USA endorsed multifetal pregnancy, and only the USA specified "previous adverse pregnancy outcome," African American race, low socioeconomic status, and low maternal birthweight.

Most CPGs advocated using clinical factors to assess preeclampsia risk. However, 2 CPGs recommended a combination of clinical markers, biomarkers, and ultrasonography for early pregnancy screening (TUN and DEU). Although 3 CPGs recommended uterine artery Doppler velocimetry for risk assessment (ISSHP, ESC, and POL), 4 recommended against it (CAN, SOMANZ, NZL, and USA).

Prevention of preeclampsia

Aspirin. All CPGs recommended low-dose aspirin for preeclampsia prevention, although who should receive it, at what dose, and from and until which gestational age were inconsistent. Indications for aspirin varied: previous preeclampsia (TUN and FRA), a history of pregnancy hypertension or a preeclampsia risk of >1:150 (POL); 1 "high" or at least 2 "moderate" risk factors (NLD, IRL, ESC, USA, NICE, and POL), a list of "high" risk factors (ISSHP), or risk assessment left to the clinician's discretion (WHO, CAN, SOMANZ, NZL, and DEU), even when no risk factors had been specified (BRA).

Aspirin dosage was specified (n=5) or a dose range suggested (n=9) by all but SOMANZ: 75 mg (WHO and IRL), 81 mg (USA), 100 mg (NZL), 150 mg (DEU), 80 to 150 mg (NLD), 75 to 162 mg (CAN and ISSHP), 75 to 160 mg (FRA), 100 to 150 mg (ESC, POL), or 75 to 150 mg (BRA, TUN, and NICE).

All CPGs advised early initiation of aspirin, optimally before 16 weeks (n=9; NLD, CAN, IRL, TUN, ISSHP, NZL, USA, DEU, and POL), but definitely from 12 weeks (NLD, IRL, BRA, ESC, and NICE), before 20 weeks (WHO, FRA, and ISSHP), or at 12 to 28 weeks (USA).

Recommendations about when to stop aspirin varied from not before 35 weeks (FRA and TUN), at 36 weeks (POL), at 36 to 37 weeks (ESC), 1 week before parturition (NLD), not before 37 weeks (SOMANZ), or continue until delivery (n=5; CAN, IRL, NZL, USA, and NICE).

Calcium. Recommendations to take calcium for preeclampsia prevention (n=9 CPGs, 1−2.5 g/d) varied according to the baseline intake and preeclampsia risk: low calcium intake regardless of preeclampsia risk (WHO, CAN, IRL, TUN, and ESC), moderate to high preeclampsia risk, regardless of calcium intake (SOMANZ), or low intake and an intermediate or high risk of preeclampsia (BRA, ISSHP, and NZL). Low calcium intake was defined by a minority of CPGs, as <600 mg/d (CAN, BRA, ISSHP, and ESC) or <1000 mg/d (IRL).

Treatment

Antihypertensive therapy. All CPGs recommended that severe hypertension be treated with antihypertensive agents, usually after referral to hospital (n=11), but few specified a BP target below the

TABLE 2
Hypertension and proteinuria diagnosis and measurement recommendations

	Number of CPGs	CPGs reporting
Hypertension and measurement of BP		
Hypertension definition	14	NLD, CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, DEU, UK, POL
sBP of ≥140 mm Hg or dBP of ≥90 mm Hg	13	NLD, CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, UK, POL
Both sBP of ≥140 mm Hg and dBP of ≥90 mm Hg	1	DEU
In-office confirmation is recommended	10	WHO, CAN, SOMANZ, IRL, BRA, ISSHP, NZL, ESC, USA, POL
Out-of-office confirmation is recommended or acknowledged as being useful	3 (recommended)	FRA, ISSHP, POL
	8 (potentially useful)	CAN, SOMANZ, IRL, BRA, TUN, ESC, USA, DEU
Severe hypertension	14	NLD, CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, DEU, UK, POL
sBP of ≥160 mm Hg or dBP of ≥110 mm Hg	13	NLD, CAN, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, DEU, UK, POL
sBP of ≥170 mm Hg or dBP of ≥110 mm Hg	1	SOMANZ
Measurement of BP		
Rest before measurement	9	NLD, IRL, BRA, FRA, TUN, NZL, USA, DEU, POL
Should be seated	11	NLD, CAN, SOMANZ, IRL, BRA, FRA, TUN, NZL, USA, DEU, POL
Choose arm with higher values	6	NLD, CAN, BRA, TUN, UK, POL
Cuff appropriate size	13	NLD, CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, DEU, POL
Cuff length 1.5 times arm circumference	4	NLD, CAN, TUN, USA
Korotkoff phase for dBP		
Phase V	9	NLD, CAN, SOMANZ, IRL, BRA, TUN, ESC, NZL, DEU
Phase IV	5	SOMANZ, IRL, BRA, NZL, DEU
BP measurement device	12	NLD, CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, POL
Mercury sphygmomanometer	9	NLD, CAN, SOMANZ, BRA, TUN, ESC, ISSHP, NZL, USA
Aneroid device	6	NLD, CAN, SOMANZ, IRL, BRA, TUN
Automated device validated in pregnancy and preeclampsia	12	NLD, CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, POL
Proteinuria and its measurement		
Proteinuria definition		
Proteinuria measurement		
Initial detection by dipstick testing	12	CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, DEU, UK, POL
"Positive" dipstick proteinuria		
≥1+	10	CAN, SOMANZ, IRL, FRA, TUN, ISSHP ESC, DEU, UK, POL
≥2+	1	NZL

Scott. Pregnancy hypertension guidelines—similarities and dissimilarities. Am J Obstet Gynecol 2022. *(continued)*

TABLE 2
Hypertension and proteinuria diagnosis and measurement recommendations *(continued)*

	Number of CPGs	CPGs reporting
Not defined	1	BRA
Positive dipstick to be confirmed by quantitative testing	12	CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, DEU, UK, POL
If quantitative testing not available, dipstick proteinuria value considered diagnostic	8	SOMANZ, IRL, BRA, TUN, ISSHP, USA, UK, POL
Repeated ≥1+	1	SOMANZ
≥2+	6	IRL, TUN, ISSHP, USA, UK, POL
A positive result in ≥2 samples	1	BRA
Proteinuria quantification method specified	13	CAN, SOMANZ, IRL, BRA, FRA, TUN, ESC, ISSHP, NZL, USA, DEU, UK, POL
Urinary PrCr ≥30 mg/mmol	11	CAN, SOMANZ, IRL, FRA, TUN, ISSHP, NZL, USA, DEU, UK, POL
24-h urinary protein of ≥0.3 g/d	8	CAN, IRL, BRA, FRA, TUN, USA, DEU, POL
Urinary ACR	3	BRA, ESC, UK

ACR, albumin-to-creatinine ratio; *BP*, blood pressure; *BRA*, Brazil; *CAN*, Canada; *CPG*, clinical practice guideline; *dBP*, diastolic blood pressure; *DEU*, Germany; *ESC*, European Society of Cardiology; *FRA*, France; *IRL*, Ireland; *ISSHP*, International Society for the Study of Hypertension in Pregnancy; *ITA*, Italy; *N/A*, not applicable; *NLD*, Netherlands; *NOR*, Norway; *NZL*, New Zealand; *UK*, United Kingdom; *POL*, Poland; *PrCr*, protein-to-creatinine ratio; *sBP*, systolic blood pressure; *SOMANZ*, Society of Obstetric Medicine of Australia and New Zealand; *TUN*, Tunisia; *USA*, United States of America; *WHO*, World Health Organization.

Scott. Pregnancy hypertension guidelines—similarities and dissimilarities. Am J Obstet Gynecol 2022.

treatment threshold of 160/110 mm Hg (Table 3). First-line options were usually intravenous (IV) labetalol, oral nifedipine, or IV hydralazine, in line with medications studied most commonly in randomized trials[74]; IRL recommended avoidance of sublingual nifedipine.

Antihypertensive treatment thresholds for nonsevere hypertension were inconsistent and sometimes varied according to the comorbidity: BP of ≥140/90 mm Hg with (n=2) or without (n=7) comorbidities, BP of ≥150/100 mm Hg (n=4), BP of <160/110 mm Hg with comorbidities (n=1), or otherwise BP of ≥160/110 mm Hg (n=2; WHO and NLD). All but 3 CPGs (WHO, SOMANZ, and ESC) specified a BP target, but inconsistently, as between 140/90 and 160/110 mm Hg (n=7) or below 140/90 mm Hg (n=5). Many CPGs either recommended (n=3) or acknowledged as potentially useful (n=6) home BP monitoring for hypertension control. First-line antihypertensive agents were most commonly labetalol, methyldopa, and nifedipine, in line with those most commonly studied in randomized trials of antihypertensive vs placebo or no therapy or other antihypertensive therapy.[75]

Other than ISSHP, all CPGs specified antihypertensive agents not to use in pregnancy, always recommending against renin-angiotensin system (RAS) blockers (n=14), and frequently against diuretics (n=6, other than for chronic hypertension or diuresis) and atenolol (n=5). Of note, 3 CPGs specifically recommended against and 1 recommended for thiazides.

Antenatal corticosteroids. Most CPGs (n=12) advised on the administration of antenatal corticosteroids (Supplemental Table 3). Most (n=9) made recommendations according to pregnancy hypertension type (usually preeclampsia) and gestational age. For women with chronic hypertension, antenatal corticosteroids were recommended by NICE 2019 for planned "early" birth. For women with GH, few CPGs recommended steroids (n=3) for delivery anticipated to be within the next 7 days, at <36 weeks, or "early" (n=1, each). For preeclampsia at <34 weeks (or $<34^{6}$ weeks for CAN), some CPGs (n=5) advised steroids for all women, whereas others made recommendations conditional on an indication for imminent delivery (n=2) and when there were associated complications that would make imminent delivery likely, such as "severe" preeclampsia (n=3); hemolysis, elevated liver enzymes, and low platelet count (HELLP) syndrome (n=2); eclampsia (n=1); or abnormal fetal growth or monitoring (n=1). Some CPGs offered recommendations according only to gestational age at presentation (n=3) or related to elective cesarean delivery at <39 weeks (n=1). A total of 6 CPGs specifically advised against steroids for HELLP, whereas FRA 2016 suggested that they could be used for severe thrombocytopenia.

Only 4 CPGs advised on repeated doses of steroids—ISSHP against and others for if the first course were ≥7 days before (n=1), within the final 2 weeks but the maternal or fetal condition had deteriorated (n=1), >14 days before, and before 30 weeks (n=1).

Timing of birth. For women with chronic hypertension, 5 CPGs

confirmed that expectant care was appropriate before term (Supplemental Table 4). Half of CPGs (n=8) made recommendations at term as delivery by 37 weeks if on antihypertensive agents or by 38 weeks if untreated (n=1), at 39 weeks (n=1), at 37 to 39 weeks (n=1), at 38 to 39 weeks (n=3), according to expectant care with enhanced surveillance (n=1), or according to a plan agreed with the woman (n=1). For women with GH, few CPGs confirmed expectant care was appropriate until term (n=6). At term, most CPGs (n=12) made recommendations for delivery at 37 weeks (n=7), to be discussed from 37 weeks (n=4), or by 39 weeks (n=1).

Most CPGs focused on the timing of birth for women with preeclampsia. Three CPGs considered "severe" preeclampsia to be an indication for birth, regardless of gestational age (n=3). Before fetal viability, most CPGs recommended delivery for preeclampsia (n=4 of 5 that made recommendations, n=6 of 6 when "severe"). Expectant care was advised by many CPGs from fetal viability to 33 weeks (n=9/9, n=5/8 when "severe") and 34 to 36 weeks (n=8/8, n=1/9 when "severe"). Delivery was advocated at term (n=12/12, n=9/9 when "severe").

Other than IRL, all CPGs provided indications for delivery regardless of gestational age or pregnancy hypertension type. The most highly endorsed were uncontrollable or worsening hypertension (n=10/14) and eclampsia (n=7/14).

Labor and delivery. Mode of delivery was addressed by most (n=12) CPGs; none recommended a specific course of action but emphasized usual obstetrical indications (n=10/12) and joint decision making with women (n=3/12) (Supplemental Table 5). Many CPGs emphasized general obstetrical practice, related to the success of labor induction (n=7), cervical ripening (n=2), or active management of the third stage of labor (n=3) (Supplemental Table 5). Of note, 5 CPGs specifically advised against the use of ergometrine.

Magnesium sulfate. CPGs recommended magnesium sulfate for eclampsia treatment (n=15, 100%) and prevention (n=13) for women with "severe" preeclampsia (n=10/13) or with serious end-organ involvement with preeclampsia (n=2/13) or according to individual protocol (n=1/13) (Supplemental Table 6).

Magnesium sulfate was otherwise recommended for imminent preterm birth by a few CPGs (n=6), at $\leq 29^{6}$ weeks (n=2/6), $\leq 31^{6}$ weeks (n=3/6), or $\leq 32^{6}$ weeks (n=1/6). The stated indication was fetal neuroprotection (n=5/6) or to improve fetal outcomes without specifying further (n=1/6).

After delivery. A total of 6 CPGs highlighted that hypertension may worsen after delivery, between days 3 and 6 (n=5), or the first 1 to 2 weeks (n=1); 6 CPGs acknowledged that preeclampsia may worsen or appear after delivery (Supplemental Table 7). Most (n=12) CPGs recommended for (and none against) continuing antihypertensive agents after delivery. However, a number of CPGs (n=6) recommended methyldopa be switched to an alternative.

Treatment of severe hypertension followed similar recommendations as antenatally (n=7), although 2 CPGs advised lower targets. Targets for nonsevere hypertension varied from as antenatally (n=4), lower (n=3), higher (n=1), or according to standard guidelines for women with comorbidities (n=1). CPGs commonly (n=11) acknowledged the association between pregnancy hypertension and future health, particularly cardiovascular. Lifestyle counseling and modification of risk factors were frequently suggested (n=11).

Other. Not discussed are the frequency of investigations and aspects of care discussed by few CPGs, such as anesthetic management (CAN, SOMANZ, IRL, and NZL), pediatric outcomes (CAN), application of recommendations to low-resource settings (ISSHP), women's experience (NZL), management of secondary causes of hypertension (POL), or auditable standards (NICE and SOMANZ).

Discussion

Summary of findings

We identified 15 clinically useful pregnancy hypertension CPGs of variable quality.

Areas of consistency were diagnosis of hypertension, use of automated BP measurement devices, proteinuria screening using dipsticks with confirmatory testing by PrCr, and classification (ie, chronic or GH, white-coat hypertension, and a broad definition of preeclampsia that does not mandate proteinuria). Most guidelines listed risk factors for preeclampsia and recommended their use to identify women at increased risk, all of whom should receive low-dose aspirin. All guidelines recommended magnesium sulfate for eclampsia treatment and usually prevention, and most recommended antenatal corticosteroids for preeclampsia with birth likely before 34^{+0} weeks. Delivery at term was recommended for women with preeclampsia and from 34 weeks, for "severe" preeclampsia, with emphasis on usual obstetrical practices and avoidance of ergometrine. There is recognition that BP and preeclampsia may worsen after delivery and that women are at increased risk of future cardiovascular and other health problems.

However, a lack of uniformity remains with regard to components of a broad definition of preeclampsia, whether "severe" preeclampsia should be used and, if so, how it should be defined, which is important because most guidelines link magnesium sulfate and timing of birth to "severe" preeclampsia. The use of biomarkers for classification is emerging. Although most guidelines list preeclampsia risk factors, there is inconsistency in how they should be used to identify risk and eligibility for aspirin. Calcium for preeclampsia prevention is variably recommended based on the level of risk and/or baseline calcium intake. There is a movement toward normalization of BP in pregnancy, but this is recommended by fewer than half of CPGs. Many guidelines do not advise practitioners about the timing of birth for women with preterm preeclampsia.

TABLE 3
Antihypertensive therapy recommendations

Recommendation	Number of CPGs	CPGs endorsing
Place of care		
Refer women with severe hypertension to hospital	11	CAN, SOMANZ, IRL, BRA, ISSHP, NZL, ESC, USA, DEU, UK, POL
BP threshold for antihypertensive therapy		
Severe hypertension	15	All
Nonsevere hypertension		
≥140/90 mm Hg	7	CAN, SOMANZ, ISSHP, NZL, ESC, UK, POL
≥140/90 mm Hg if CV risk factors	2	FRA, TUN
≥150/100 mm Hg	4	IRL, BRA, TUN, DEU
Treatment at lower BP (<160/110 mm Hg) may be appropriate if comorbidities	1	USA
Choice of antihypertensive agent		
Severe hypertension—first line		
IV labetalol	11	NLD, CAN, FRA, IRL, ISSHP, NZL, ESC, USA, DEU, UK, POL
Oral nifedipine	10	NLD, CAN, FRA, ISSHP, NZL, ESC, USA, DEU, UK, POL
IV hydralazine (or dihydralazine)	8	CAN, BRA, ISSHP, NZL, USA, DEU, UK, POL
Oral methyldopa	3	NLD, FRA, ESC
IV nicardipine	2	FRA, TUN
Choice based on clinician's experience, familiarity, cost, or local availability	2	WHO, SOMANZ
Oral labetalol	1	UK
IV urapidil	1	DEU
Nonsevere hypertension—first line		
Labetalol	10	SOMANZ, IRL, FRA, ISSHP, NZL, ESC, USA, DEU, UK, POL
Methyldopa	7	SOMANZ, FRA, ISSHP, NZL, ESC, DEU, POL
Nifedipine	6	FRA, ISSHP, NZL, USA, DEU, POL
Oxprenolol	2	SOMANZ, ISSHP
Calcium antagonists	1	ESC
Nicardipine	1	FRA
Choice left to the clinician	2	TUN, BRA
Antihypertensive agents to avoid		
Angiotensin-converting enzyme inhibitors	14	WHO, NLD, CAN, SOMANZ, IRL, FRA, BRA, TUN, NZL, ESC, USA, DEU, UK, POL
Angiotensin II receptor blockers	14	WHO, NLD, CAN, SOMANZ, IRL, FRA, BRA, TUN, NZL, ESC, USA, DEU, UK, POL
Direct renin inhibitors	7	NLD, IRL, FRA, NZL, ESC, USA, POL
Diuretics[a]	6	WHO, SOMANZ, BRA, ESC, DEU, POL
Methyldopa postnatally	6	IRL, NZL, ESC, USA, UK, POL
Atenolol	5	CAN, FRA, BRA, ESC, USA

Scott. Pregnancy hypertension guidelines—similarities and dissimilarities. Am J Obstet Gynecol 2022. *(continued)*

TABLE 3
Antihypertensive therapy recommendations *(continued)*

Recommendation	Number of CPGs	CPGs endorsing
Magnesium sulfate as antihypertensive	3	CAN, SOMANZ, USA
Thiazide diuretics	3	WHO, FRA, UK
Spironolactone	2	USA, POL
Prazosin	2	CAN, BRA
Sublingual nifedipine	1	IRL
Diltiazem	1	POL
Sodium nitroprusside	1	WHO
Target BP on antihypertensive therapy		
Severe hypertension		
<160/110 mm Hg	2	CAN, POL
<160/105 mm Hg (MAP <125 mm Hg)	1	IRL
130–150 mm Hg/80–100 mm Hg	1	NZL
140–150/90–100 mm Hg	1	USA
Nonsevere hypertension (or unspecified)		
<160/110 mm Hg	1	NLD
<160 mm Hg/85–100 mm Hg	2	FRA, TUN
150/80–99 mm Hg (without comorbidity)	1	IRL
130–150/80–100 mm Hg	2	BRA, DEU
<140/100 mm Hg	1	NZL
140/80–90 mm Hg (with comorbidity)	1	IRL
dBP of 85 mm Hg specifically	1	CAN
<135/85 mm Hg	1	UK
110–140/80–85 mm Hg	1	ISSHP
110–139 mm Hg/81–85 mm Hg	1	POL
Use of home BP assessment for ongoing of hypertension control		
Recommended	3	ISSHP[b]
Acknowledged as potentially useful	6	SOMANZ, CAN, IRL, FRA, ISSHP[b]

ACR, albumin-to-creatinine ratio; *BP*, blood pressure; *BRA*, Brazil; *CAN*, Canada; *CPG*, clinical practice guideline; *CV*, cardiovascular; *dBP*, diastolic blood pressure; *DEU*, Germany; *ESC*, European Society of Cardiology; *FRA*, France; *ISSHP*, International Society for the Study of Hypertension in Pregnancy; *IV*, intravenous; *N/A*, not applicable; *NLD*, Netherlands; *NOR*, Norway; *NZL*, New Zealand; *POL*, Poland; *PrCr*, protein-to-creatinine ratio; *IRL*, Ireland; *sBP*, systolic blood pressure; *SOMANZ*, Society of Obstetric Medicine of Australia and New Zealand; *TUN*, Tunisia; *UK*, United Kingdom; *USA*, United States of America; *WHO*, World Health Organization.

[a] Situations where diuretics may be used were listed as: thiazides for chronic hypertension as they do not cause volume depletion (BRA), furosemide for oliguria (ESC), or pulmonary edema (SOMANZ); [b] ISSHP recommends home BP monitoring for white-coat, transient, and masked hypertension, and acknowledges that such monitoring may be potentially useful in other hypertensive disorders of pregnancy.

Scott. Pregnancy hypertension guidelines—similarities and dissimilarities. Am J Obstet Gynecol 2022.

Comparison with current literature

The current review included 70% more "clinically useful" CPGs than our 2014 review (n=15 vs 9)[3] with broad international representation.

The diagnostic criteria for hypertension and its severity were unchanged and consistent among the CPGs. Advice about self-monitoring devices reflects progressive interest in home BP monitoring[76] and the fact that most CPGs now define white-coat hypertension. Although most guidelines recommend that a normal self-monitored BP is ≤135/85 mm Hg, systematic review of relevant literature has not found that home measurements are consistently lower than clinic measurement, although there was a wide variability and home measurements may have been lower for hypertensive women specifically.[77] CPGs have deemphasized aneroid devices but, despite its withdrawal from the market, most guidelines continued to discuss mercury sphygmomanometry.

Current CPGs were clearer about proteinuria testing than previously.

Dipstick proteinuria testing was widely endorsed as a screening test, followed by quantitative testing. There is a move toward the use of urinary PrCr and away from 24-hour urine collection, although both are still supported. There is little attention given to urinary ACR and no consensus on its cutoff for an abnormal result despite the publication of DAPPA in 2017.[78]

Diagnostic criteria for chronic and GH remain consistent and unchanged. However, there has been a move away from the traditional definition of preeclampsia that mandates proteinuria (55% previously) and toward a broad definition (now 80%), with most endorsing target organ manifestations of headache or visual symptoms and/or laboratory abnormalities of platelets, creatinine, or liver enzymes. This means that women may have GH by 1 CPG and preeclampsia by another when proteinuria is not a mandatory criterion. In addition, "severe" preeclampsia use and definition remain controversial; what constitutes "severe" preeclampsia by CPGs that mandate proteinuria now defines any preeclampsia for most CPGs.

There has been an emergence of recommendations to use multivariable models for preeclampsia risk prediction—models that add biomarkers and ultrasonography to clinical risk markers in early pregnancy. This is likely related to the Aspirin for Evidence-Based Preeclampsia Prevention trial that revealed that aspirin prescribed based on multivariable screening substantially reduced the incidence of preterm preeclampsia.[79] All CPGs now advise on aspirin use and recommend it for women at increased risk, but there remain inconsistencies about the dosing and gestational ages for starting and stopping. Calcium is more frequently recommended than aspirin in Gillon et al[3] (by 9/15 vs 3/9 CPGs, respectively), particularly when there is both low intake and increased risk of preeclampsia.

Antihypertensive therapy is now addressed by all CPGs rather than 6 of 9 in our previous review. All continue to agree that severe hypertension should be treated, most commonly with IV labetalol, oral nifedipine, or IV hydralazine. Although the target BP for nonsevere hypertension remains inconsistent, there is a movement toward normalization of BP even for women without comorbidities (4/12) compared with the previous one (0/4) when target BP was reported, citing the international Control of Hypertension In Pregnancy Study[80] and the relevant Cochrane review.[75] First-line agents are the same, although oral labetalol is now more frequently endorsed than methyldopa or nifedipine, which were similarly recommended previously. There is no change in the recommendation not to use RAS blockers.

For women anticipated to deliver preterm, particularly women with preeclampsia, antenatal corticosteroid administration is now more clearly presented by the majority (as opposed to just under half previously) of CPGs, and when discussed, all recommend against its use for HELLP syndrome. Fetal indications have emerged as an indication for magnesium sulfate, but recommendations for eclampsia treatment and prevention have changed a little. Of note, however, indications for prevention were still tied to the definition of "severe" preeclampsia.

Recommendations have become consistent in recommending birth for women with preeclampsia at term, previously recommended by only half of CPGs, even with "severe" preeclampsia; about half of guidelines make similar recommendations for women with GH. Nevertheless, when women present preterm, about half of the guidelines for preeclampsia and most for GH give practitioners advice about the timing of birth. Evidence continues to emerge.[81] Management of labor and delivery remains as previously, with a focus on usual care but avoidance of ergometrine.

There remains an appreciation that BP and preeclampsia can worsen after delivery, antihypertensive therapy may still be required, and long-term health complications are increased in incidence, mandating lifestyle change and risk factor modification.

Strengths and limitations

The strengths of this review include a comprehensive search strategy and rigorous methodology informed by the AGREE II, as followed for our 2014 review.[3] We included recommendations and information from tables and text to provide a comprehensive picture. Most CPGs were explicitly evidence based, according to the grading of the quality of evidence and/or strength of recommendations.

Limitations include potential selection bias because we only included CPGs published in English, French, German, or Dutch. We did not include a discussion of the strength of recommendations in our summary because 6 CPGs provided no such evaluation of recommendations and there were 9 different evidence-grading systems. Given the word count constraints, it is possible that some CPGs were downgraded in quality based on the failure to report an activity when it was actually undertaken.

Conclusion and future direction

Increasingly, there is consistency in CPG recommendations that are appropriate for implementation and as auditable standards. Key definitions and most aspects of classification are automated BP measurement, preeclampsia prediction and aspirin prophylaxis, magnesium sulfate for eclampsia prevention and treatment, antenatal corticosteroids for preterm birth, and delivery at term for preeclampsia. A lack of uniformity was seen for components of a broad definition of preeclampsia (with biomarkers emerging), the utility of "severe" preeclampsia as a term and how it should be defined to inform care pathways, how preeclampsia risk should be identified, aspirin dose, and calcium intake. There is a movement toward normalization of BP with antihypertensive agents. Consistent recommendations should be implemented and audited, and inconsistencies should inform future research. ■

REFERENCES

1. Mustafa R, Ahmed S, Gupta A, Venuto RC. A comprehensive review of hypertension in pregnancy. J Pregnancy 2012;2012:105918.
2. Knight M, Nair M, Tuffnell D, et al. on behalf of MBRRACE-UK. Saving lives, improving

mothers' care: surveillance of maternal deaths in the UK 2012-14 and lessons learned to inform maternity care from the UK and Ireland confidential enquiries into maternal deaths and morbidity 2009-14. Oxford, England: National Perinatal Epidemiology Unit, University of Oxford; 2016.

3. Gillon TE, Pels A, von Dadelszen P, MacDonell K, Magee LA. Hypertensive disorders of pregnancy: a systematic review of international clinical practice guidelines. PLoS One 2014;9:e113715.

4. About us. International Federation of Gynecology and Obstetrics. 2020. Available at: https://www.figo.org/about-us. Accessed April 3, 2017.

5. Brouwers MC, Kho ME, Browman GP, et al. AGREE II: advancing guideline development, reporting and evaluation in health care. J Clin Epidemiol 2010;63:1308–11.

6. Société française d'anesthésie et de réanimation (Sfar); Collège national des gynécologues et obstétriciens français (CNGOF); Société française de médecine périnatale (SFMP); Société française de néonatalogie (SFNN). [Multidisciplinary management of severe pre-eclampsia (PE). Experts' guidelines 2008. Société française d'anesthésie et de réanimation. Collège national des gynécologues et obstétriciens français. Société française de médecine périnatale. Société française de néonatalogie]. Ann Fr Anesth Reanim 2009;28:275–81.

7. The Association of Obstetricians & Gynaecologists of Malawi. Obstetrics & gynaecology protocols and guidelines. The Association of Obstetricians & Gynaecologists of Malawi; 2014:1–105.

8. The Editor. Management of hypertensive disease during pregnancy. SLJOG 2014;36:49–52.

9. Mandrupkar G, Kore S, Gupte S, et al. Hypertensive disorders of pregnancy (HDP). 2014. Available at: https://www.fogsi.org/wp-content/uploads/2015/11/hdp.pdf 2014. Accessed October 31, 2019.

10. Chahine R, Khazaal J. Guidelines for diagnosis and management of preeclampsia. Lebanese Society of Obstetrics and Gynecology; 2018. Available at: http://www.lsog.org.lb/public/uploads/documents/22838991.pdf. Accessed October 31, 2019.

11. Nepal Society of Obstetricians & Gynaecologists. Hypertensive disorders in pregnancy diagnosis. evaluation and management; 2013. Available at: http://www.nesog.org.np/images/resources/resourceP_8569.pdf. Accessed October 31, 2019.

12. Hegde CV. The use of protocols in obstetrics and gynecology. J Obstet Gynaecol India 2013;63:359–60.

13. Abrams RM. Hypertension in pregnancy: a review of current guidelines. Curr Womens Health Rev 2015;11:109–19.

14. Nelson-Piercy C, Lowe S. Clinical practice guidelines in obstetric medicine. Obstet Med 2015;8:59–60.

15. Hackney DN, March MI. Who should receive low-dose aspirin for pre-eclampsia prevention? Sorting through the meta-analyses. Curr Womens Health Rev 2015;11:91–6.

16. Pal B, Biniwale P, Sundari T, et al. P 4 diagnosis, management and care of hypertensive disorders of pregnancy (HDP) in India—an Indian expert opinion. Pregnancy Hypertens 2017;9:38–9.

17. Piccoli GB, Cabiddu G, Castellino S, et al. A best practice position statement on the role of the nephrologist in the prevention and follow-up of preeclampsia: the Italian study group on kidney and pregnancy. J Nephrol 2017;30:307–17.

18. Bernstein PS, Martin JN Jr, Barton JR, et al. Consensus bundle on severe hypertension during pregnancy and the postpartum period. J Midwifery Womens Health 2017;62:493–501.

19. Coutinho T, Lamai O, Nerenberg K. Hypertensive disorders of pregnancy and cardiovascular diseases: current knowledge and future directions. Curr Treat Options Cardiovasc Med 2018;20:56.

20. Reddy M, Springhall EA, Rolnik DL, da Silva Costa F. How to perform first trimester combined screening for pre-eclampsia. Australas J Ultrasound Med 2018;21:191–7.

21. Malhotra J, Patel MC, Malhotra N. FOGSI focus: medical disorders in pregnancy, 1st ed. New Delhi, India: Jaypee Brothers Medical Publishers (P) Ltd; 2018.

22. SEC Working Group for the ESC 2018 guide on the treatment of cardiovascular diseases during pregnancy. Comments on the 2018 ESC Guidelines for the Management of Cardiovascular Diseases During Pregnancy. Rev Esp Cardiol (Engl Ed) 2019;72:109–14.

23. Expertos Intervinientes. Guias de la Sociedad Argentina de Hipertension para el diagnostico, estudio, tratamiento y seguimiento de la hipertension arterial. 2007. Available at: http://www.saha.org.ar/pdf/formacion/GUIA_SAHA_VERSION_DE_BOLSILLO.pdf. Accessed October 31, 2019.

24. Lagunes-Espinosa AL, Ríos-Castillo B, Peralta-Pedrero ML, et al. Guía de práctica clínica. Enfermedades hipertensivas del embarazo. Rev Med Inst Mex Seguro Soc 2011;49:213–24. Available at: http://www.medigraphic.com/pdfs/imss/im-2011/im112t.pdf. Accessed October 31, 2019.

25. Vigil De Gracia P, De Gracia J, Campana S, et al. Módulo de capacitación en preeclampsia-eclampsia, 1st ed. Lima, Perú: Federación Latinoamericana de Sociedades de Obstetricia y Ginecología. 2012. Available at: http://www.sogiba.org.ar/documentos/Eclampsia.pdf. Accessed October 31, 2019.

26. Representantes del Grupo Desarrollador de la Guía - Universidad Nacional de Colombia - Alianza Cinets. Clinical practice guidelines for approaching pregnancy-associated hypertensive complications [Article in Spanish]. Rev Colomb Obstet Ginecol 2013;64:289–326. Available at: http://www.scielo.org.co/pdf/rcog/v64n3/v64n3a06.pdf.

27. Federation of Anaesthesiologists and Reanimatologists, Kulikov AV, Shifman EM, Belomestnov SR, Levit AL. Emergency care for eclampsia and its complications. Eclampsia, HELLP-syndrome [Article in Russian]. Anesteziol Reanimatol 2013:75–81.

28. Abraitis V, Arlauskienė A, Bagušytė L, et al. METODIKA nėštumo sukelta hipertenzinė BŪKLĖ (nėščiųjų hipertenzija, preeklampsija, EKLAMPSIJA). Lietuvos akušerių-ginekologų draugija Lietuvos akušerių sąjunga. 2014. Available at: https://sam.lrv.lt/uploads/sam/documents/files/Veiklos_sritys/Programos_ir_projektai/Sveicarijos_parama/Akuserines metodikos/Nestumo sukelta hipertenzine bukle (nesciuju hipertenzija%2C preeklampsija%2C eklampsija).pdf 2014. Accessed October 31, 2019.

29. Nielsen LH, Sundtoft I, Vestgaard MJ, et al. Guidelines til hypertension og præeklampsi. Dan Selsk Obstet Og Gynækologi 2018:1–44.

30. Societatea de obstetrica si ginecologie din Romania. Hipertensiunea asociată sarcinii. 2019. Available at: https://sogr.ro/wp-content/uploads/2019/05/12.-Hipertensiunea-asociat%C4%83-sarcinii.pdf. Accessed October 31, 2019.

31. Prejbisz A, Dobrowolski P, Kosiński P, et al. Postępowanie w nadciśnieniu tętniczym u kobiet w ciąży. Zapobieganie, diagnostyka, leczenie i odległe rokowanie. Stanowisko Polskiego Towarzystwa Nadciśnienia Tętniczego, Polskiego Towarzystwa Kardiologicznego oraz Polskiego Towarzystwa Ginekologów i Położników. Ginekol i Perinatol Prakt 2019;4:43–111.

32. Lowe SA, Brown MA, Dekker GA, et al. Guidelines for the management of hypertensive disorders of pregnancy 2008. Aust N Z J Obstet Gynaecol 2009;49:242–6.

33. National Collaborating Centre for Women's and Children's Health. Hypertension in pregnancy: the management of hypertensive disorders during pregnancy. London, England: RCOG Press; 2010.

34. European Society of Gynecology (ESG), Association for European Paediatric Cardiology (AEPC), German Society for Gender Medicine (DGesGM), et al.. ESC guidelines on the management of cardiovascular diseases during pregnancy: the Task Force on the management of cardiovascular diseases during pregnancy of the European Society of Cardiology (ESC). Eur Heart J 2011;32:3147–97.

35. American College of Obstetricians and Gynecologists, Task Force on Hypertension in Pregnancy. Hypertension in pregnancy. Report of the American College of Obstetricians and Gynecologists' Task Force on hypertension in pregnancy. Obstet Gynecol 2013;122:1122–31.

36. Stepan H, Kuse-Föhl S, Klockenbusch W, et al. Diagnosis and treatment of hypertensive pregnancy disorders. Guideline of DGGG (S1-level, AWMF Registry No. 015/018, December 2013). Geburtshilfe Frauenheilkd 2015;75:900–14.

37. Committee on Obstetric Practice. Committee Opinion no. 692: emergent therapy for

acute-onset, severe hypertension during pregnancy and the postpartum period. Obstet Gynecol 2017;129:e90–5.
38. Emergency Nurses Association. Clinical practice guideline: noninvasive blood pressure measurement with automated devices. Guideline Central. 2012. Available at: https://www.guidelinecentral.com/summaries/clinical-practice-guideline-non-invasive-blood-pressure-measurement-with-automated-devices/#section-99999 2012. Accessed October 31, 2019.
39. Watanabe K, Naruse K, Tanaka K, Metoki H, Suzuki Y. Outline of definition and classification of "Pregnancy Induced Hypertension (PIH)." Hypertens Res Preg 2013;1:3–4.
40. United States Preventive Services Task Force, Bibbins-Domingo K, Grossman DC, et al. Screening for preeclampsia: US Preventive Services Task Force recommendation statement. JAMA 2017;317:1661–7.
41. Watanabe K, Matsubara K, Nakamoto O, et al. Outline of the new definition and classification of "Hypertensive Disorders of Pregnancy (HDP)"; a revised JSSHP statement of 2005. Hypertens Res Preg 2018;6:33–7.
42. Queensland Clinical Guidelines. Hypertensive disorders of pregnancy. Document no. MN10.13.V4-R15. Queensland, Australia: State of Queensland (Queensland Health); 2015.
43. Milne F, Redman C, Walker J, et al. The pre-eclampsia community guideline (PRECOG): how to screen for and detect onset of pre-eclampsia in the community. BMJ 2005;330:576–80.
44. Milne F, Redman C, Walker J, et al. Assessing the onset of pre-eclampsia in the hospital day unit: summary of the pre-eclampsia guideline (PRECOG II). BMJ 2009;339:b3129.
45. HDP CPG Working Group. Association of Ontario Midwives. Hypertensive Disorders of Pregnancy. Clinical Practice Guideline no. 15. 2012. 2012. Available from: https://www.ontariomidwives.ca/sites/default/files/CPG%20full%20guidelines/CPG-HDP-PUB.pdf 2012. Accessed October 31, 2019.
46. Der Deutschen Gesellschaft für Gynäkologie und Geburtshilfe. Hypertensiver schwangerschaftserkrankungen: diagnostik und therapie. AWMF Online 2007. Available from: https://www.awmf.org/uploads/tx_szleitlinien/015-018l_S2k_Diagnostik_Therapie_hypertensiver_Schwangerschaftserkrankungen_2019-07.pdf. Accessed September 16, 2020.
47. Lindheimer MD, Taler SJ, Cunningham FG; American Society of Hypertension. ASH position paper: hypertension in pregnancy. J Clin Hypertens (Greenwich) 2009;11:214–25.
48. World Health Organization. WHO recommendations for prevention and treatment of preeclampsia and eclampsia. 2011. Available at: https://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548335/en/ 2011. Accessed October 31, 2019.
49. Nederlandse Vereniging voor Obstetrie en Gynaecologie. Hypertensieve aandoeningen in de zwangerschap. Utrecht: Nederlandse Vereniging voor Obstetrie en Gynaecologie; 2011. Available at: https://www.internisten.nl/sites/internisten.nl/files/uploads/CV/Mx/CVMxUs9h0bleN-QRN2Y83A/richtlijn_2012_-Hypertensieve-aandoeningen-in-de-zwangerschap.pdf. Accessed October 31, 2019.
50. Magee LA, Pels A, Helewa M, Rey E, von Dadelszen P; Canadian Hypertensive Disorders of Pregnancy (HDP) Working Group. Diagnosis, evaluation, and management of the hypertensive disorders of pregnancy. Pregnancy Hypertens 2014;4:105–45.
51. World Health Organization. WHO recommendation: calcium supplementation during pregnancy for the prevention of pre-eclampsia and its complications. 2018. Available at: https://apps.who.int/iris/handle/10665/277235 2018. Accessed October 31, 2019.
52. World Health Organization. WHO recommendations: drug treatment for severe hypertension in pregnancy. 2018. Available at: https://apps.who.int/iris/handle/10665/277234 2018. Accessed October 31, 2019.
53. World Health Organization. WHO recommendations: policy of interventionist versus expectant management of severe pre-eclampsia before term. 2018. Available at: https://apps.who.int/iris/handle/10665/277236 2018. Accessed October 31, 2019.
54. Brown MA, Magee LA, Kenny LC, et al. The hypertensive disorders of pregnancy: ISSHP classification, diagnosis & management recommendations for international practice. Pregnancy Hypertens 2018;13:291–310.
55. Butalia S, Audibert F, Côté AM, et al. Hypertension Canada's 2018 guidelines for the management of hypertension in pregnancy. Can J Cardiol 2018;34:526–31.
56. American College of Obstetricians and Gynecologists' Committee on Practice Bulletins—Obstetrics. ACOG Practice Bulletin no. 203: chronic hypertension in pregnancy. Obstet Gynecol 2019;133:e26–50.
57. ACOG Practice Bulletin no. 202: gestational hypertension and preeclampsia. Obstet Gynecol 2019;133:e1–25.
58. ACOG Committee Opinion no. 767: emergent therapy for acute-onset, severe hypertension during pregnancy and the postpartum period. Obstet Gynecol 2019;133:e174–80.
59. Malachias MVB, Plavnik FL, Machado CA, Malta D, Scala LCN, Fuchs S. 7th Brazilian guideline of arterial hypertension: chapter 1 - concept, epidemiology and primary prevention. Arq Bras Cardiol 2016;107(Suppl3):1–6.
60. Borghi C, Ferri C, Sechi L. Clinical Management of Hypertension in Pregnancy. High Blood Press Cardiovasc Prev 2013;20:123–7.
61. Mounier-Vehier C, Amar J, Boivin JM, et al. Hypertension and pregnancy: expert consensus statement from the French Society of Hypertension, an affiliate of the French Society of Cardiology. Fundam Clin Pharmacol 2017;31:83–103.
62. Staff AC, Andersgaard AB, Henriksen T, et al. Chapter 28 hypertensive disorders of pregnancy and eclampsia. Eur J Obstet Gynecol Reprod Biol 2016;201:171–8.
63. Clinical practice guideline. The diagnosis and management of severe pre-eclampsia and eclampsia. Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and the Clinical Strategy and Programmes Division, Health Service Executive. 2016. Available at: https://www.hse.ie/eng/services/publications/clinical-strategy-and-programmes/diagnosis-and-management-of-pre-eclampsia-and-eclampsia.pdf. Accessed October 31, 2019.
64. Clinical practice guideline. The manangement of hypertension in pregnancy. Institute of Obstetricians and Gynaecologists, Royal College of Physicians of Ireland and the Clinical Strategy and Programmes Division, Health Service Executive. 2016. Available at: https://rcpi-live-cdn.s3.amazonaws.com/wp-content/uploads/2017/02/Hypertension-Guideline_approved_120716-1.pdf. Accessed October 31, 2019.
65. Regitz-Zagrosek V, Roos-Hesselink JW, Bauersachs J, et al. 2018 ESC guidelines for the management of cardiovascular diseases during pregnancy. Eur Heart J 2018;39:3165–241.
66. Werkgroep NO. Addendum bij multidisciplinaire richtlijn Hypertensieve aandoeningen in de zwangerschap uit 2011. Utrecht: Nederlandse Vereniging voor Obstetrie en Gynaecologie; 2014. Available at: https://www.nvog.nl/wp-content/uploads/2018/02/Addendum-Hypertensieve-aandoeningen-uitgangsvragen-bloeddruk-meten-en-significante-proteinurie-bij-rl-hypertensieve-aandoeningen-2014-2.pdf. Accessed October 31, 2019.
67. NVOG-module 'Wat is de rol van acetylsalicylzuur, gestart ≤16 weken amenorroeduur, ter preventie van pre-eclampsie bij zwangere vrouwen?' (behorende bij de richtlijn Hypertensieve aandoeningen in de Zwangerschap). Ned Ver Obstet Gynecol (NVOG) 2019:1–32. Available at: https://www.nvog.nl/wp-content/uploads/2019/10/NVOG-module-Acetylsalicylzuur-okt-2019.pdf. Accessed October 31, 2019.
68. Deutsche Gesellschaft Fur Gynakologie und Geburtshilfe. Hypertensive Schwangerschaftserkrankungen: Diagnostik und Therapie, Vol. 1. Deutsche Gesellschaft Fur Gynakologie und Geburtshilfe; 2019:1–13. Available at: https://www.awmf.org/uploads/tx_szleitlinien/015-018l_S2k_Diagnostik_Therapie_hypertensiver_Schwangerschaftserkrankungen_2019-07.pdf. Accessed October 31, 2019.
69. National Institute for Health and Care Excellence. Hypertension in pregnancy: diagnosis and management (NG133). 2019:1–54. Available at: https://www.nice.org.uk/guidance/ng133/resources/hypertension-in-pregnancy-diagnosis-and-management-pdf-66141717671365. Accessed October 31, 2019.
70. Prejbisz A, Dobrowolski P, Kosiński P, et al. Management of hypertension in pregnancy: prevention, diagnosis, treatment and long-term prognosis. Kardiol Pol 2019;77:757–806.

71. Lowe SA, Bowyer L, Lust K, et al. The SOMANZ guideline for the management of hyprtensive disorders of pregnancy 2014. Aust N Z J Obstet Gynaecol 2015;55:11–6.

72. Diagnosis and treatment of hypertension and pre-eclampsia in pregnancy in New Zealand: a clinical practice guideline. Ministry of Health, New Zealand Government. 2018. Available at: https://www.health.govt.nz/system/files/documents/publications/diagnosis-and-treatment-of-hypertension-and-pre-eclampsia-in-pregnancy-in-new-zealand-v3.pdf. Accessed October 31, 2019.

73. Ben Temime R, Boudaya F, Ouerdiane N, et al. Recommandations STGO: troubles Hypertensifs de la Grossesse. La Soc Tunisienne Gynecol Obstet 2016:1–36.

74. Sridharan K, Sequeira RP. Drugs for treating severe hypertension in pregnancy: a network meta-analysis and trial sequential analysis of randomized clinical trials. Br J Clin Pharmacol 2018;84:1906–16.

75. Abalos E, Duley L, Steyn DW, Gialdini C. Antihypertensive drug therapy for mild to moderate hypertension during pregnancy. Cochrane Database Syst Rev 2018;10:CD002252.

76. Rushbrook J, Shennan A. Self-monitoring of blood pressure in pregnancy. Prof Care Mother Child 1997;7:88–90.

77. Tucker KL, Bankhead C, Hodgkinson J, et al. How do home and clinic blood pressure readings compare in pregnancy? Hypertension 2018;72:686–94.

78. Waugh J, Hooper R, Lamb E, et al. Spot protein-creatinine ratio and spot albumin-creatinine ratio in the assessment of pre-eclampsia: a diagnostic accuracy study with decision-analytic model-based economic evaluation and acceptability analysis. Health Technol Assess 2017;21:1–90.

79. Rolnik DL, Wright D, Poon LC, et al. Aspirin versus placebo in pregnancies at high risk for preterm preeclampsia. N Engl J Med 2017;377:613–22.

80. Magee LA, von Dadelszen P, Rey E, et al. Less-tight versus tight control of hypertension in pregnancy. N Engl J Med 2015;372:407–17.

81. Chappell LC, Brocklehurst P, Green ME, et al. Planned early delivery or expectant management for late preterm pre-eclampsia (PHOENIX): a randomised controlled trial. Lancet 2019;394:1181–90.