The High Blood Pressure Management Development Team, under the guidance of Intermountain’s Primary Care and Cardiovascular Clinical Programs, developed this care process model (CPM) to guide the effective, consistent management of high blood pressure for patients across the Intermountain system. This CPM is based on the JNC-8, other new guidelines released by national and international societies, and national initiatives led by the CDC and the American Medical Association.

Why Focus ON HIGH BLOOD PRESSURE?

• It’s the most common chronic condition in primary care. About one in three US adults, nearly 75 million, has high blood pressure (BP).MER1

• It’s dangerous. In 2014, there were 73,345 deaths attributable to high BP and 410,624 deaths with any mention of high BP. Of children and adolescents aged 8 to 17 years, 11% had either high BP or elevated high BP. Life expectancy is 5 years shorter for people with high BP.CDC2

• It’s expensive. High BP costs the nation $51 billion annually in direct medical expenses, and another $3.5 billion in lost productivity.AMA

• It’s undertreated. While effective treatments have been available for more than 50 years, fewer than half of Americans with high BP have their condition under control. The lack of consistent treatment within healthcare delivery systems appears to be a major contributor.AHA

• Outcomes improve when systems consistently follow practical treatment guidelines and adopt team processes. Recent initiatives and evidence reviews show that it’s essential to create system-wide targets and algorithms, and to use health information technology to identify hypertensive patients and update providers on patient status.

• A powerful opportunity to improve outcomes. Intermountain has the data collection and reporting, decision support, and team coordination to identify and engage all patients with high BP across our system.

What’s new in this update?

• New ACC/AHA Guidelines for the prevention, detection, evaluation, and management of high blood pressure in adults have been incorporated throughout this CPM.

• New guidelines for managing high blood pressure in pediatric populations. (See page 16.)

• Guidance for incorporating AOBP (Automated Office Blood Pressure) into the HBP clinic workflow. (See pages 4–5.)

• New process for rapid cycling during medication titration. This includes clinical team processes to improve communication and efficiency. (See pages 6–8.)

• Improved tools for patient education and shared decision-making on therapeutic lifestyle changes. (See pages 10–11.)

• Updated medication tables and guidance on special populations. (See pages 12–18.)

• Reports to help you manage your patient population. (See page 21.)
ALGORITHM 1: BLOOD PRESSURE SCREENING, DIAGNOSIS, AND TREATMENT

Check BP at each office visit (a)

Yes

Systolic ≥130 OR diastolic ≥80 (mmHg)?

No

RECHECK BP after waiting quietly for 5 minutes OR perform AOBP

Yes

BP remains elevated?

No

SCHEDULE follow-up visit within 2 to 4 weeks to confirm high BP

Yes

High BP confirmed? (b)

No

DIAGNOSE high BP

Classify high BP (in mm Hg):

- Normal: <120 and <80
- Elevated BP: 120-129 and <80
- Stage 1 HBP: 130-139 or 80-89
- Stage 2 HBP: ≥140 or ≥90

Perform diagnostic workup: (see page 5)

- History and exam: Assess for personal/family history of associated conditions and CV risk factors; identifiable causes of hypertension; end-organ damage
- Tests: Comprehensive metabolic panel, urinalysis, and urine albumin to creatinine ratio (ACR)

TREAT high BP to management target

RECOMMEND therapeutic lifestyle changes (TLC) (c)

- If BP < 160 / < 100 mm Hg AND NO kidney disease, diabetes, heart failure, or vascular disease: Start meds concurrently with TLC or start with trial of 3 months of TLC alone (c)
- If BP ≥ 160 / ≥ 100 mm Hg OR any of the conditions above: Start meds concurrently with TLC and consider adding two-drug regimen

MAINTAIN TLC throughout course of treatment

Treatment process:

- Rapid cycle: Evaluate BP every two weeks while titrating or switching meds. (d)
- Order BMP two to three weeks after initiation or dose changes of lisinopril or HCTZ.
- Consider divided dosing (AM/PM) when patient is on three medications or more.
- When BP is at target, maintain current therapy and evaluate BP every 6 to 12 months.
- Ongoing: Patients should see a PCP or specialist at least yearly.

INITIATE TREATMENT with ACE-I (or ARB): lisinopril (or losartan) (e)

Lisinopril titration: 10 mg daily ➔ 20 mg daily

ADD amiodipine (e)

Amlodipine titration: 5 mg daily ➔ 10 mg daily

ADD HCTZ (as single combo pill with ACE-I/ARB) (e)

Lisinopril/HCTZ (20 / 12.5 mg pill) titration: 1 pill daily ➔ 2 pills daily

Resistant high BP: If BP is still not in control when patient is prescribed 3 medications and adherence has been confirmed, consider referral to Resistant High Blood Pressure Clinic (if available), cardiology (if heart failure), or nephrology (if kidney disease). (See page 14.)

ADD carvedilol (keep heart rate > 55 bpm) (e)

Carvedilol titration: 6.25 mg, twice daily ➔ 12.5 mg, twice daily ➔ 25 mg, twice daily

Special populations:

See note (f) for options in treating high blood pressure in the following:

- Coronary artery disease
- Heart failure
- Chronic kidney disease
- Diabetes
- Patients of African ancestry
- Pregnancy
- Pediatric patients
- Older patients

Indicates an Intermountain measure
### ALGORITHM NOTES

#### (a) Checking BP

**When**
- **At every office visit.** Regardless of the visit’s purpose, measure BP, and make a plan to confirm high BP if the patient’s BP is ≥ 130/≥ 80 mmHg.
- **Every 2 weeks** during medication titration.
- **Every 6 to 12 months** once a patient with high BP has achieved BP control.

**How**
See page 4 for tips on checking BP, including timing, patient position, cuff size and position, and so forth.

#### (b) Confirming high BP

**Methods**
- **Follow-up office visit**
  - High BP can be confirmed through 2 office visits total, with 2 BP checks during each visit.
- **Home BP monitoring**
  - Train patient on checking BP at home (see page 4), and make sure patient has appropriate home BP monitor.
  - Patient takes at least 6 to 10 home BP readings over 2 weeks or more; provider evaluates readings.

**Results**

- **Suspected high BP**
  - If BP is ≥ 130/≥ 80 mmHg with several readings, but you suspect BP is not truly elevated:
    - Code appropriately in EMR (see page 5).
    - Educate patient and counsel on lifestyle changes.
    - Follow up until it’s clear whether BP is normal or elevated.
  - See pages 5–8 for process details.

- **Elevated BP**
  - If BP is 120–129/< 80 mmHg:
    - Counsel patient on therapeutic lifestyle changes.
  - See pages 5–8 for process details.

- **High BP**
  - Treat as per algorithm. See pages 6–8 for process details.

#### (c) Therapeutic Lifestyle Changes (TLC)

**TLC elements**
- TLC elements include weight reduction, the DASH eating plan, sodium reduction, regular physical activity, limiting alcohol, and smoking cessation. See page 10 for more information on these elements and their BP effects.

**Shared decision making on TLC**
- All patients with high BP should be advised to start TLC as part of their treatment plan. For patients with Stage 1 HBP who do NOT have kidney disease, diabetes, heart failure, or vascular disease, TLC alone is a proven therapeutic option if the patient can make these lifestyle changes.
- Present the option of starting with a 3-month trial of TLC alone, assess the patient’s readiness for these changes, and decide whether or not to start meds along with TLC from the start.
- See pages 10–11 for tools and processes to help you assess readiness and motivate patients to maintain TLC.

#### (d) Frequent monitoring and titration

- **Rapid cycling:** See “Population and Process Management,” pages 6–8, for information on processes that can assist in frequent monitoring.
- **If BP is not in control after 2 weeks therapy** on a new medication or dose, move to the next step in the medication cascade.

#### (e) Medication notes (see pages 18–20 for details)

- **Consider nonadherence.** Nearly 50 % of patients referred to an Intermountain Resistant HBP Clinic were found to be not taking their medication and, therefore, did not have resistant HBP.
- **Consider interfering agents.** Ask about NSAID use.

**Medications in the algorithm**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lisinopril/Loxartan</td>
<td>- If dry cough with lisinopril, switch to losartan. Losartan titration: 50 mg daily → 100 mg daily.</td>
</tr>
<tr>
<td></td>
<td>- Avoid all ACE-I or ARB medications in pregnancy (can cause fetal toxicity).</td>
</tr>
<tr>
<td></td>
<td>- Do NOT combine an ACE-I and an ARB.</td>
</tr>
<tr>
<td>Amlodipine</td>
<td>- Monitor for peripheral edema.</td>
</tr>
<tr>
<td></td>
<td>- If patient is on simvastatin &gt; 20 mg daily, consider alternative statin due to drug interaction.</td>
</tr>
<tr>
<td></td>
<td>- Consider starting with 2.5 mg daily in elderly patients.</td>
</tr>
<tr>
<td>Carvedilol</td>
<td>- Monitor for bradycardia (keep HR &gt; 55 BPM).</td>
</tr>
</tbody>
</table>

**f) Special populations (see pages 12–16 for details)**

- **Coronary artery disease**
  - Consider adding carvedilol (preferred) or metoprolol succinate to ACE-I/ARB. As needed, add amlodipine and then a diuretic.

- **Heart failure**
  - If ejection fraction < 40 %, ACE-I/ARB PLUS carvedilol (preferred) or metoprolol succinate PLUS spironolactone (if not contraindicated). If needed for BP, add amlodipine.

- **Kidney disease**
  - As per the current CKD CPM, treat to < 140/< 90 mmHg if ACR > 300. Monitor K- and creatinine with ACE-I/ARBs.

- **Diabetes**
  - As per the current Adult Diabetes Mellitus CPM, treat to < 140/< 90 mmHg. In prediabetes, consider avoiding thiazides and beta blockers (based on BG effects).

- **African ancestry**
  - Consider starting with CCB or thiazide; then, add thiazide or CCB as 2nd line.

- **Pregnancy**
  - Avoid ACE-I/ARB medications. Consider labetalol, CCB (nifedipine preferred), hydralazine, or methylodopa.

- **Resistant hypertension**
  - If BP is still not in control after patient is on 3 meds or more, consider referral to Resistant High Blood Pressure Clinic, cardiology (if heart failure or coronary disease), or nephrology (if kidney disease).

- **Pediatric patients**
  - For ages 3–11, check BP annually and at every visit for ages 12–18. Initiate TLC for all stages. Initiate workup, referral, and treatment for Stages 1 and 2 HBP.

- **Older patients**
  - Institute an individualized approach considering age, health, and risk factors.
BP MEASUREMENT ERRORS

Faulty BP measurement technique can lead to false high readings.

<table>
<thead>
<tr>
<th>Common error</th>
<th>mm Hg too high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff too small</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Unsupported arm</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Patient talking</td>
<td>10</td>
</tr>
<tr>
<td>Patient listening</td>
<td>5</td>
</tr>
<tr>
<td>Back unsupported</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Feet not on floor</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Legs crossed</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Full bladder</td>
<td>5 – 10</td>
</tr>
<tr>
<td>Forearm BP</td>
<td>5 – 10</td>
</tr>
</tbody>
</table>

BP MEASUREMENT & DIAGNOSIS

Tips for accurate BP measurement

Follow these tips to avoid common errors in BP measurement:

- **Timing and preparation.** Wait 30 minutes after the patient has had a heavy meal, caffeine, alcohol, nicotine, or heavy exercise. Before checking BP, give the patient three to five minutes of rest, and let the patient void the bladder if needed.

- **Patient positioning.** Make sure the patient’s feet are on the floor, the back and arm are supported, and the arm is at the level of the heart. For patients with diabetes, it is recommended that physicians evaluate standing blood pressure to assess autonomic function and potential volume depletion.\(^{\text{ADA}}\)

- **Cuff and arm.** Use a properly sized cuff (avoid using a too-small cuff). Don’t take BP on the forearm, and don’t roll up tight sleeves. Don’t check BP on the side of a radical mastectomy, a limb with an IV or a dialysis fistula, or a limb with paralysis.

- **Process.** Avoid talking with the patient or asking questions while checking BP. Use of either an automatic or manual cuff is acceptable, as proper technique is significantly more important than the method.

Confirming an elevated blood pressure

Confirm an initial elevated blood pressure using:

- **Automated Office Blood Pressure (AOBP).** This is done with an automatic cuff and machine that performs, and then averages three to six blood pressure measurements at one-minute intervals while the patient is seated alone in a quiet room. It is recommended for patients with known high BP or for any patient whose initial BP reading is elevated. This methodology can decrease error, overdiagnosis, and overtreatment of high BP and eliminate the “white coat effect.”

To maintain data accuracy, a BP reading obtained by AOBP must be entered in the separate AOBP field in the “vitals” or “intake” section in iCentra.

- **A follow-up office visit with clinic staff.** Frequent follow-up checks can be done without a scheduled appointment (see pages 6–8). For initial diagnosis it is recommended that a follow-up visit be scheduled.

- **Home BP measurements.** In most guidelines, the diagnosis of high BP is made based on in-office BP measurements. However, high BP should be confirmed by home BP measurements due to the possibility of “white coat” high BP. If accurate BP measurements at home are consistently <130/ <80 mmHg, the diagnosis of high BP is in question. This CPM recommends at least 6 to 10 home BP readings over two weeks, preferably with measurements taken twice daily. Train patients how to choose an appropriate monitor and check their BP correctly.
Suspected high or elevated blood pressure

For some patients with elevated BP, the diagnosis of Stage 1 high BP is not clear-cut. See the guidance below.

Suspected high blood pressure

For patients with first-time BP of $\geq 130$ or $\geq 80$ mmHg, if you strongly feel there’s a good chance the patient truly doesn’t have high blood pressure (the measurement was due to stress, white-coat hypertension, or other factors):

- Provide brief patient education; advise on therapeutic lifestyle changes.
  - Talk about the possibility of having high BP and the impact of high BP.
  - Discuss therapeutic lifestyle changes and encourage action.
- Consider repeat BP readings using AOBP. This methodology can help decrease both over and under diagnosis of HBP.
- Create a follow-up plan to recheck and confirm BP:
  - Ask the patient to return in two weeks for another BP check under ideal circumstances to get an accurate reading (see the previous page).
  - Offer the patient the option of obtaining a BP cuff (if available) and educate the patient on accurate BP monitoring. Contact the patient in two weeks to obtain measurements.
  - Consider ambulatory BP monitoring. Intermountain’s Resistant High BP clinic provides this service (see sidebar, page 14).

Elevated blood pressure (120 – 129 and < 80 mmHg)

Add this to the patient’s problem list. This will provide a reminder to follow the issue in the future as needed.

Basic diagnostic workup

While some guidelines\(^\text{MAN}\) describe an extensive workup for every patient with elevated BP, many of the recommended tests do not change treatment decisions for managing the patient’s blood pressure. This CPM recommends the following basic workup for patients with high BP:

- History and physical to assess personal/family history of associated conditions and CV risk factors, assess for identifiable causes of high BP (see the sidebar), and check for signs of end-organ damage (heart failure symptoms, eyes, peripheral vascular disease).
- Metabolic panel (MP) to check that baseline electrolytes are normal and to evaluate serum creatinine.
- Urinalysis (U/A) and albumin-creatinine ratio (ACR) to check for protein and signs of kidney disease. If U/A shows protein of 1+ or greater consider microscopic exam (first morning specimen preferred). See the Chronic Kidney Disease CPM for details on evaluating patients for CKD.

Depending on the patient, other tests may be necessary to rule out related conditions such as heart failure or cardiovascular disease, or to screen for diabetes or lipid disorders.

IDENTIFIABLE CAUSES OF HIGH BP

- Primary aldosteronism (frequent in patients with type 2 diabetes)
- Obstructive sleep apnea
- Drug induced/related (e.g., NSAIDs, cold remedies, some antidepressants)
- Chronic kidney disease
- Renovascular disease
- Cushing’s syndrome or steroid therapy
- Pheochromocytoma
- Coarctation of aorta
- Thyroid/parathyroid disease
- Pregnancy
- NSAIDS
- Birth control pills
- Scleroderma
- Alcohol abuse
POPULATION & PROCESS MANAGEMENT

Population health management aims to reach every person who needs care. It deploys health IT, broad-reaching policies, and system changes to complement clinic-level care efforts. Population approaches are especially relevant with chronic conditions, which require longitudinal, team-based care.

Studies suggest that population and systems-level approaches are the strongest opportunity to improve blood pressure in the communities we serve. A Cochrane review of blood pressure interventions concluded that the most likely way to improve BP control, more effective than patient or provider education, is “...an organized system of registration, recall, and regular review allied to a vigorous stepped care approach.”

In a joint scientific advisory, the American Heart Association, American College of Cardiology, and the US Centers for Disease Control and Prevention called for system-level approaches as well.

Elements of population management

The following list outlines the American Heart Association’s recommendations and the system-level steps Intermountain is taking to implement them:

- **Standardization of care with an evidence-based diagnosis and treatment algorithm.** The algorithms on page 2 and page 8 provide default clinical and process approaches with proven benefits.

- **A hypertension registry to identify all patients eligible for management.** Intermountain’s hypertension registry meets these needs (see page 21).

- **System-level process approaches** including:
  - **Monitoring and frequent reporting** on the control status of all patients at the practice and population levels. The Primary Care Clinical Program will maintain reports on the reports portal to compare data at both clinic and population levels.
  - **Systematic follow up** of patients for therapy initiation and intensification. See the process algorithm on page 8 for a model that Intermountain will use for diagnosis and to facilitate follow-up reminders.
  - **Technology-facilitated decision support and feedback.** The recommendations in this CPM will be integrated into the EMR workflow to provide decision support during treatment.
  - **Clarification of the roles and responsibilities** of healthcare providers to implement a team approach. See the table on page 7 for key clinical processes and how a clinic might assign them.
  - **Reducing barriers to medication adherence and lifestyle modifications.** A key tenet of this care process is to contact patients every two weeks during medication titration (rapid cycling) and inquire about medication issues and lifestyle changes. See page 10 for ideas on how to support patients with lifestyle changes.
**KEY RECOMMENDATIONS**

- This model's success depends on clinical integration. Each staff member has an important role to play in BP management.
- Frequent follow-up BP measurements can be taken by a medical assistant, a clinical pharmacist, or PCP.

**COLLABORATIVE PHARMACY MANAGEMENT**

The collaborative pharmacy model of disease management is an emerging program to help providers achieve clinical goals and improve satisfaction for patients with dyslipidemia, diabetes, and/or hypertension.

This program allows providers to partner with a pharmacist for support in selecting, titrating, and monitoring medications. For more information on this program, see the Disease Management in Collaboration with Your Pharmacist: Dyslipidemia, Diabetes, and Hypertension Care Process Model.

**Clinic team roles to ensure adequate blood pressures**

Table 1 below describes general roles and responsibilities to help a clinic team share accountability for blood pressure management. Each clinic should adopt a process that ensures best practices.

<table>
<thead>
<tr>
<th>TABLE 1: Key roles and responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsibility</strong></td>
</tr>
<tr>
<td>Check BP for every high-BP patient. At every visit:</td>
</tr>
<tr>
<td>Record side effects and medication compliance, and ask about lifestyle change</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Prescribe and update medications</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Rapid-cycle follow up:</td>
</tr>
<tr>
<td>• Review reports and action list to identify patients due for follow up</td>
</tr>
<tr>
<td>• Contact all patients not at goal or with a new prescription every 2 weeks</td>
</tr>
<tr>
<td>• Follow up once BP controlled</td>
</tr>
<tr>
<td>• Contact patients who don't show up for follow-up visits.</td>
</tr>
<tr>
<td>Patient education</td>
</tr>
<tr>
<td>• Initial</td>
</tr>
<tr>
<td>• Follow up</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

The following algorithm shows how the clinic team can implement the process of “rapid cycling” to appropriately and quickly get patients with Stages 1 and 2 HBP treated to their appropriate goal.
HIGH BP READINGS IN A SPECIALTY CARE OFFICE
For undiagnosed high BP identified in a specialty care office:
• Refer to PCP.
• Code as “elevated BP” (RO3.0) in the EHR.
• Make sure correct PCP is listed in Revenue Cycle/EHR.
• Provide patient education

THE HIGH BP PATIENT MANAGEMENT REPORT
A High BP Patient Management Report for each provider will be maintained in the “reports” portal and will include patients who:
• Are due for two-week follow-up visit, including all patients coded as “high BP” or “elevated BP”
• Are due for 12-month follow-up visit, including all patients whose high BP is in control
• Have either two or three consecutive elevated BP readings
• Have elevated BP but no diagnosis in EHR problem list, including patients with EITHER of the following:
  – Each of the last three BPs elevated,
  – One BP in last 12 months is > 180/110

ALGORITHM 2: CLINIC PROCESS FOR RAPID CYCLING

CHECK BP at every visit

BP <130/<80?

CONFIRM BP measurement

• SCHEDULE follow-up visit in 2 weeks under optimal circumstances
• PERFORM AOBP
AND/OR
• INITIATE home BP measurement. Train patient to take BP at home; have them home monitor until 6 to 10 values are obtained and reported.

BP 130–159/80–99 mmHg

Suspected high BP
If PCP feels patient may not actually have high BP:
• Advise patient that BP is in high range
• Code in EMR
• Counsel on TLC

High BP
• Advise patient that BP is in high range
• Educate patient and counsel on TLC
• As appropriate,* initiate a shared decision discussion on whether or not to start medications concurrently or try TLC alone for 3 months (see page 11)

Follow up every 2 weeks until diagnosis is clear
This BP check can be performed by any appropriately trained clinical staff, such as physician, advanced practice clinician (APC), care manager, medical assistant (MA), nurse, or pharmacist.

Follow up every 2 weeks until BP in control
• DEVELOP or revisit treatment plan according to high BP medication algorithm (see page 2) or flash card
• INITIATE rapid cycling
Patient will appear on High BP Follow-up Patient List every 3 weeks until:
• A new BP is entered in a PCP office
• A medication change has been entered in CPOE
• A clinical note indicates contact has been made, such as a phone evaluation of home BP readings
• BP is controlled

Once BP is controlled, follow up with PCP and check BP in office every 6 to 12 months.

*Note: Patients with diabetes, kidney disease, heart failure, or vascular disease should start with medications and TLC concurrently, not TLC alone.
**Patient Education**

Patient education is critical for blood pressure management because adequate control depends on how well the patient engages in treatment by making lifestyle changes (see pages 10–11) and taking medications appropriately. To engage most fully, patients need support to:

- **Understand their personal risk.** High BP is a “silent killer,” and patients may be less likely to believe it is serious and needs treatment when compared with conditions that cause pain or other symptoms. They need a vivid understanding of risk.
- **Maintain focus and self-control.** BP management requires lifelong commitment. Patients need ongoing support to develop the habits of regularly monitoring their BP, taking medication, and maintaining lifestyle changes.
- **Manage demands on time, focus, and finances.** Patients often need to take several medications, have frequent follow-up appointments, and take other actions to address other health conditions along with managing BP. It’s hard to keep track of it all.

**Recommended strategies and tools**

Table 2 below outlines key actions for patients, barriers that may make these actions difficult, and education materials that can provide support.

<table>
<thead>
<tr>
<th>Patient goal</th>
<th>Potential barriers</th>
<th>Education tools and methods</th>
</tr>
</thead>
</table>
| Understand high BP and personal risk of complications | • Not taking risk seriously  
• Low health literacy  
• Feeling overwhelmed | • **BP Basics booklet** — in-depth information on BP, risk, and what patients can do about it  
• **Elevated Blood Pressure** fact sheet — handout for patients |
**THERAPEUTIC LIFESTYLE CHANGES (TLC)**

### Effects of TLC on blood pressure

Clinical studies show that the BP-lowering effects of targeted lifestyle changes can be equivalent to drug monotherapy. While guidelines agree on which lifestyle changes lower blood pressure, the American Heart Association is the only one that approximates reduction in systolic blood pressure (SBP). Table 3 below summarizes these recommendations:

**TABLE 3: Therapeutic lifestyle changes to lower BP**

<table>
<thead>
<tr>
<th>Lifestyle change</th>
<th>Recommendation</th>
<th>Approximate reduction in SBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce weight</td>
<td>Maintain a normal body weight (BMI 18.5 - 24.9)</td>
<td>5 – 20 mmHg per 10 kg lost</td>
</tr>
<tr>
<td>Adopt DASH eating plan</td>
<td>Consume a diet rich in fruits, vegetables, and low-fat dairy products with a reduced content of saturated fat and total fat</td>
<td>8 – 14 mmHg</td>
</tr>
<tr>
<td>Lower sodium intake</td>
<td>• Consume ≤ 2,400 mg of sodium / day</td>
<td>2 – 8 mmHg</td>
</tr>
<tr>
<td></td>
<td>• Further reduce of sodium intake to ≤ 1,500 mg / day (associated with even greater reduction in SBP)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Advise that even if the desired daily sodium intake is not achieved, a reduction of 1,000 mg / day from baseline shows benefit</td>
<td></td>
</tr>
<tr>
<td>Increase physical activity</td>
<td>Engage in regular aerobic physical activity, such as brisk walking at least 30 minutes / day, most days of the week</td>
<td>4 – 9 mmHg</td>
</tr>
<tr>
<td>Limit alcohol consumption</td>
<td>Limit alcohol to ≤ 2 drinks / day in most men, or ≤ 1 drink / day in women and lighter-weight persons</td>
<td>2 – 4 mmHg</td>
</tr>
<tr>
<td>Quit smoking</td>
<td>Quit smoking by initiating a tobacco cessation program (see <em>Quitting Tobacco: Your Journey to Freedom</em> booklet.)</td>
<td>(not reported)</td>
</tr>
</tbody>
</table>

### Tools to support education and motivation for TLC

BP management requires modification of daily behaviors, which most patients find challenging. For detailed, evidence-based support in this process, see the “Behavior Change Techniques and Tools” section (pages 8 – 11) in the *Lifestyle and Weight Management* CPM. Clinicians should work with patients to:

- **Agree on one or two appropriate goals.** Efforts to promote lifestyle change should begin with identifying recommended behaviors the patient currently feels ready to change, and developing specific goals and plans around those behaviors.

- **Create a plan for self monitoring.** The most important behavior modification for patients is the daily tracking of food intake and physical activity. Patients should record calorie and activity totals daily and weekly and weight at least weekly.

- **Arrange for clinician monitoring and follow up.** Visits with a care team should focus on individualized assessment of progress, review of self-monitoring records, problem solving, and goal setting. Visits should reinforce behavioral strategies and, when appropriate, apply them to the problem of relapse.

- **Arrange for additional assistance.** Patients experiencing difficulty adhering to diet and exercise recommendations or who lose < 1% of weight per month may require additional assistance. Referral to an intensive lifestyle intervention program (such as *The Weigh to Health*) or additional contact with a clinician may help.
Provider counseling makes a difference

Healthcare providers are sometimes discouraged at patients’ low level of adherence to lifestyle change regimens. It’s important to remember that some patients will be more motivated to change when presented with a new diagnosis like high BP and fear of complications.

Research shows that provider counseling does make a difference. For example, studies show that structured physical activity counseling by a primary care provider is recalled by patients; even if they don’t change immediately, they become more prepared to change.\(^{JAY}\) In one large study, the number of patients needed to treat (NNT) with brief counseling to motivate one additional sedentary adult to meet recommended levels of physical activity (assessed a year later) was only 12.\(^{ORR}\)

Considering treatment with TLC alone

All patients should be counseled to begin therapeutic lifestyle changes upon diagnosis with high BP or elevated high BP. In some patients, several months of TLC can be attempted with the goal of reducing BP without medication.\(^{WEB, MAN}\) If patients are able to lower BP within three months, it is appropriate to continue without medication as long as BP remains in control, and monitor BP in the medical office at least annually. If BP does not improve, patients should begin medication therapy.

Intermountain experts recommend considering a three-month trial of TLC alone for patients with:

- BP lower than 160 / 100 mmHg
- No other risk factors such as diabetes, chronic kidney disease, heart failure, coronary artery disease or other vascular disease (retinopathy, carotid artery, PVD), or smoking
- Motivation and ability to adopt several lifestyle changes simultaneously

When discussing this option with patients, a shared decision-making approach can help both patient and provider assess whether this approach is right for the patient. Shared decision-making helps patients clarify their goals and values and think more concretely about their ability to commit to lifestyle changes. Key elements of shared decision-making include:

- Using conversational techniques that enhance communication.
- Helping patients see the benefits of TLC.
- Helping patients realistically assess their readiness to make and sustain lifestyle changes.
- Asking patients about work, home life, and financial barriers to making therapeutic lifestyle changes.

The patient fact sheet High Blood Pressure Treatment: A Decision Guide is a tool to help guide this conversation with the patient.
SPECIAL POPULATIONS

This section describes considerations for BP management in certain groups, including patients with atherosclerotic cardiovascular disease, heart failure, chronic kidney disease, resistant high blood pressure, and diabetes mellitus, as well as those who are of African ancestry, over 60, pregnant, or pediatric patients.

Atherosclerotic Cardiovascular Disease (ASCVD)

Uncontrolled high BP is a key risk factor for both ASCVD and myocardial infarction (MI); the 2004 international study (INTERHEART) showed that approximately 25% of the population-attributable risk of MI can be accounted for by high BP. While some past guidelines suggested a target of <140/<90 mmHg, recent guidelines recommend treatment to a goal of <130/<80 mmHg.

• Management target: < 130 / < 80 mmHg.

• Medications:

  Begin medications and therapeutic lifestyle changes concurrently.

  Consider adding carvedilol (preferred) or metoprolol succinate to an ACE-I / ARB as the first step for patients after ACSVD / MI or revascularization, with ischemia as shown by angina symptoms or stress test, or with ejection fraction < 40%.

Heart failure

For patients with heart failure, alternative medications are more effective, and some medications should be avoided entirely. Recommendations depend on whether the patient has heart failure with reduced ejection fraction (HFrEF, with LVEF ≤ 40%, also called “systolic heart failure”) or heart failure with preserved ejection fraction (HFpEF, with LVEF > 40%, also called “systolic heart failure”). For all heart failure patients, do not attempt a trial of therapeutic lifestyle changes before starting medications.

• Treatment notes for patients with HFrEF (reduced ejection fraction):

  – First-line medications: To reduce mortality and prevent hospitalizations, patients with LVEF ≤ 40% should be on an ACE-I / ARB PLUS carvedilol or metoprolol succinate if heart failure is NYHA Class I – IV PLUS an aldosterone receptor antagonist (unless contraindicated) if heart failure is NYHA Class II – IV. Ensure the patient is euvolemic before uptitrating carvedilol or metoprolol.

  – Additional medication if needed for BP control: Consider adding amlodipine (avoid other calcium channel blockers).

  – Diuretics for fluid retention: While thiazides may be considered to treat mild fluid retention, they are less potent than loop diuretics (furosemide, torsemide, and bumetanide). For greater than mild fluid retention, consider using loop diuretics to maintain euvolemia and using agents other than thiazides for BP control. Avoid concurrent use of a thiazide and loop diuretic.

  – Change in BP as disease progresses: Many patients with HFrEF have a history of high BP, but elevated BP often disappears as systolic dysfunction develops.

• Treatment notes for patients with HFpEF (preserved ejection fraction):

  – General medications: Start with an ACE-I / ARB as the first-line agent, followed by carvedilol (preferred) or metoprolol succinate, then use diuretics if needed. No specific therapies have shown an impact on mortality in HFpEF, although ARBs may reduce hospitalizations.

  – Diuretics for fluid retention: See the notes above on diuretics. For mild fluid retention, consider a thiazide diuretic; for moderate fluid retention, use a loop diuretic. Avoid concurrent use of a thiazide and a loop diuretic.
Chronic kidney disease (CKD)

Observational studies have shown a direct relationship between elevated BP and CKD progression. Besides lowering BP, reducing albuminuria is also an important goal that shapes medication choice in hypertensive patients with CKD, since increased urinary protein excretion predicts adverse CV events and progression to end-stage renal disease. See Intermountain’s Management of Chronic Kidney Disease CPM for details.

- Management target (per the CKD CPM): < 140 / < 90 mmHg; consider < 130 / < 80 mmHg based on ACR (albumin-creatinine ratio).
  - Guidelines recommend treatment to a goal of < 140 / 90 mmHg due to lack of studies that prove improved mortality or CV outcomes with intensive treatment to a lower BP goal.
  - Some guidelines also suggest that when overt proteinuria is present (albumin:creatinine ratio > 300), providers can consider management to < 130 / 80 mmHg. Treatment should include careful monitoring of medication-based changes in potassium, serum creatinine, and eGFR.

- Management target per the 2017 ACC / AHA Guidelines: A goal of < 130 / < 80 mmHg is recommended for all patients with CKD.

- Medication notes:
  - Begin medication and therapeutic lifestyle changes concurrently.
  - Patients with eGFR < 30: Refer to a nephrologist for medication management; many BP medications will require dose adjustments based on renal function. For renal dosing, see Intermountain’s Management of Chronic Kidney Disease CPM.
  - CKD patients over 80 years old: Starting with a thiazide diuretic or CCB is an option for these patients; see “Older Patients” on page 15 for more details.

Diabetes

Elevated BP is common among patients with diabetes. In diabetes, microvascular disease and increased cardiovascular risks reinforce the importance of BP control. This CPM recommends evaluating standing BP to evaluate for autonomic dysfunction.

- Management target (per the Adult Diabetes CPM): < 140 / < 90 mmHg.
  - Intermountain’s Adult Diabetes Team recommends that a target of < 130 / < 80 mmHg be considered for those at high ASCVD risk if the burden of aggressive therapy is not excessive.

- Management target per the 2017 ACC / AHA Guidelines: A goal of < 130 / < 80 mmHg is recommended for all patients with diabetes.

- Medication notes:
  - Begin medication and therapeutic lifestyle changes concurrently.
  - Diabetes patients: Follow algorithm 1, starting with an ACE-I/ARB. Do not combine an ACE-I and ARB, and avoid the direct renin inhibitor aliskiren.
  - Prediabetes patients: Avoid thiazides and beta blockers as they can increase blood glucose. However, if a beta blocker is used, carvedilol is preferred as it may help with insulin resistance.

- CKD and diabetes: See Intermountain’s Management of Chronic Kidney Disease CPM.
Resistant high BP

Resistant high BP occurs in approximately 10% of patients and brings a higher risk of CV events and renal damage. If BP is not controlled to target through adequate doses of three or more medications (including a diuretic):

- **Confirm that the patient has resistant BP.** Check home blood pressure measures and confirm that BP is being checked accurately in the office and at home. Consider ambulatory BP monitoring; this service is provided by Intermountain’s Resistant High Blood Pressure Clinic (described at left). Consider checking BP using AOBP.

- **Check to make sure the patient is taking BP medications as prescribed.** Many patients are falsely diagnosed with resistant BP when in reality they are not taking their medication. Talk with family members, check the patient’s prescriptions, and ask the patient about side effects that may be interfering with medication compliance.

- **Check for secondary causes.** These include:
  - **Chronic kidney disease:** See Intermountain’s Chronic Kidney Disease CPM.
  - **Obstructive sleep apnea:** Use the STOP-BANG Questionnaire for initial screening, and see Intermountain’s Obstructive Sleep Apnea CPM.
  - **Aldosterone excess,** which may be present in approximately 20% of patients with resistant high BP.
  - **Renal artery stenosis:** Consider evaluation with duplex renal ultrasound, renal artery CT angiogram, or MR angiogram of the renal arteries.
  - **Coarctation of the aorta:** Perform four-point BP. Consider echocardiogram, chest x-ray, or CT angiogram if indicated.

- **Double-check for interfering agents and lifestyle factors.** These include NSAIDs, cold remedies, some antidepressants, excess alcohol, and excessive dietary sodium.

- **Consider referral to a specialist or specialty clinic.** Refer to a cardiologist (if the patient has heart disease), a nephrologist (if the patient has kidney disease), or to Intermountain’s Resistant High Blood Pressure Clinic (described at left).

- **Consider medication changes.** Most patients with resistant high BP will require treatment with more than three medications. Switch the patient to chlorthalidone if they are on HCTZ; if persistent fluid overload is expected, consider a loop diuretic. If needed, add further medications (listed in preferred order): Spironolactone, vasodilator, centrally acting agent, and alpha blocker (see pages 18–20).

**Patients of African ancestry**

Patients of African ancestry require a special treatment approach for a number of reasons. High blood pressure is common in these patients, it occurs earlier in life, and it is commonly more severe than in Caucasian patients. The resulting risk of stroke is higher with elevated BP, and there is an increased risk of kidney disease when compared with Caucasian patients. In addition, because patients of African ancestry have a reduced response to ACE inhibitors, ARBs, and beta blockers, alternative strategies are important. Follow these guidelines:

- **Management target:** < 130/ < 80 mmHg. Treat high blood pressure to the standard management target for all patients.

- **Medications:** Start with a thiazide or calcium channel blocker. If needed, add a thiazide or CCB, whichever medication class was not used first. The ALLHAT study showed that patients of African ancestry who started with an ACE-I had a significantly higher stroke rate than those who started with a CCB.

- **Medications for patients of African ancestry with chronic kidney disease:**
  - **If albuminuria is present:** Start with an ACE inhibitor or ARB due to the elevated risk of developing end-stage renal disease among black patients. If ACR is > 300 mg/g, refer to a nephrologist.
  - **If albuminuria is not present:** Begin with a thiazide diuretic or calcium channel blocker, but use an ACE inhibitor or ARB as second-line therapy.
**KEY RECOMMENDATIONS**

**Older patients.** Take an individualized approach. In patients > 80 years old, treat if systolic BP > 150, to a management target of SBP < 150. For a quick summary of medications for special populations, see page 18.

**ORTOSTATIC HYPOTENSION**
Consider measuring for orthostatic hypotension, especially in the elderly, during initiation of therapy, and before and after any high blood pressure medication change. To measure for orthostatic hypotension:
1. Have the patient lie down for five minutes.
2. Measure blood pressure and pulse rate.
3. Have the patient stand.
4. Repeat blood pressure and pulse rate measurements after the patient has been standing for three minutes.

A drop of ≥ 20 mmHg systolic blood pressure or ≥ 10 mmHg diastolic blood pressure or experiencing lightheadedness or dizziness is considered abnormal.

**KEY RECOMMENDATIONS**

- **Pregnancy.** Avoid ACE-I/ARB medications. Refer to OB/GYN for BP management during pregnancy.
- **Resistant high BP.** Confirm medication adherence; check for secondary causes and interfering agents; consider referral to resistant hypertension clinic or specialist (cardiologist if heart disease; nephrologist if kidney disease). For a quick summary of medications for special populations, see page 18.

**Older patients**

Based on recent guidelines and expert consensus, this CPM recommends taking an individualized approach to treating high blood pressure in patients over 60 years old, particularly patients age 60 to 79 years. Older patients vary widely in their overall health, frailty, risk factors, and response to medication. Starting at age 50–60, diastolic pressure may begin to decrease while systolic pressure continues to rise. Standard BP management strategies can lead to isolated systolic hypertension, a major risk factor for CV events, stroke, and kidney disease progression. See This CPM recommends performing a standing blood pressure in patients 80 year and older. Be cautious to not treat to a standing diastolic BP lower than 70 mmHg as this can cause syncope.

- **Potential management targets:**
  - **Patients age 60–79 years:** < 140 / 90 mmHg. While the JNC-8 recommends treating BP to a management goal of < 150 / < 90 mmHg in patients over 60, the report also describes a lack of full consensus among panel members on this recommendation.\textsuperscript{10}
  - **Patients 80 years and older:** < 150 / 90 mmHg. Begin treatment if systolic BP is ≥ 150 mmHg, with a management target of a systolic BP < 150 mmHg as long as the treatment is well tolerated. Carefully monitor for orthostatic hypotension, side effects, and the development of isolated systolic hypertension. In very fit patients older than 80 years, consider management to a systolic BP target of < 140 mmHg.
  - **Patients 65 and older (noninstitutionalized, ambulatory, community-living adults):** The 2017 ACC/AHA guidelines recommend initiating treatment at ≥ 130 mmHg, with a BP goal of < 130 mmHg.

- **Medications:** In patients with isolated systolic hypertension, start with a thiazide or CCB, then add a CCB or thiazide (whichever not started first). If needed, add an ACE-I/ARB as a third step.

**Pregnancy**

Recent US data show an increasing rate of pregnancy-related stroke.\textsuperscript{32} Women with chronic hypertension have an increased risk of superimposed preeclampsia and also have poorer perinatal outcomes. Careful BP monitoring and management is advised, including the following for:

- **Women with preexisting high BP who become pregnant.** Refer to the patient’s OB/GYN, who can follow the risk-specific protocol for these patients. If the patient has been taking an ACE inhibitor or ARB, discontinue immediately and substitute an agent safe for use during pregnancy, such as labetalol or nifedipine (see medication notes below). Baseline labs including CBC, LFT, and urine protein are recommended. Consider referral to MFM.

- **Women who develop high BP in pregnancy.** Consider starting drug treatment if BP is > 140/90 in women with gestational hypertension (with or without proteinuria) or who have high BP with signs of organ damage at any time during pregnancy. Evaluate for signs/symptoms of preeclampsia (headache, scotomata, epigastric pain). Perform serial BP measurements and obtain labs including CBC, LFT, and urine protein.

- **After delivery.** Ensure BP is under control before discharge, and have the patient monitor BP at home. Plan for a follow-up visit within a week after delivery. Patients should continue to monitor for symptoms of preeclampsia as this can develop postpartum.

- **Treating high BP in pregnancy with medications:**
  - Avoid ACE inhibitors and ARBs, which can cause fetal toxicity.\textsuperscript{1} Women of childbearing potential should use birth control if taking an ACE-I or ARB.
  - Use caution in prescribing beta blockers in early pregnancy (they may retard fetal growth). If plasma volume is already reduced, use caution with diuretics. Do not use atenolol in pregnancy as it may cause harm to the fetus.
  - Consider oral labetalol (generally used first-line), CCB (nifedipine preferred, as it has been tested in pregnancy), hydralazine, and/or methylxypopa. For emergency treatment, use IV labetalol, IV hydralazine, or oral nifedipine.
Pediatric patients

High blood pressure in pediatric patients is increasing due to the obesity epidemic and affects roughly 3.5 percent of all pediatric patients (Elevated readings due to white coat prevalence is estimated to affect nearly 30%). The cause may be secondary to another illness, such as kidney disease (most common), cardiovascular or endocrine disorders, coarctation, and malignancy, although primary causes are most often related to a family history of hypertension and/or excess weight.

Diagnostic Definitions

- **Pre-High Blood Pressure (HBP) — Within the 90th to 95th percentile.** Any BP ≥ 120/80 mmHg in any patient < 18 years is considered pre-HBP. Confirmed by three consecutive readings on three separate days.

- **Stage 1 HBP — 95th to 99th percentile + 5 mmHg.** Confirmed by three consecutive readings on three separate days.

- **Stage 2 High Blood Pressure — 99th percentile + 5 mmHg.** Confirmed with one reading or if symptomatic.

Measurement

For an initial check, the use of either automatic or manual readings is acceptable. Automatic cuffs may read higher in children under 6 years, although obtaining a reading with proper technique is more important than the type of cuff used. If the initial reading is elevated, wait at least 5 minutes and repeat manually. It may be helpful to eliminate misdiagnosis or “white coat” HBP by performing a second reading in 24 hours. For ages:

- **3 – 11 years:** Perform a BP check at least annually. Consider a check at each visit, depending on the child’s personal and family health history.

- **12 – 18 years:** Perform a BP check at every visit.

In iCentra:

- Pre HBP and Stage 1 HBP results will be highlighted as yellow in the iCentra vital signs.

- Stage 2 HBP results will be highlighted as red in the iCentra vital signs.

Management

- **Pre HBP:** Initiate Therapeutic Lifestyle Changes (TLC) (exercise, diet, weight loss) and follow up every one to two months, checking BP at each visit. If BP remains elevated after six months of TLC, consider lab work (CMP, Lipids, CBC, UA, TSH) and/or referring to a nephrologist.

- **Stage 1 HBP:** Initiate TLC and lab work (CMP, CBC, UA, Lipids, TSH). Consider renal sonogram with Doppler and echo. Obtain 2 or 4 point BP to assess for coarctation. Refer to outpatient nephrology within 4 weeks. Initiate medication therapy only if symptomatic or evidence of organ damage is present.

- **Stage 2 HBP:** As most Stage 2 is secondary, it is recommended that the patient be referred to nephrology within one week if asymptomatic. If the patient is symptomatic (headache, dyspnea, confusion, seizure, blurry vision, nausea and/or vomiting), refer to nephrology or the ER immediately. Initiate lab work at time of referral (CMP, CBC, UA, ACR, Renin, Aldosterone, Serum Complement 3 & 4, Lipids, and A1C).

For more information on secondary hypertension, refer to the National Kidney Foundation (Kidney.org).
ALGORITHM 3: BP MANAGEMENT IN PEDIATRIC PATIENTS

Pediatric Patient with Elevated Blood Pressure (a)

INITIATE TLC

Pre HBP or HBP? (b)

CONFIRM diagnosis and STAGE (c)

ASSESS for aortic coarctation (AC) via 2- or 4-point BP, and REFER to cardiology if coarctation suspected.

Follow up

Follow up every 1–2 months to perform BP check and assess progress with TLC

Does patient have persistent pre-HBP after 6 months?

yes

Stage 1 and symptomatic?

Stage 2 and Symptomatic?

yes

no

no

no

yes

yes

Normotensive. FOLLOW routine health maintenance

ORDER labs: CBC, CMP, UA, TSH, Lipid

CONTINUE TLC with BP check every 6 months

REFER for nephrology workup within 1 week.

ORDER the following:
- CBC
- CMP
- UA
- ACR
- Renin
- Lipid panel
- TSH
- A1C
- Aldosterone
- Complement 3 & 4

REFER to nephrologist

MANAGEMENT

INITIATE workup:
- CBC
- CMP
- UA
- ACR
- Renin
- Lipid panel
- TSH
- A1C
- Aldosterone
- Complement 3 & 4

REFER to nephrologist within 4 weeks

BEGIN medication immediately if symptomatic or if end-stage organ damage (d)

INITIATE TLC

CONTINUE TLC

(d) Symptoms of stage 1 HBP
- Headache
- Dyspnea
- Confusion
- Seizure
- Blurry vision
- Nausea
- Vomiting
- Epistaxis
- Flushing
- Cough
- Palpitation
- Slurred speech

ALGORITHM NOTES

(a) Measuring BP and height in pediatric patients
- ≥ 12 years: Every visit.
- 3 to 11 years: Annually.

(b) High BP in pediatric patients
- Pre-high BP: 90–95% or ≥120/80 mmHg
- High BP: ≥95% or ≥5 mmHg

(c) Confirm diagnosis and stage
- Stage 1 HBP: 95–99% + 5 mmHg. Diagnosis is confirmed if BP is elevated in 3 consecutive readings on 3 separate days
- Stage 2 HBP: >99% + 5 mmHg (usually secondary HBP). One reading is adequate to establish a diagnosis.
LOW BP

What about low BP while on treatment, especially if symptomatic?

- It is not clear if very low systolic or diastolic BP is harmful. Base a decision to reduce or stop medications on low BP symptoms, not on a specific threshold.
- If SBP is above target but DBP is low, consider increasing medications to achieve SBP goal as long as low BP symptoms are absent.

*KEY RECOMMENDATIONS*

“Rapid cycling” helps you efficiently arrive at the best therapy for each patient. Check BP and adjust every 2 weeks until BP is controlled.

**MEDICATIONS TO CONTROL BP**

Table 4 below (and on the next two pages) provides medication dosing for most patients. (Those in **bold** type are first-line recommendations). For effective medication management, use the following guidelines:

- **Check for side effects**, and assess medication compliance at every visit. **Monitor for orthostasis**, especially with elderly or compromised patients.
- **Encourage patients to keep an updated list** of all their prescribed and OTC medications including dose and frequency; they should bring the list to every visit.
- **Use generic, single-pill combination products and once-daily medications where possible** to simplify the regimen and potentially decrease copays and/or costs.
- **When the patient is on three medications or more, consider divided dosing (AM/PM)**. Increasing evidence links sleep-time blood pressure and incidence of CV disease.\(^2\)

<table>
<thead>
<tr>
<th>Medication type</th>
<th>Medication name generic (brand)</th>
<th>Start dose (mg / daily)</th>
<th>Daily range (mg)</th>
<th>Tier, cost*</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACE inhibitors (ACE-Is)</strong></td>
<td>lisinopril (Prinivil, Zestril)</td>
<td>10</td>
<td>10 – 80</td>
<td>Tier 1, $</td>
<td>• ACE-I/ARB contraindications:</td>
</tr>
<tr>
<td></td>
<td>benazepril (Lotensin)</td>
<td>10</td>
<td>10 – 80</td>
<td>Tier 1, $</td>
<td>– Pregnancy (contraception recommended during therapy for women of reproductive age as can cause fetal toxicity)(^2)</td>
</tr>
<tr>
<td></td>
<td>captopril (Capoten)</td>
<td>25, two to three times</td>
<td>75 – 450</td>
<td>Tier 1, $</td>
<td>– Bilateral renal artery stenosis</td>
</tr>
<tr>
<td></td>
<td>enalapril (Vasotec)</td>
<td>5</td>
<td>2.5 – 40</td>
<td>Tier 1, $</td>
<td>• ACE-I/ARB side effects:</td>
</tr>
<tr>
<td></td>
<td>fosinopril (Monopril)</td>
<td>10</td>
<td>10 – 80</td>
<td>Tier 1, $</td>
<td>– Cough (dry, hacking): Occurs in 5% – 20% of patients treated with an ACE-I; cough is much less common with ARBs. Cough usually resolves a few days after stopping therapy, but resolution can take up to 4 weeks.</td>
</tr>
<tr>
<td></td>
<td>moexipril (Univasc)</td>
<td>7.5</td>
<td>7.5 – 60</td>
<td>Tier 1, $</td>
<td>– Decrease in eGFR: A rise in serum creatinine usually begins a few days after starting ACE-I/ARB or increasing the dose. Check sCr and/or eGFR within 2 – 3 weeks of starting or dose change, particularly in patients with chronic kidney disease.</td>
</tr>
<tr>
<td></td>
<td>perindopril (Acorex)</td>
<td>4</td>
<td>4 – 16</td>
<td>Tier 1, $</td>
<td>– Hypotension: Avoid starting ACE-I or ARB if patient is volume depleted; start at low dose to minimize first-dose hypotension. ARBs have higher rates of hypertensive symptoms.</td>
</tr>
<tr>
<td></td>
<td>quinapril (Accupril)</td>
<td>10</td>
<td>10 – 80</td>
<td>Tier 1, $</td>
<td>– Hyperkalemia: For patients with kidney disease, reduce dietary potassium and monitor potassium carefully. Discontinue ACE-I/ARB if potassium is &gt; 5.5 mmol/L.</td>
</tr>
<tr>
<td></td>
<td>ramipril (Altace)</td>
<td>2.5</td>
<td>2.5 – 20</td>
<td>Tier 1, $</td>
<td>– Angioedema: This rare complication (0.1 % to 0.7 % of ACE-I-treated patients) is potentially fatal. If swelling of mouth, tongue, pharynx, and eyelids occurs, discontinue ACE-I or ARB; symptoms usually resolve in 24 – 48 hours. Protect the airway; tongue swelling can cause asphyxiation.</td>
</tr>
<tr>
<td></td>
<td>trandolapril (Mavik)</td>
<td>1</td>
<td>1 – 8</td>
<td>Tier 1, $</td>
<td>• Other notes: Do not combine an ACE-I and ARB. Begin with an ACE-I and transition to an ARB if the ACE-I is not tolerated.</td>
</tr>
<tr>
<td><strong>Angiotensin receptor blockers (ARBs)</strong></td>
<td>losartan (Cozaar)</td>
<td>50</td>
<td>50 – 100</td>
<td>Tier 1, $</td>
<td>• ACE-I/ARB contraindications:</td>
</tr>
<tr>
<td></td>
<td>azilsartan (Edarbi)</td>
<td>80</td>
<td>80</td>
<td>Tier 3, $$$$</td>
<td>– Pregnancy (contraception recommended during therapy for women of reproductive age as can cause fetal toxicity)(^2)</td>
</tr>
<tr>
<td></td>
<td>candesartan (Atacand)</td>
<td>16</td>
<td>8 – 32</td>
<td>Tier 1, $</td>
<td>– Bilateral renal artery stenosis</td>
</tr>
<tr>
<td></td>
<td>eprosartan (Teveten)</td>
<td>600</td>
<td>400 – 800</td>
<td>Tier 1, $$$</td>
<td>• ACE-I/ARB side effects:</td>
</tr>
<tr>
<td></td>
<td>irbesartan (Avapro)</td>
<td>150</td>
<td>150 – 300</td>
<td>Tier 1, $</td>
<td>– Cough (dry, hacking): Occurs in 5% – 20% of patients treated with an ACE-I; cough is much less common with ARBs. Cough usually resolves a few days after stopping therapy, but resolution can take up to 4 weeks.</td>
</tr>
<tr>
<td></td>
<td>olmesartan (Benicar)</td>
<td>20</td>
<td>20 – 40</td>
<td>Tier 1, $$$$</td>
<td>– Decrease in eGFR: A rise in serum creatinine usually begins a few days after starting ACE-I/ARB or increasing the dose. Check sCr and/or eGFR within 2 – 3 weeks of starting or dose change, particularly in patients with chronic kidney disease.</td>
</tr>
<tr>
<td></td>
<td>telmisartan (Micardis)</td>
<td>40</td>
<td>20 – 80</td>
<td>Tier 1, $$$$</td>
<td>– Hypotension: Avoid starting ACE-I or ARB if patient is volume depleted; start at low dose to minimize first-dose hypotension. ARBs have higher rates of hypertensive symptoms.</td>
</tr>
<tr>
<td></td>
<td>valsartan (Diovan)</td>
<td>80</td>
<td>80 – 320</td>
<td>Tier 1, $$$</td>
<td>– Hyperkalemia: For patients with kidney disease, reduce dietary potassium and monitor potassium carefully. Discontinue ACE-I/ARB if potassium is &gt; 5.5 mmol/L.</td>
</tr>
</tbody>
</table>

* SelectHealth Tier and Cost:
  Tier 1 = $ 10 copay; Tier 2 = $ 30 copay to 25 % coinsurance; Tier 3 = $ 70 copay to 50 % coinsurance (based on SelectMed 2017 benefit design; designs may differ). For the most recent SelectHealth formulary information, visit selecthealth.org/pharmacy or call 800-538-5038.

Cost is based on 30-day average wholesale price (AWP) (not copay) for regular dose and on generic unless otherwise noted. Key to cost symbols:

- $ = $1 to $50; $$ = $51 to $100; $$$ = $101 to $150; $$$$ = $151 to $300.
## Table 4: Medications used to control high blood pressure (part 2 of 3)

<table>
<thead>
<tr>
<th>Medication type</th>
<th>Medication name</th>
<th>Starting dose (mg/daily)</th>
<th>Daily range (mg)</th>
<th>Tier, cost*</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium Channel Blockers (CCBs)</td>
<td>amlodipine (Norvasc)</td>
<td>5</td>
<td>2.5 – 10</td>
<td>Tier 1, $</td>
<td>• General: Common side effects related to vasodilation: Headache, flushing, ankle edema.</td>
</tr>
<tr>
<td></td>
<td>felodipine ER (Plendil)</td>
<td>2.5</td>
<td>2.5 – 20</td>
<td>Tier 1, $</td>
<td>• Non-DHP meds: Can lead to bradycardia if combined with beta blockers, especially when used with digoxin.</td>
</tr>
<tr>
<td></td>
<td>isradipine (Dynacirc CR)</td>
<td>5</td>
<td>0.5 – 20</td>
<td>Tier 1, $</td>
<td>• Amlodipine and verapamil: Can increase statin concentrations and risk of myopathy. Do not use amlodipine with more than 20 mg daily simvastatin. Do not use verapamil with more than 10 mg daily simvastatin.</td>
</tr>
<tr>
<td></td>
<td>nifedipine ER (Adalat CC, Procardia XL)</td>
<td>30 Sustained-release: 120, twice Extended-release: 120, once</td>
<td>30 – 120 – 540</td>
<td>Tier 1, $$$, Tier 1, $ (SR)</td>
<td>• Carvedilol: Monitor for peripheral edema; consider a reduced starting dose of 2.5 mg daily in elderly patients.</td>
</tr>
<tr>
<td></td>
<td>diltiazem (Cardizem, Cartia, Dilacor, etc.)</td>
<td>IR: 80, three times ER/SR: 180</td>
<td>240–480 180–480</td>
<td>Tier 1, $</td>
<td>• Verapamil: Can cause constipation.</td>
</tr>
<tr>
<td></td>
<td>verapamil (Calan, Isoptin)</td>
<td>IR: 80, three times ER/SR: 180</td>
<td>240–480 180–480</td>
<td>Tier 1, $</td>
<td>• Side effects: Hypokalemia is the most common side effect; thiazide diuretics can also cause fluid and electrolyte abnormalities.</td>
</tr>
<tr>
<td>Thiazide diuretics</td>
<td>hydrochlorothiazide (HCTZ) (Hydrodiuril)</td>
<td>12.5</td>
<td>12.5 – 50</td>
<td>Tier 1, $</td>
<td>• General: While other ACE-I / ARB + diuretic combination options are on the market, these are recommended in algorithm 1.</td>
</tr>
<tr>
<td></td>
<td>chlorothalidone (Thalitone)</td>
<td>12.5</td>
<td>12.5 – 100</td>
<td>Tier 1, $</td>
<td>• Side effects: See notes on individual medications.</td>
</tr>
<tr>
<td></td>
<td>metolazone (Zaroxolyn)</td>
<td>2.5</td>
<td>2.5 – 20</td>
<td>Tier 1, $$</td>
<td></td>
</tr>
<tr>
<td>ACE-I / ARB + HCTZ combo pills</td>
<td>lisinopril / HCTZ</td>
<td>20 / 12.5</td>
<td>20 / 12.5 – 40 / 25</td>
<td>Tier 1, $</td>
<td></td>
</tr>
<tr>
<td></td>
<td>losartan / HCTZ</td>
<td>50 / 12.5</td>
<td>50 / 12.5 to 100 / 25</td>
<td>Tier 1, $</td>
<td></td>
</tr>
<tr>
<td>Beta blockers</td>
<td>carvedilol (Coreg)</td>
<td>6.25, twice</td>
<td>6.25 – 50</td>
<td>Tier 1, $$</td>
<td>• General:</td>
</tr>
<tr>
<td></td>
<td>atenolol (Tenormin)</td>
<td>50</td>
<td>50 – 100</td>
<td>Tier 1, $</td>
<td>– Side effects include fatigue, diminished exercise ability, weight gain, and worsening of insulin sensitivity.</td>
</tr>
<tr>
<td></td>
<td>bisoprolol (Zebeta)</td>
<td>2.5</td>
<td>2.5 – 20</td>
<td>Tier 1, $</td>
<td>– Monitor heart rate to assure it remains &gt; 55 BPM. Can lead to bradycardia if combined with calcium non-DHP channel blockers, especially when used with digoxin.</td>
</tr>
<tr>
<td></td>
<td>labetalol (Trandate)</td>
<td>100, twice</td>
<td>200 – 800</td>
<td>Tier 1, $</td>
<td>• Carvedilol: Enhances insulin sensitivity.</td>
</tr>
<tr>
<td></td>
<td>metoprolol (Lopressor)</td>
<td>100</td>
<td>100 – 450</td>
<td>Tier 1, $</td>
<td>– Heart failure with reduced ejection fraction (HFrEF): Choose ONLY these medications:</td>
</tr>
<tr>
<td></td>
<td>metoprolol succinate ER (Toprol XL)</td>
<td>25</td>
<td>100 – 400</td>
<td>Tier 1, $</td>
<td>– Carvedilol: 25 mg twice daily if patient &lt; 85 kg; 50 mg twice daily if ≥ 85 kg</td>
</tr>
<tr>
<td></td>
<td>nadolol (Corgard)</td>
<td>40</td>
<td>40 – 320</td>
<td>Tier 1, $$</td>
<td>– Metoprolol ER: 200 mg, once daily</td>
</tr>
<tr>
<td></td>
<td>nebivolol (Bystolic)</td>
<td>5</td>
<td>5 – 40</td>
<td>Tier 2, $$$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>propranolol (Inderal)</td>
<td>40 twice</td>
<td>80 – 640</td>
<td>Tier 1, $</td>
<td></td>
</tr>
<tr>
<td>Aldosterone receptor antagonist (ARA)</td>
<td>eplerenone (Inspra)</td>
<td>50, in single dose</td>
<td>50 – 100</td>
<td>Tier 1, $$$</td>
<td>• Monitoring: Monitor potassium and serum creatinine in patients with kidney disease.</td>
</tr>
<tr>
<td></td>
<td>spironolactone (Aldactone)</td>
<td>50 to 100, in single or divided doses</td>
<td>50 – 400</td>
<td>Tier 1, $</td>
<td>• Side effects: Spironolactone may induce gynecomastia in up to 10 % of patients or cause occasional menstrual irregularities or impotence. Eplerenone may have lower gynecomastia effects.</td>
</tr>
</tbody>
</table>

*SelectHealth Tier and Cost:*

- Tier 1 = $10 copay; Tier 2 = $30 copay to 25% coinsurance; Tier 3 = $70 copay to 50% coinsurance (based on SelectMed 2017 benefit design; designs may differ). For the most recent SelectHealth formulary information, visit selecthealth.org/pharmacy or call 800-538-5038.

Cost is based on 30-day average wholesale price (AWP) (not copay) for regular dose and on generic unless otherwise noted. Key to cost symbols: $ = $1 to $50; $$ = $51 to $100; $$$ = $101 to $150; $$$$ = $151 to $300.
### TABLE 4: Medications used to control high blood pressure (part 3 of 3)

<table>
<thead>
<tr>
<th>Medication type</th>
<th>Medication name</th>
<th>Start dose (mg / daily)</th>
<th>Daily range (mg)</th>
<th>Tier, cost*</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vasodilators</strong></td>
<td>hydralazine (Apresoline)</td>
<td>10 mg, four times</td>
<td>40 – 300, in divided doses</td>
<td>Tier 1, $</td>
<td>• <strong>Hydralazine:</strong> Side effects include chest pain and tachycardia.</td>
</tr>
<tr>
<td></td>
<td>minoxidil (Loniten)</td>
<td>5</td>
<td>10 – 100</td>
<td>Tier 1, $</td>
<td>• <strong>Minoxidil:</strong> Side effects include fluid retention and hirsutism.</td>
</tr>
<tr>
<td><strong>Central-acting agents</strong></td>
<td>clonidine (Catapres)</td>
<td>Oral: 0.1, twice</td>
<td>Oral: 0.2 – 2.4, in divided doses</td>
<td>Tier 1, $</td>
<td>• <strong>Clonidine:</strong> Side effects include hypotension, dry mouth, dizziness, sedation, fatigue; abrupt discontinuation may result in withdrawal symptoms (agitation, tremor, headache, rapid rise in blood pressure).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Patch: 0.1 mg</td>
<td>Patch: 0.1 – 0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>guanfacine (Tenex)</td>
<td>1, at bedtime</td>
<td>1 – 3</td>
<td>Tier 1, $</td>
<td>• <strong>Guanfacine:</strong> Side effects include constipation, dry mouth, dizziness, somnolence; abrupt withdrawal may result in rebound hypertension.</td>
</tr>
<tr>
<td></td>
<td>methyl dopa (Aldomet)</td>
<td>500, in divided doses</td>
<td>500 – 3000, in divided doses</td>
<td>Tier 1, $</td>
<td>• <strong>Methyldopa:</strong> Consider for hypertension in pregnancy. Monitor LFTs. Side effects include dizziness and impotence.</td>
</tr>
<tr>
<td><strong>Loop diuretics</strong></td>
<td>bumetanide (Bumex)</td>
<td>0.5</td>
<td>0.5 – 2</td>
<td>Tier 1, $</td>
<td>• <strong>General:</strong> May cause fluid and other electrolyte abnormalities.</td>
</tr>
<tr>
<td></td>
<td>furosemide (Lasix)</td>
<td>20</td>
<td>20 – 80</td>
<td>Tier 1, $</td>
<td>• <strong>Furosemide:</strong> May titrate by increasing 20 – 40 mg at 6-hour to 8-hour intervals.</td>
</tr>
<tr>
<td></td>
<td>torsemide (Demadex)</td>
<td>20</td>
<td>20 – 200</td>
<td>Tier 1, $</td>
<td>• <strong>Torsemide:</strong> May titrate by doubling the dose.</td>
</tr>
<tr>
<td><strong>Alpha blockers</strong></td>
<td>doxazosin (Cardura)</td>
<td>1</td>
<td>1 – 16</td>
<td>Tier 1, $</td>
<td>• <strong>Side effects:</strong> Leg edema and orthostasis are commonly reported.</td>
</tr>
<tr>
<td></td>
<td>prazosin (Minipress)</td>
<td>1</td>
<td>1 – 20</td>
<td>Tier 1, $</td>
<td>• <strong>Notes:</strong> Consider giving prazosin and terazosin at bedtime on initiation.</td>
</tr>
<tr>
<td></td>
<td>terazosin (Hytrin)</td>
<td>1</td>
<td>1 – 20</td>
<td>Tier 1, $</td>
<td></td>
</tr>
<tr>
<td><strong>Direct renin inhibitor</strong></td>
<td><strong>Aliskiren is NOT recommended</strong>, particularly in combination with an ACE-I or an ARB.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### MEASUREMENT AND REPORTING

#### High blood pressure quality measure

The main quality measure for most publicly related groups, such as HEDIS and STARS, is the **percentage of patients aged 18 to 85 years who have a diagnosis of HBP and whose BP was adequately controlled** per the following metrics:

- For patients aged 18 to 59 years, BP of < 140 / < 90 mmHg.
- For patients aged 60 to 85 years, BP of < 150 / < 90 mmHg.
- For patients 18 and older with diabetes BP of <140 / < 90 mmHg.

The HBP Population View report and HBP Patient Management report will be modified in 2018 to include a filter to support management of patients according to the new ACC/AHA Guidelines.

### Registry

A database of patients diagnosed with high blood pressure is maintained by the Primary Care Clinical Program (see sidebar for inclusion criteria) to support analysis and reporting. It contains clinical data including BP, medications prescribed, comorbidities, etc. Data are obtained from insurance claims, billing records, and electronic medical records.

### Reports

Using the database, two main reports are produced to guide and inform clinical staff and leadership:

- **High BP Patient Management report.** This report is designed to support clinical staff in following the recommendations outlined in this CPM. It groups patients into categories, including those with uncontrolled BP who are due for follow up contact and those with controlled BP who are due for routine follow up. Additionally, users can view lists of patients with elevated BP readings but no diagnosis of high BP as well as patients with suspected high BP.

- **High BP Population View report.** This report focuses on the percent of patients diagnosed with high BP whose BP is in control. The report allows comparison of the BP management within the Intermountain Healthcare system as well as with other groups nationally, leading to more coordinated and accountable team-based care. The report can be sorted by region, clinic, and provider.

  This report also allows users to view other quality metrics related to management of High BP, including:
  - Percent of patients with uncontrolled high BP who have been contacted in the last three weeks (rapid cycling).
  - Patients who have been contacted in the last 15 months.
  - Patients with high BP who have an anti-hypertensive prescription.
  - Patients who have received lifestyle/wellness counseling.

Both reports are updated daily.
RESOURCES AND REFERENCES

Patient resources
Clinicians can order Intermountain patient education booklets and fact sheets for distribution to their patients.

- Log in to IntermountainPhysician.org/PEN, and search for the item number or title in the appropriate area.
- In iCentra, search for Intermountain items in the patient education module.
- Use iPrintStore, Intermountain’s online library and print center.

Provider resources
To find this CPM and its flash card, clinicians can go to intermountainphysician.org/clinicalprograms, and select “Blood Pressure” from the topic list on the right side of the screen.

Intermountain fact sheets:
- High Blood Pressure Treatment: A Decision Guide
- Elevated Blood Pressure
- How to Monitor Your Blood Pressure
- High Blood Pressure: Follow up to confirm

Patient Information:
An array of booklets, trackers, and fact sheets to help, including:
- BP Basics
- BP Tracker

Related care process models can also be found at intermountainphysician.org/clinicalprograms and include:
- Management of Chronic Kidney Disease CPM
- Outpatient Management of Adult Diabetes Mellitus CPM
- Diabetes Prevention Program CPM
MANAGEMENT OF HIGH BLOOD PRESSURE

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This CPM presents a model of best care based on the best available scientific evidence at the time of publication. It is not a prescription for every physician or every patient, nor does it replace clinical judgment. All statements, protocols, and recommendations herein are viewed as transitory and iterative. Although physicians are encouraged to follow the CPM to help focus on and measure quality, deviations are a means for discovering improvements in patient care and expanding the knowledge base. Send feedback to Mark R. Greenwood, MD, Medical Director of Intermountain’s Primary Care Clinical Program (markr.greenwood@imail.org).

References


