



# Patient Safety Conference

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RACHAEL PETRY, MD

# Outline

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Minute 1-5: Introduction and Objectives

Minute 5-20: Case presentation

Minute 20-40: Teaching topics

- Blood pressure targets in the elderly.
- Pharmacokinetics in aging adults.

Minute 40-45: Action Plan

Minute 45-55: Wrap Up/Discussion

# Patient Safety Objectives + Goals

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- Recall Blood Pressure Goals in the Elderly (and determine which older patients we should consider “SPRINT-ing”).
- Summarize evidence for safe management of blood pressure in the inpatient setting.
- Apply how the physiologic changes in the elderly (GFR and Cystatin-C) may impact pharmacokinetics for renally cleared meds (Lisinopril, Bactrim).

GOAL: Utilize proper laboratory monitoring after initiation of Bactrim, especially in those on other medications that impact potassium balance (ex. ACE Inhibitors/ARBs).

Privileged & Confidential: Subject to Peer Review and Medical Review Protections,  
O.C.G.A. 31-7-130 et seq. and 31-7-140 et seq.

# Case Presentation

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“History is severely **limited secondary to patient's mental status** and likely substance abuse/psychiatric illness. From what can be gathered, patient states that she *sustained an injury to her right hand about 3 days ago*. She states that people drove by and shot at her from within a vehicle. Cannot provide any additional history.”



## ER Course:

- Initial Antibiotics: Vanc/Ceftaz/Flagyl
- Blood Cultures (9/4): Negative
- CT Hand (9/4): Soft tissue edema and swelling, compatible with cellulitis, without evidence of soft tissue abscess.
- Admit to Hospital Medicine

# BP Trend



## FOR SOME CONTEXT:

- Received 3 doses IM Haldol this day
- Was in "severe pain" in her hand, requiring PRN narcotics

↑  
Lisinopril 20mg Qday initiated (9/6)

# Timeline

20
9/6/2021 1025
141
3.5
104
26
11
7
0.57
>60 *
163 ▲
8.8

19
9/9/2021 0716
138
4.5
102
23
13
16
0.75
>60 *
87
9.0

17
9/14/2021 0800
125 ▼
5.7 ▲
91 ▼
22
12
25 ▲
0.81
>60 *
103 ▲
9.8

"Bactrim scares me"

- Rachael Petry, MD (9/13/2021)

Lisinopril 20mg  
initiated (9/6)

Bactrim Initiated  
(9/7)

Transfer to SBH  
(9/8)

Bactrim Stop Date  
(9/13)

# Spoiler Alert

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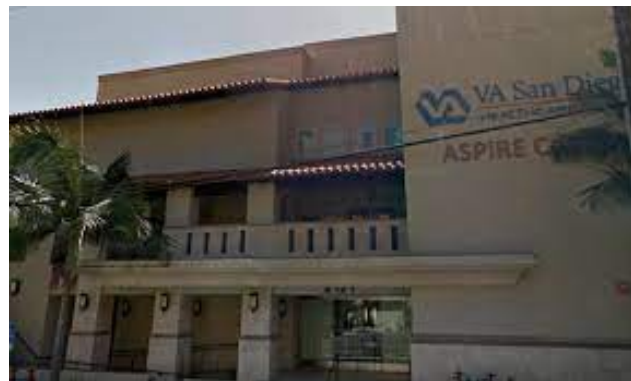
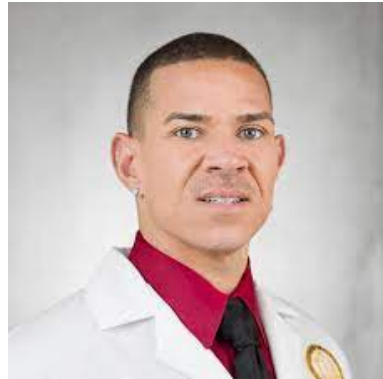
Nothing bad happened to this patient.

Lisinopril was stopped, nurses pushed hydration

Potassium normalized and renal function improved over 48-72 hours.

# Then why does this case matter?

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# Blood Pressure Guidelines

**TABLE 2**

**Recommended BP goals according to JNC 7, JNC 8, and 2017 ACC/AHA guidelines<sup>1,2,6</sup>**

Patient group	JNC 7	JNC 8	2017 ACC/AHA
General	<140/90 mm Hg	<140/90 mm Hg	<130/80 mm Hg*
Older patients	<140/90 mm Hg	<150/90 mm Hg <sup>†</sup>	<130 mm Hg <sup>†</sup>
Diabetes	<130/80 mm Hg	<140/90 mm Hg	<130/80 mm Hg
Chronic kidney disease	<130/80 mm Hg	<140/90 mm Hg	<130/80 mm Hg

ACC, American College of Cardiology; AHA, American Heart Association; BP, blood pressure; JNC 7, Seventh Report of the Joint National Committee; JNC 8, Eighth Joint National Committee.

\*Includes patients with atherosclerotic cardiovascular disease (ASCVD) or an estimated 10-year risk  $\geq 10\%$ , as well as patients needing primary prevention or those with 10-year ASCVD risk  $< 10\%$ .

<sup>†</sup>General population  $\geq 60$  years of age. Treatment does not need to be adjusted in patients  $\geq 60$  years who may have lower systolic BP (eg,  $< 140$  mm Hg) and are not experiencing adverse effects.

<sup>‡</sup>Ambulatory, community-dwelling, noninstitutionalized patients  $\geq 65$  years of age. Clinical judgment, patient preference, and a team-based approach to assess benefits and risks are reasonable for patients with a high burden of comorbidity and limited life expectancy.

# JNC 8

## Trials:

HYVET

Syst-Eur

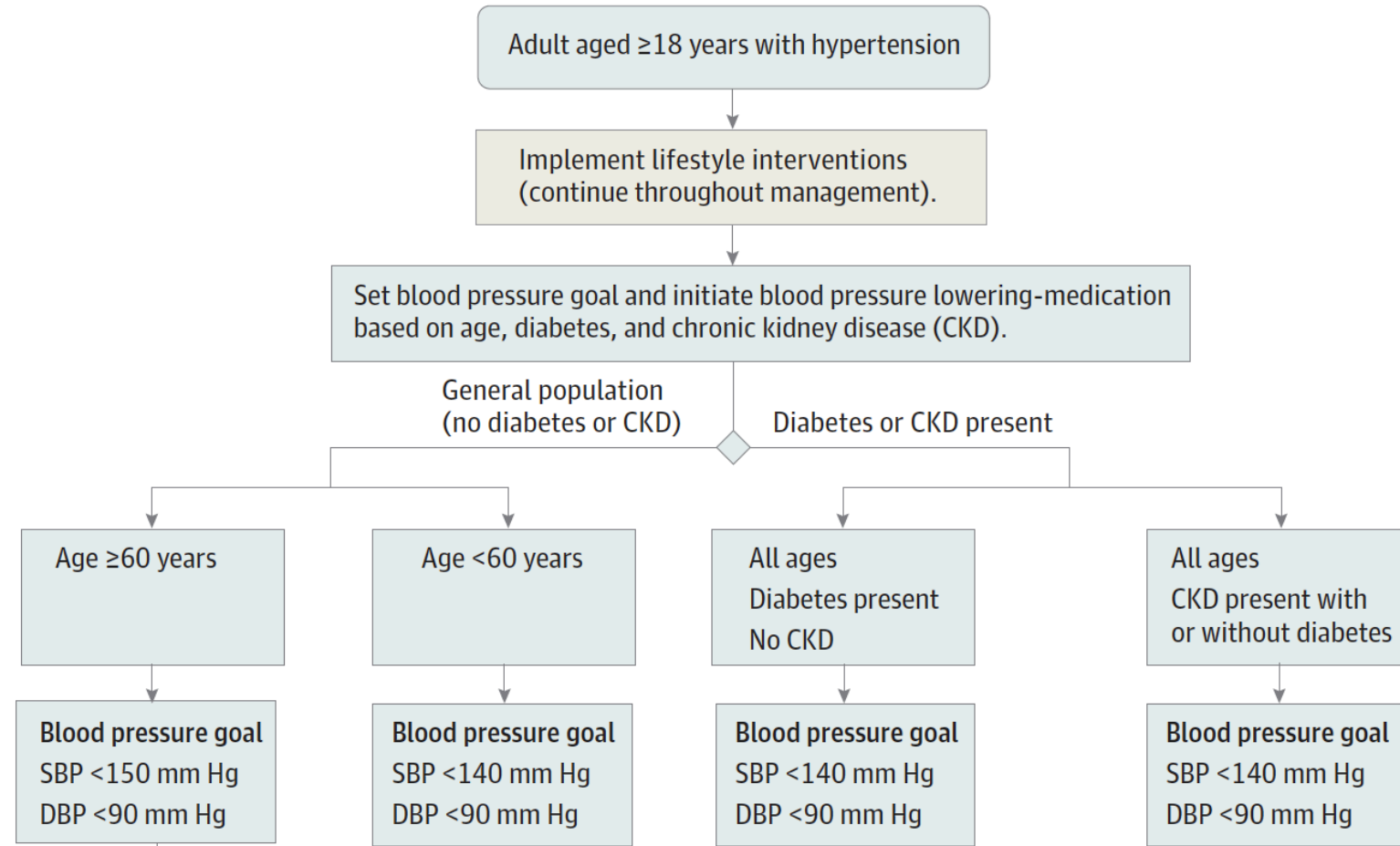
SHEP

JATOS

VALISH

CARDIO-SIS

Figure. 2014 Hypertension Guideline Management Algorithm



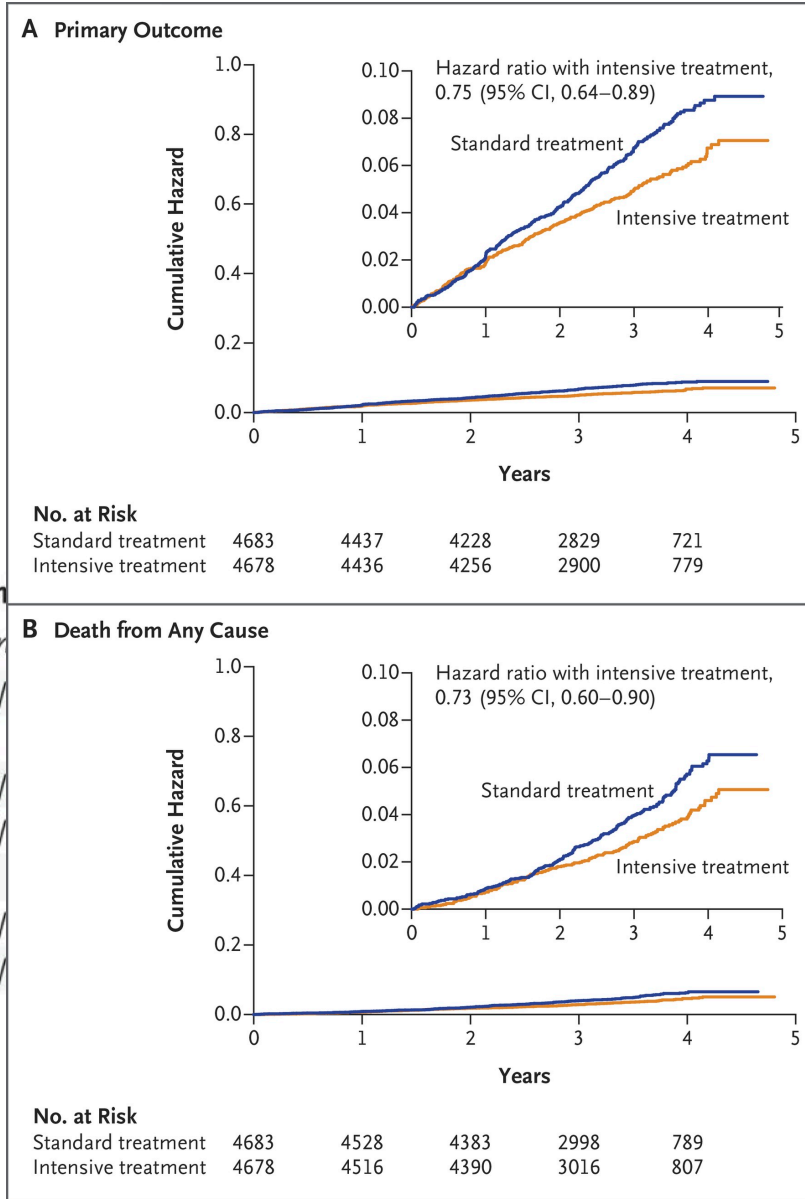
# What about SPRINT?

-9361 Patients >50 years old

-HTN + 1 CV risk factor

-Excluded DM, prior stroke, dementia

Subgroup	n
Overall	264/
Previous chronic kidney disease	
No	146/
Yes	118/
Age	
<75 yr	156/
≥75 yr	108/



Serious adverse effects in intensive control (<120) group were more common than in standard treatment:

Adverse Effect	Hazard Ratio (95% CI)	P Value
-Hypotension	1.28 (1.03–1.59)	0.03
-Syncope	1.28 (1.03–1.59)	0.03
-Electrolyte Abnormalities	1.28 (1.03–1.59)	0.03
-AKI/Renal Failure	1.28 (1.03–1.59)	0.03

Interestingly, NOT falls or orthostatic hypotension.

# “SPRINT Senior”?

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## Exclusion:

- Type 2 diabetes
- History of stroke
- Symptomatic HF within the past 6 months or LVEF

**<35% (NNT) estimate for:**

- Dementia
- expected survival of less than 3 years
- Primary outcome was  $>2\%$  (95% CI, 1.9-6.1) <sup>loss of  $>2\%$  of body weight</sup> during the preceding 6 months
- All cause mortality was  $41$  (95% CI, 27-145)
- SBP of less than 110 mm Hg following 1 minute of standing, or
- resided in a nursing home.

# What AGS Says about Blood Pressure

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Treating hypertension  $>130$  mmHg in ambulatory, cognitively normal adults is beneficial, independent of age, and reduces the incidence of conditions on the pathway to physical and cognitive disability such as stroke, heart failure, myocardial infarction, mild cognitive impairment (MCI), and cardiovascular and overall mortality.

# Rachael's Proposed BP Target Algorithm

Does your community-dwelling 60+ y/o patient have >2 years life expectancy?

**YES**



**NO**



BP Goal per Goals of Care



Does your patient have:

- Cognitive Impairment,
- Prior Stroke,
- Diabetes or
- Orthostatic hypotension?

**NO**



ACC/AHA 2017 Guidelines  
**SBP <130**

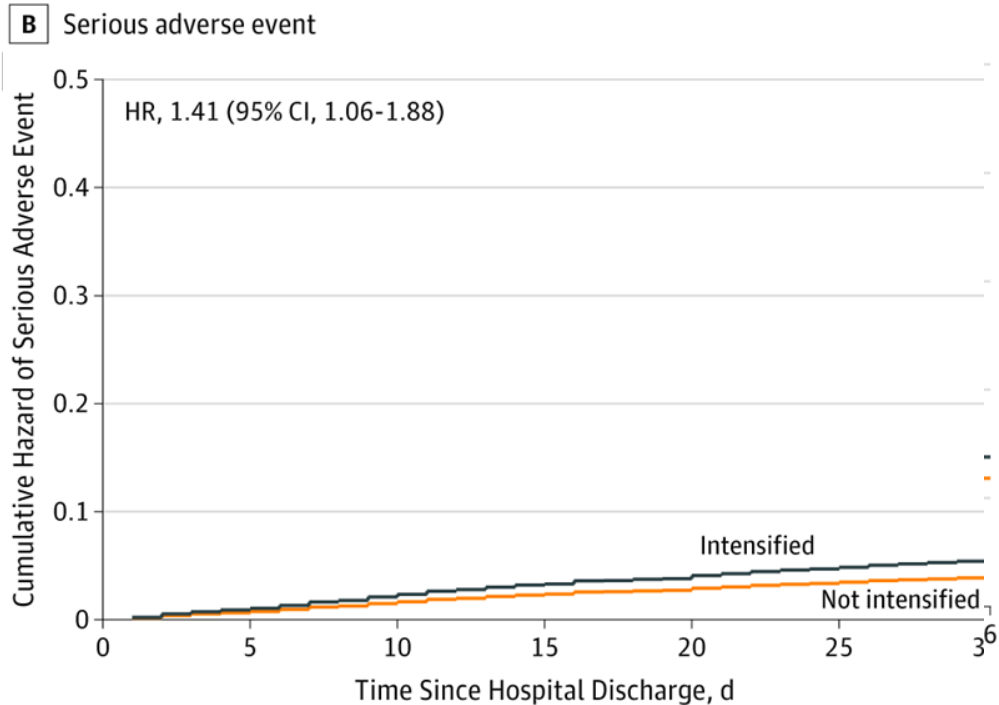
**YES**



JNC 8 Guidelines

BP <150/90  
or  
<140/90 if DM

# Inpatient Blood Pressure Management



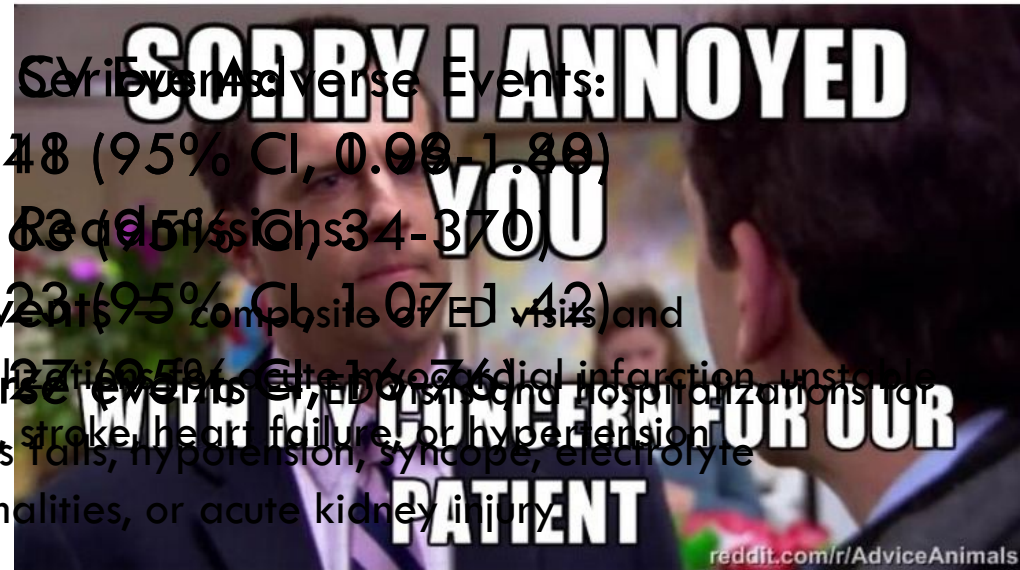
More Serious Adverse Events:

HR 1.48 (95% CI, 1.06-1.88)

More Readmissions (34-370)

ER Events (95% CI, 1.07-1.42)

Adverse events (MI, ED visits and hospitalizations for angina, stroke, heart failure, or hypertension; injurious falls, hypotension, syncope, electrolyte abnormalities, or acute kidney injury)



# HTN Take Home Message

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- Be thoughtful about initiation of blood pressure medications in older hospitalized adults.
- Assess symptoms and other etiologies of elevated blood pressures.
- Know that many older patients will have BP goals that are higher than the average population.

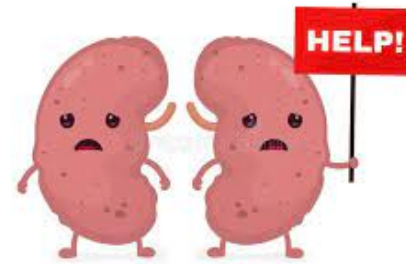


# “I’m going through changes.”- Ozzy

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As we age, kidneys change in the following ways:

- Decreased Kidney size/weight
- Lower number of functional glomeruli
- Decreased GFR
- Decreased Renal Blood Flow



Which leads to decreased:

- Concentrating ability of kidney
- Renal clearance of drugs and toxins
- Ability to resorb glucose

# Age-Associated Pharmacokinetics

FACT 1: Many medications are eliminated by the kidney.

FACT 2: Age related chronic kidney impairment (decreased GFR) occurs but also the decreased muscle mass can lead to false reassurance in renal function if using serum creatinine to assess renal function.

FACT 3: Cystatin-C is a more reliable indicator of renal function in the elderly.

**PRESCRIPTION**

<b>FOR:</b>	<b>FROM:</b>
<b>AILMENT:</b>	<b>DATE:</b>

**R<sub>x</sub>**  CHILL PILL  DAY OFF  GOOD CRY  SHOPPING  
 VACATION  LAUGHTER  MASSAGE  EXERCISE  
 STIFF DRINK  HUG  REHAB  OTHER

**SPECIAL INSTRUCTIONS**

DOSAGE: \_\_\_\_\_  PER HOUR  PER WEEK  
 PER DAY  PER MONTH

DURATION: \_\_\_\_\_  HOURS  WEEKS  
 DAYS  MONTHS

REFILLS: \_\_\_\_\_  ZERO  TWO  
 ONE  THREE

\_\_\_\_\_  
SIGNATURE

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# Back to our Patient

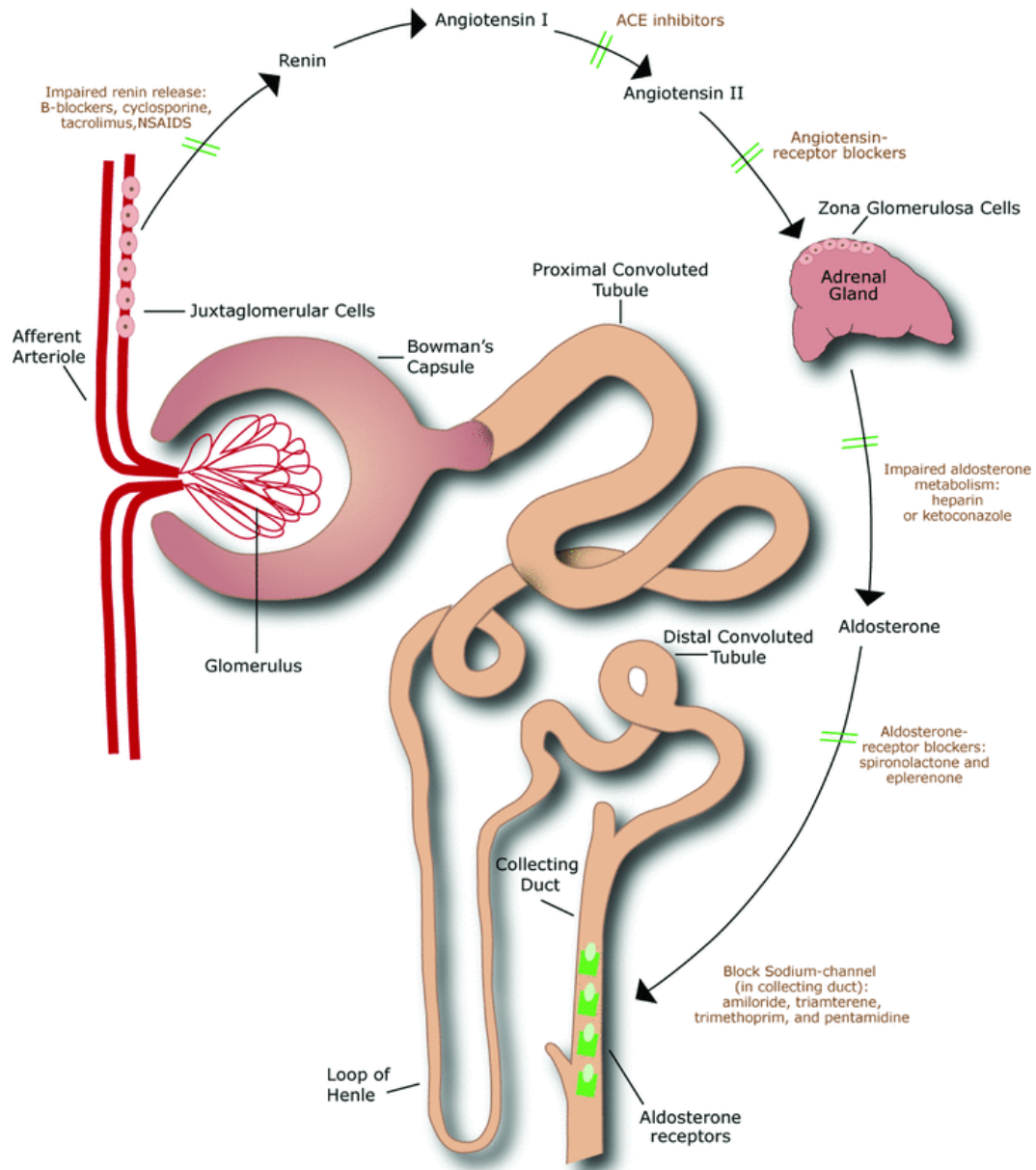
Lisinopril started:

1. Inhibits efferent arteriolar vasoconstriction = decreased GFR

2. Blocks aldosterone release = K<sup>+</sup> retention

Bactrim started:

3. TMP blocks distal nephron Na-channels = K<sup>+</sup> retention



# Why Bactrim scares me...

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Table 6—Risk Factors for Adverse Drug Events in Older Adults

- Age >85 years
- Low body weight or BMI
- Six or more concurrent chronic diagnoses
- An estimated CrCl <50 mL/min
- Nine or more medications
- Twelve or more doses of medications per day
- A prior adverse drug event

## Significant DDIs with:

- ACE Inhibitors and ARBs (HyperK)
- Spironolactone (HyperK)
- Warfarin (increased Bleeding)
- Sulfonylureas (hypoglycemia)
- Phenytoin (Phenytoin toxicity)

# Bactrim Take-Home Message

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- Be wary of using creatinine as a measure of renal function in the elderly, assume renal function is worse than advertised.
- Consider alternate agent (than Bactrim) for infections if your patient is also on an ACE inhibitor, ARB, or K Sparing Diuretic.
- If you **MUST** use Bactrim in patient on med listed above or with CKD, consider checking labs \_\_\_\_ days after initiation

# Action Plan

What is a reasonable amount of time to check labs after initiation of Bactrim (in patient with CKD or on ACEi, ARB or Spironolactone)?

**3 days?**

# Case Resolution

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- Patient remained on SBH for around 1 month.
- During that time, her cellulitis resolved.
- Her blood pressure persisted above 150 systolic despite control of her agitation and pain, so she was initiated on 5mg amlodipine daily, which was uptitrated to 10mg amlodipine by the time of discharge.



# Discussion

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# STEP(ping) up our HTN Management

**STEP: NEJM 9/2021**

**SBP <130-110**

**SBP <150**

**Table 2.** Hazard Ratios for the Primary and Secondary Outcomes.\*

Outcome	Intensive Treatment (N=4243)		Standard Treatment (N=4268)		Hazard Ratio (95% CI)	P Value
	no. of patients (%)	% with event per year	no. of patients (%)	% with event per year		
Primary outcome†	147 (3.5)	1.0	196 (4.6)	1.4	0.74 (0.60-0.92)	0.007

-8511 Chinese patients  
60-80 years old  
Stroke

**Outcome**

**SPRINT HR (95% CI)**

**STEP HR (95% CI)**

0.89 (0.64-1.23)

**0.67 (0.47-0.97)**

-ACC  
-Extensive exclusion

1.02 (0.66-1.57)

**0.67 (0.47-0.94)**

criteria  
Death from CV Disease

**.58 (0.39 to 0.84)**

0.72 (0.39-1.32)

Death from any cause

**0.75 (0.61 to 0.92)**

1.11 (0.78-1.56)

# References

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