

# BP Track: National Surveillance for Blood Pressure Control and Related Process Metrics Using PCORnet

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# Overview

- BP Control Lab Overview – Mark
- BP Track – Rhonda
- Impact of COVID-19 Pandemic - Alanna

# Colleagues

- Emily O'Brien, Tom Carton, Jonathan Todd, Madelaine Faulkner Modrow
- Mike Rakotz and Greg Wozniak, Chris Shay and Eduardo Sanchez
- Teams at each institution
- BP Track Collaborators
- Patient advisory board supported by Heart Research Alliance

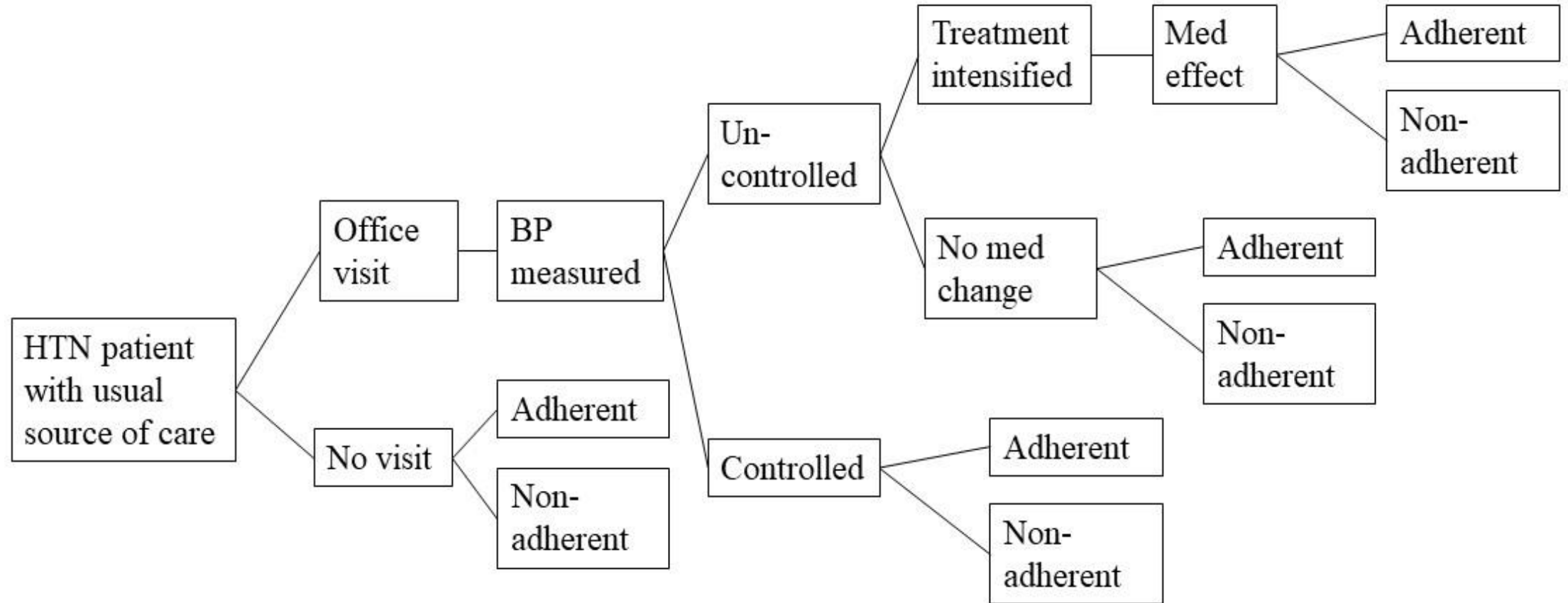
# BP Control

- Leading preventable cause of morbidity and mortality
- Disparities
- Quality metric
- Amenable to EHR data analysis

# Analyzing BP Control via EHR data

- BP measurements
  - Universally measured and recorded during in-person visits
  - Continuous outcome, quality indicator
  - Repeated measurements, measurement error, variability
- BP control-related process metrics
  - Visits, measurement patterns, medication orders
- PCORnet Common Data Model

# Process model



# Opportunities for improvement?

- Quality improvement programs
- Healthcare reorganization
- Community-based interventions
- Technology

**METHODS PAPER**

# The PCORnet Blood Pressure Control Laboratory

## A Platform for Surveillance and Efficient Trials

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**BACKGROUND:** Uncontrolled blood pressure (BP) is a leading preventable cause of death that remains common in the US population despite the availability of effective medications. New technology and program innovation has high potential to improve BP but may be expensive and burdensome for patients, clinicians, health systems, and payers and may



# PCORnet BP Control Laboratory

- Goal: Improve BP Control at Scale in the US
- Methods: Surveillance and efficient pragmatic RCTs
- First 3 projects:
  - BP Track
  - BP MAP
  - BP Home

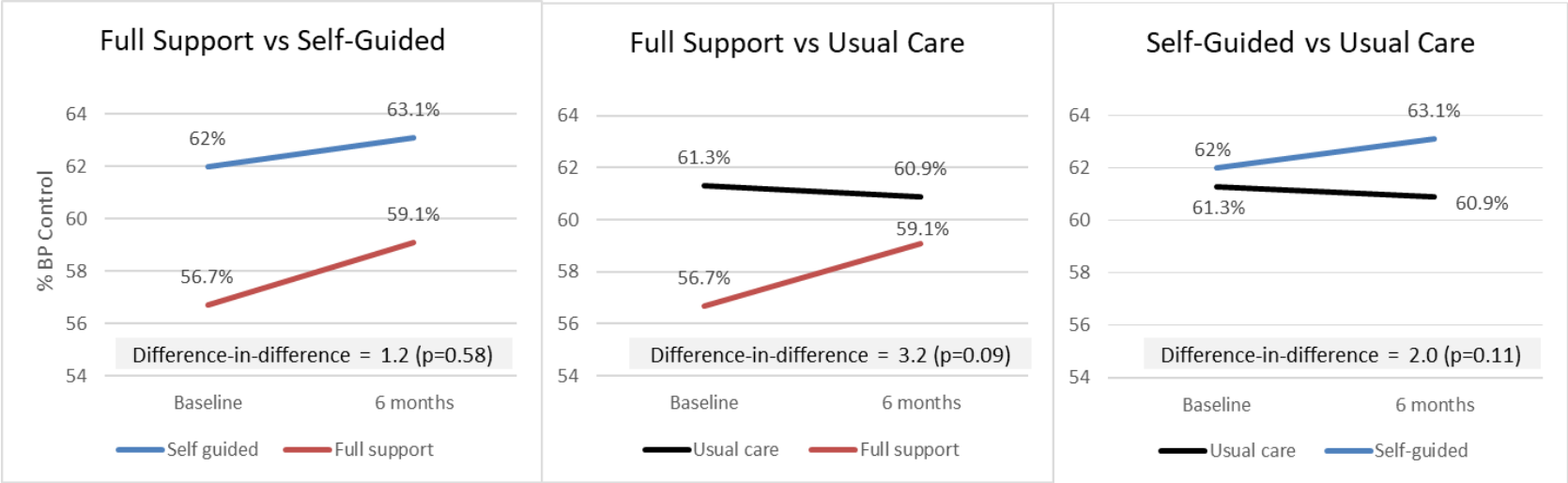
# PCORnet BP Control Laboratory

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Quick teaser

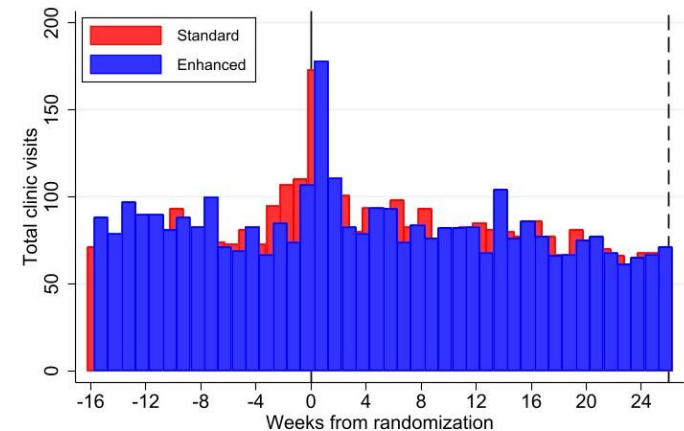
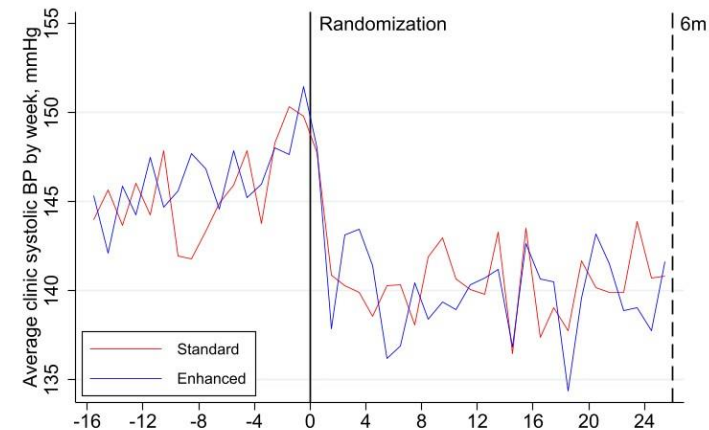
# BP MAP

- Cluster RCT in 24 safety net clinics
- Comparing two versions of QI intervention
- Used BP Control Metrics from BP Track as outcomes
- Modest improvements overall and in a couple of process metrics, no significant impact on BP control



# BP Home

- Individual patients with uncontrolled BP recruited and randomized
- Standard home monitoring device vs. device+app
- EHR-derived outcomes
- Overall no difference, but some intriguing details



# Scalable approach

- Use PCORnet for:
  - Quality and process metrics surveillance
  - Outcomes for pragmatic trials
  - Finding eligible patients
- Need to find more effective interventions...

# BP Track

Rhonda Cooper-DeHoff

# Background

## Uncontrolled BP

- Leading cause of preventable death

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## Many questions remain

- BP goal
- BP medications – which one(s)
- Surveillance and monitoring metrics



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## Many questions remain

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## BP Control Lab

- Platform designed to enable national surveillance
- Facilitate quality improvement and comparative effectiveness research

PCORnet Participating  
healthcare organizations



PCORnet Participating  
healthcare organizations



Heterogeneous EHR  
data in enterprise data  
warehouses



PCORnet Participating  
healthcare organizations



Heterogeneous EHR  
data in enterprise data  
warehouses



Extract, transform and load  
operations to PCORnet CDM (5.1)



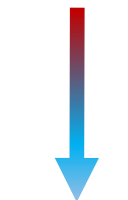
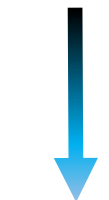
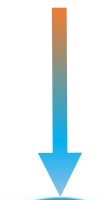
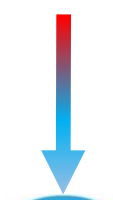
PCORnet Participating  
healthcare organizations



Heterogeneous EHR  
data in enterprise data  
warehouses



Extract, transform and load  
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PCORnet Datamarts



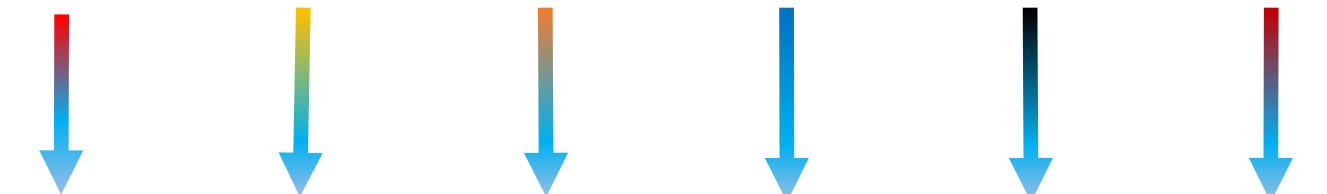
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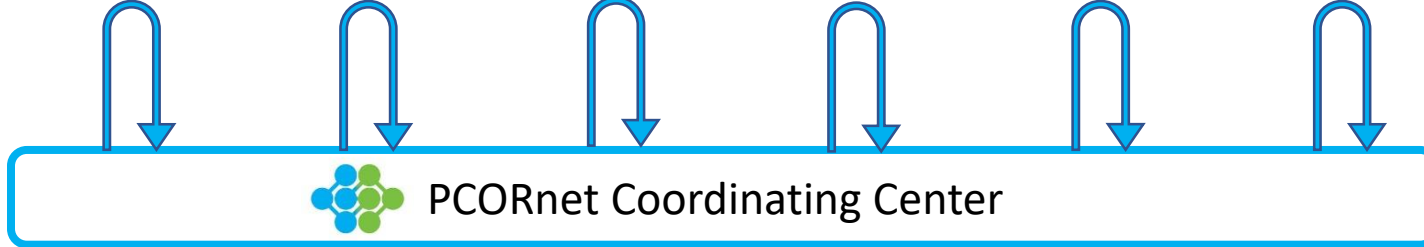
Extract, transform and load  
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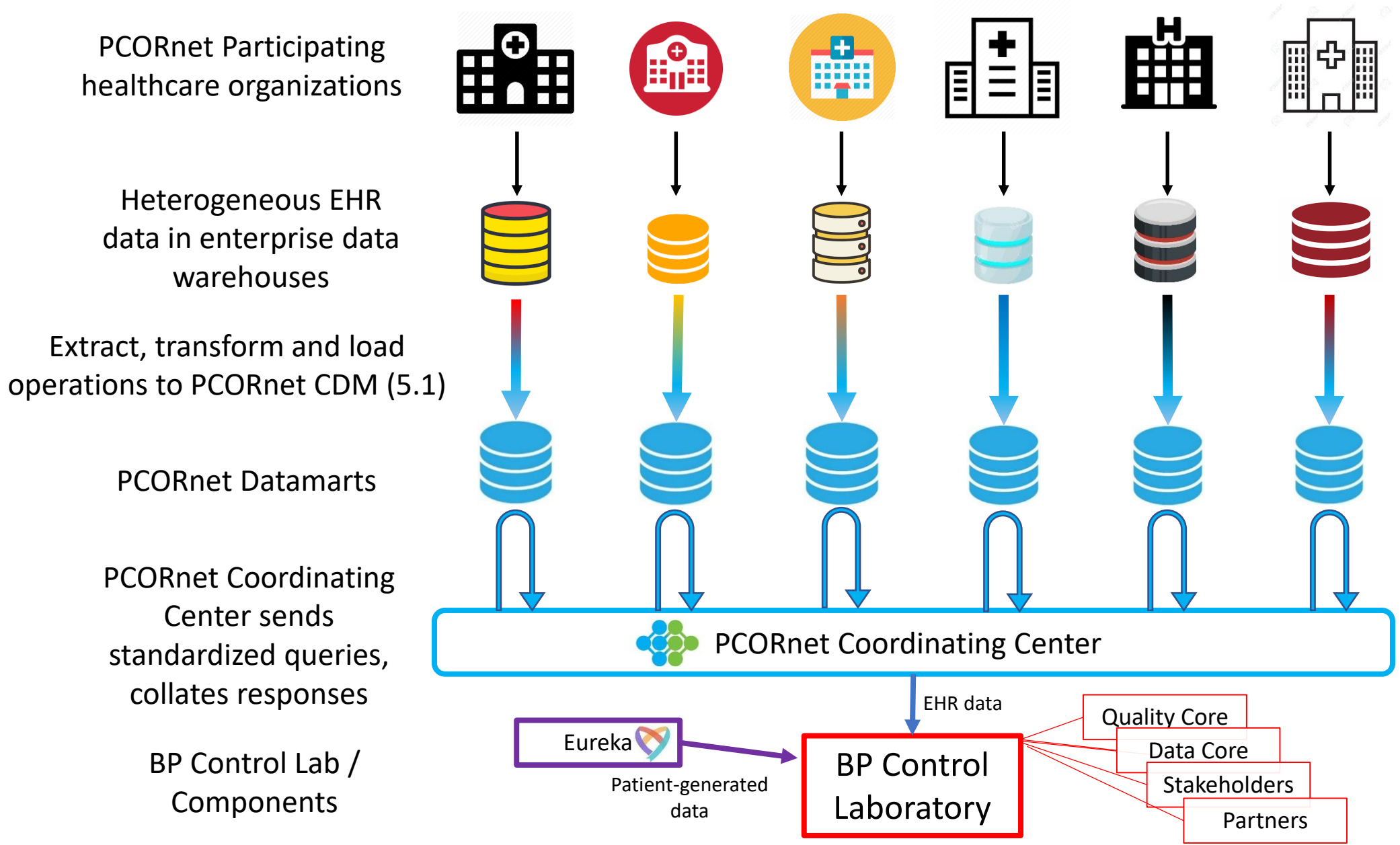


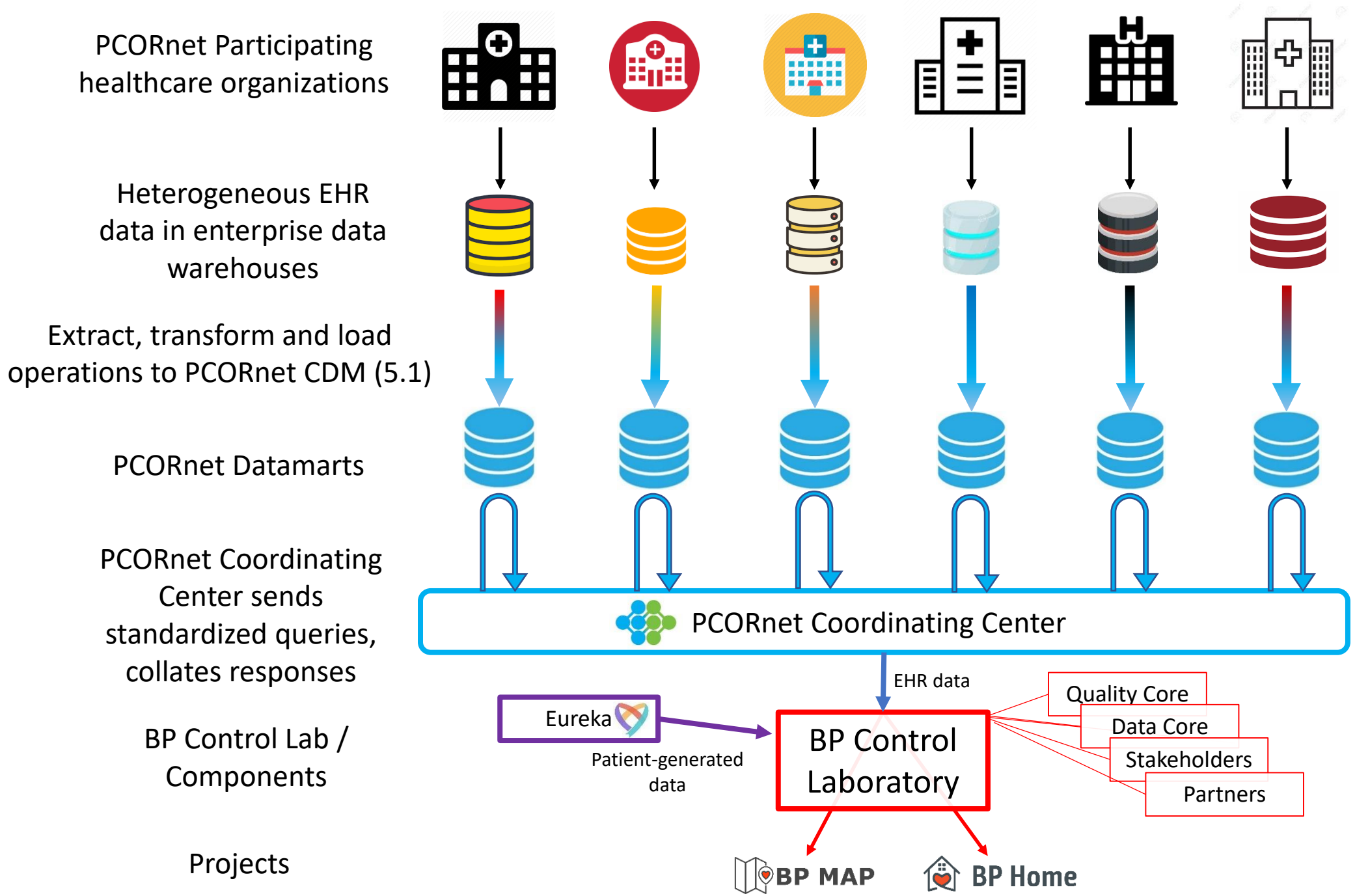
PCORnet Datamarts



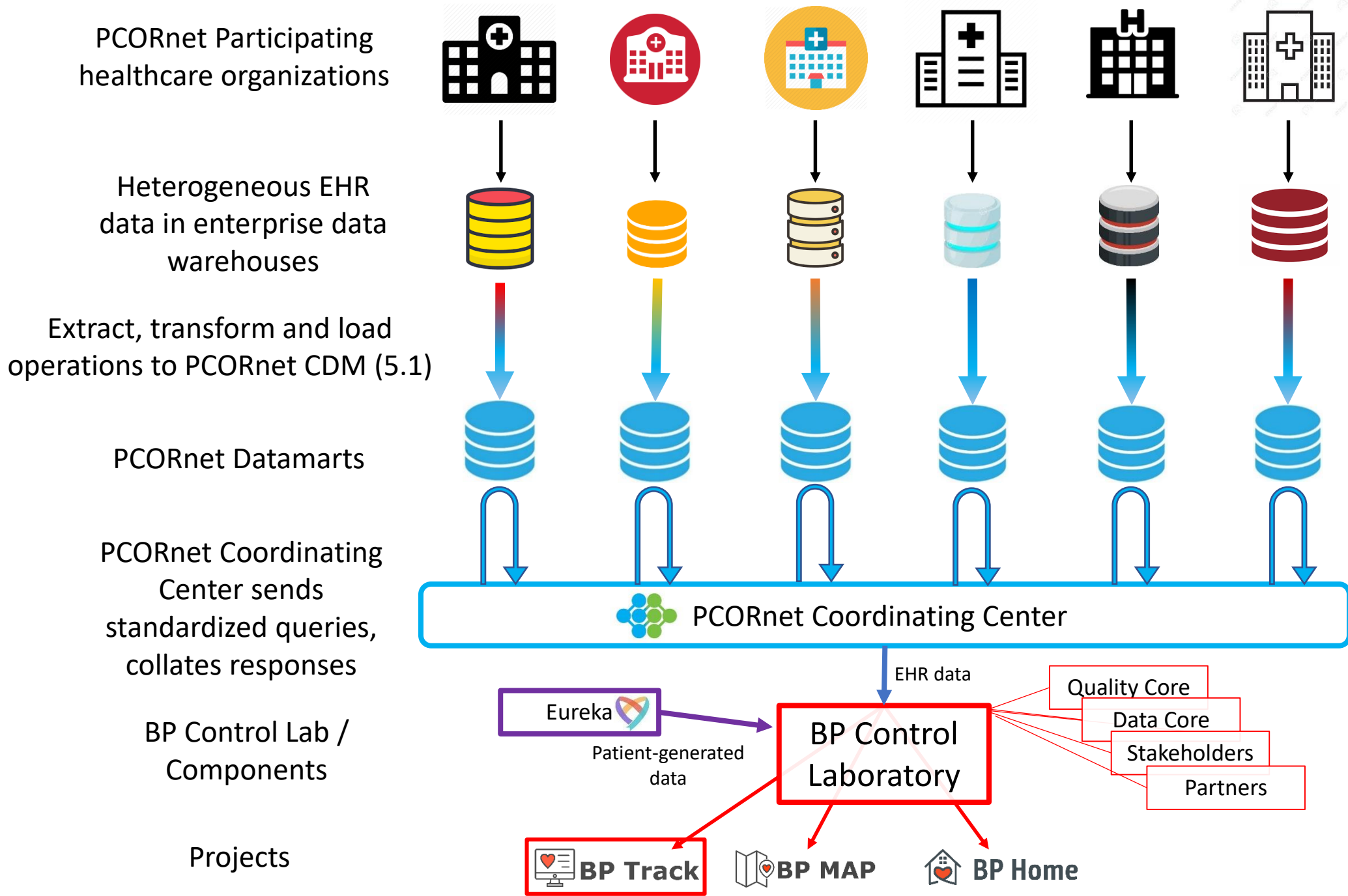
PCORnet Coordinating  
Center sends  
standardized queries,  
collates responses

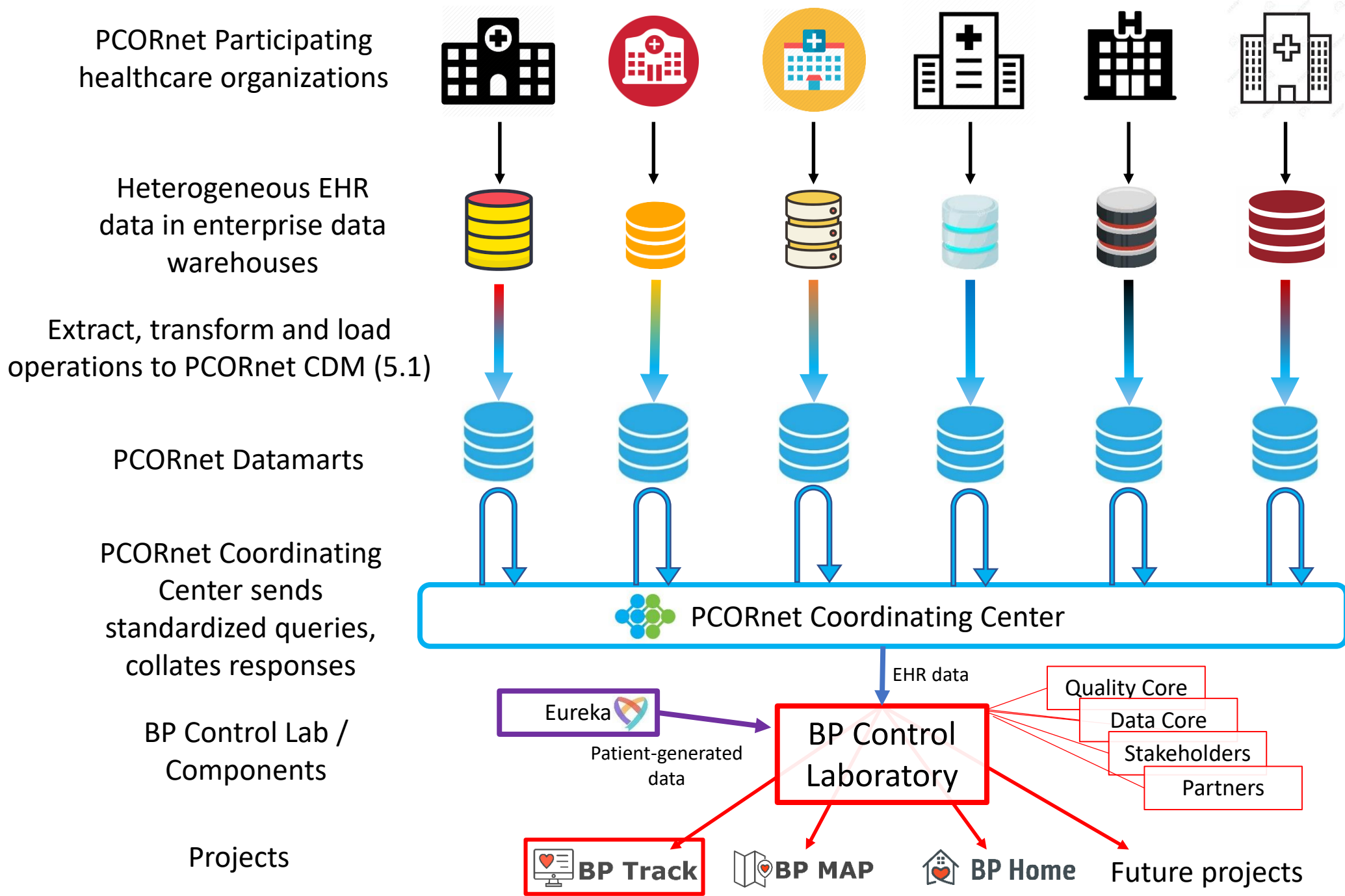












# Methods



**BP Track**

- National Surveillance system

- Created queries for 10 BP control metrics
  - Controlling High Blood Pressure (NQF 0018)
  - Improvement in BP (CMS65v7)
  - Additional processes relevant to clinical guidelines



# BP Track

#	Metric
1	BP Control ( $<140/<90$ mm Hg)
2	BP Control ( $<130/<80$ mm Hg)
3	Improvement in BP
4	Confirmatory Repeated BP Measurement
5	Terminal Digit = Zero



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#	Metric
6	Medication Intensification
7	Repeat visit in 4 wks after uncontrolled BP
8	Avg SBP reduction after medication intensification
9	Use of CCB or TD in African American patients on at least 1 med
10	Use of Fixed Dose combo product among patients taking at least 2 classes of drugs



# BP Track

## Outcomes

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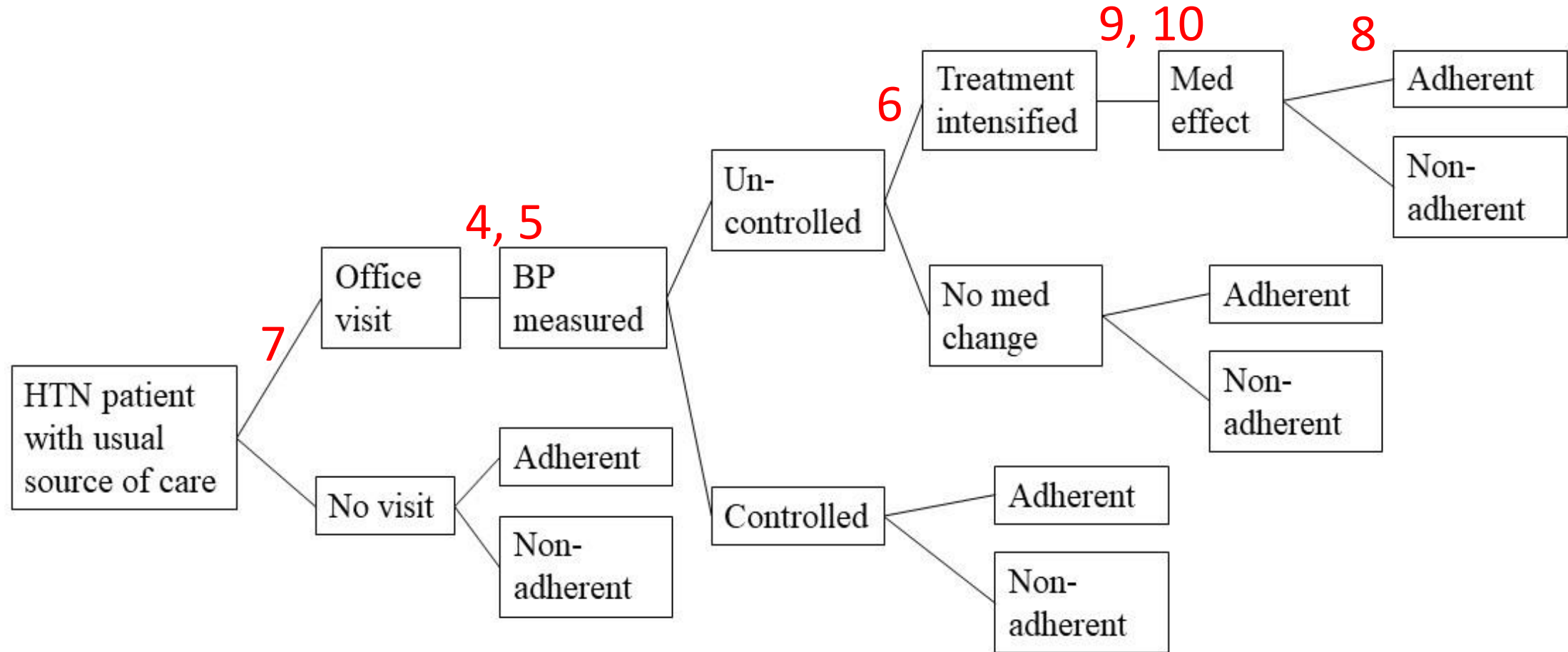
# BP Track

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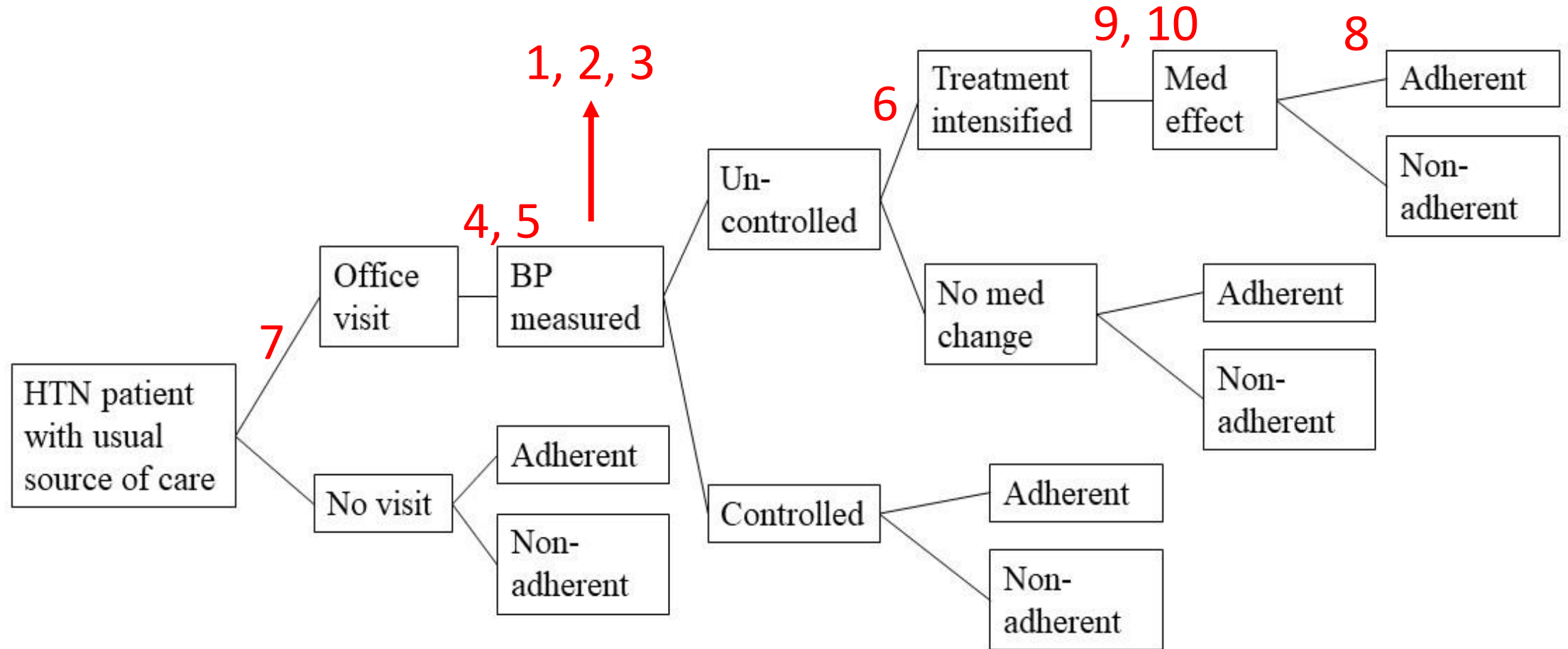
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# Process model









# Process model



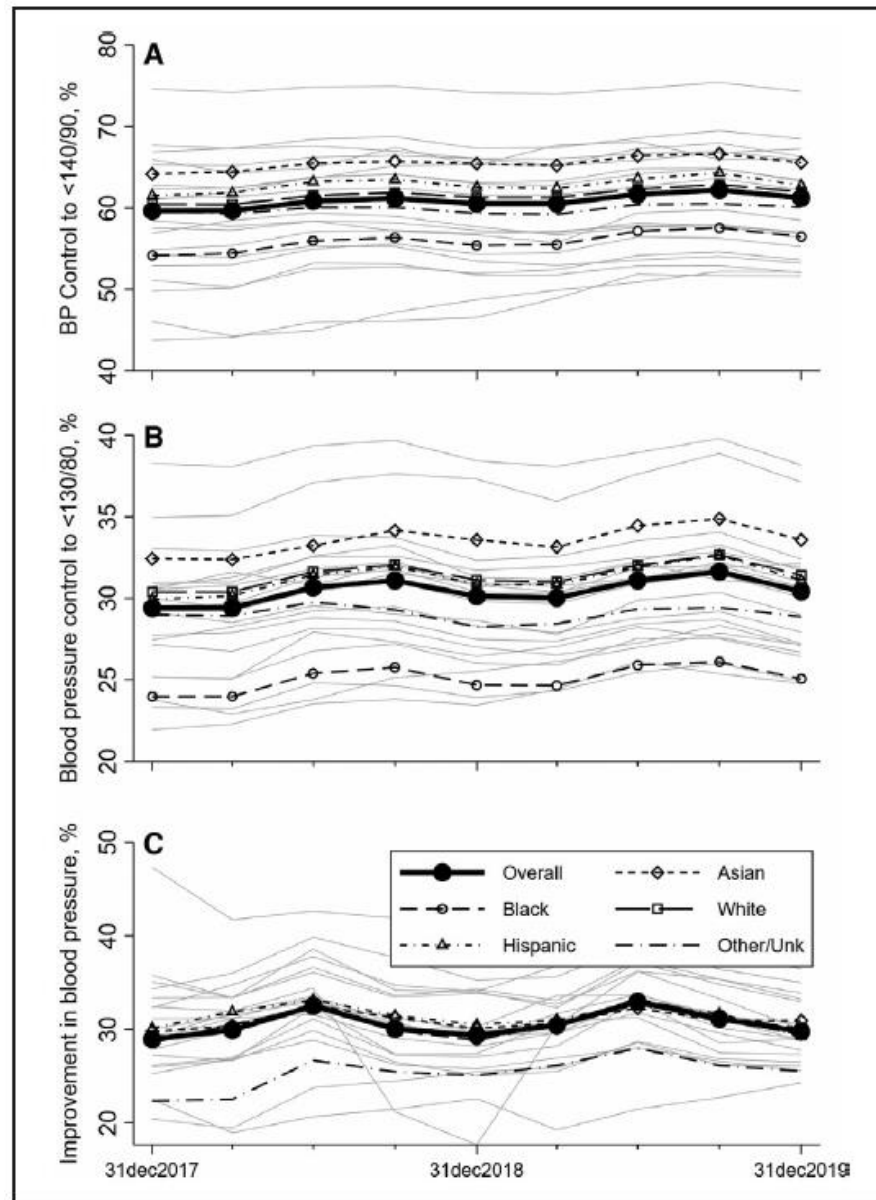
**ORIGINAL RESEARCH**

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# Tracking Blood Pressure Control Performance and Process Metrics in 25 US Health Systems: The PCORnet Blood Pressure Control Laboratory

Rhonda M. Cooper-DeHoff , PharmD, MS; Valy Fontil, MD, MAS; Thomas Carton, PhD; Alanna M. Chamberlain , PhD; Jonathan Todd, PhD; Emily C. O'Brien, PhD; Kathryn M. Shaw, MPH; Myra Smith, MPH; Sujung Choi, PhD; Ester K. Nillis, PhD; Daniel Ford, MD, MPH; Kristen M. Tecson , PhD; Princess E. Dennar, MD; Faraz Ahmad , MD, MS; Shenghui Wu, MD, PhD; James C. McClay , MD, MS; Kristen Azar , RN, MSN/MPH; Rajbir Singh, MBBS; Madelaine Faulkner Modrow, MPH; Christina M. Shay, PhD; Michael Rakotz , MD; Gregory Wozniak, PhD; Mark J. Pletcher , MD, MPH

# Data from Wave 4

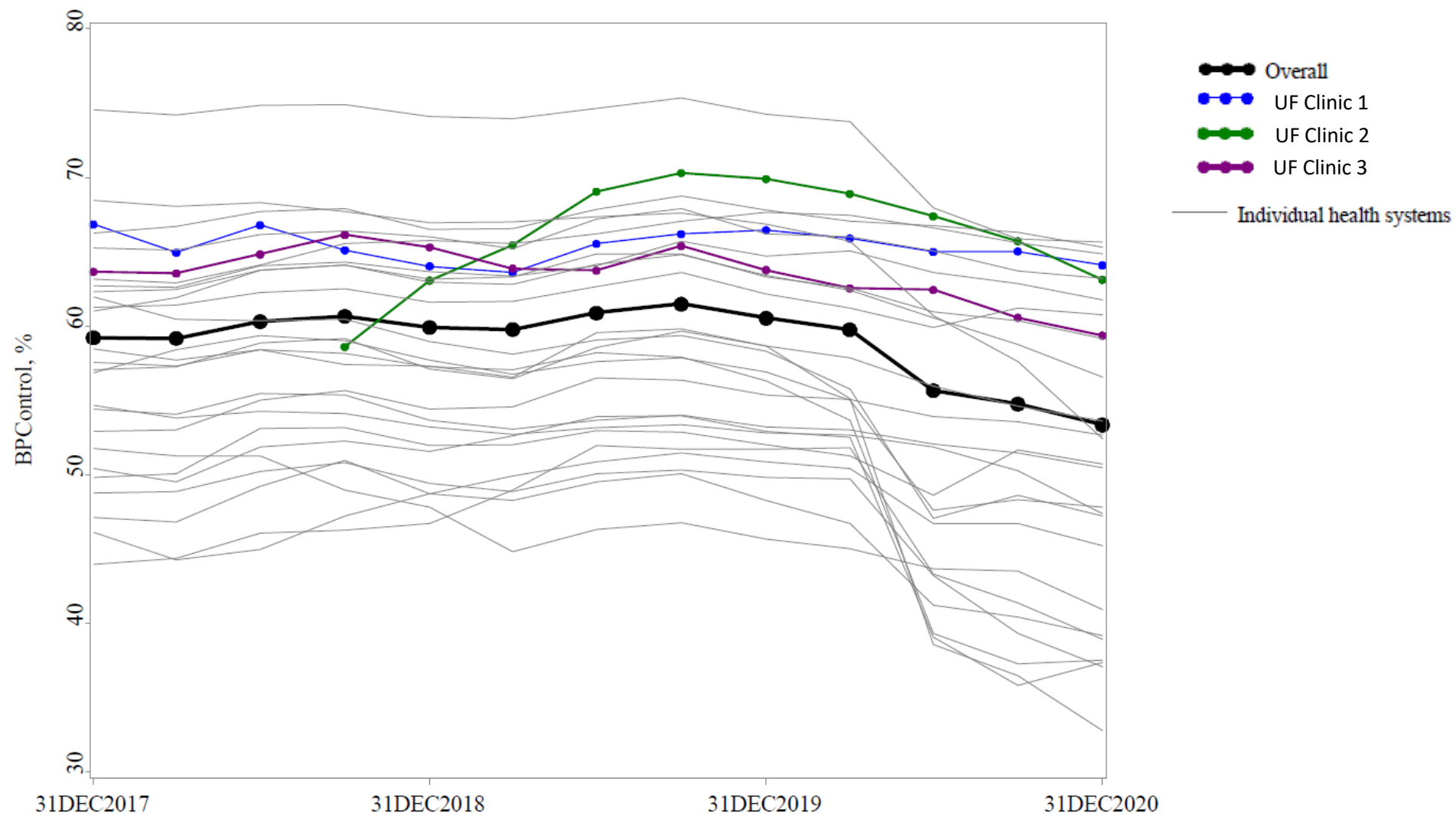


**Figure 1.** Time trends in blood pressure (BP) control outcomes, 2017 to 2019.

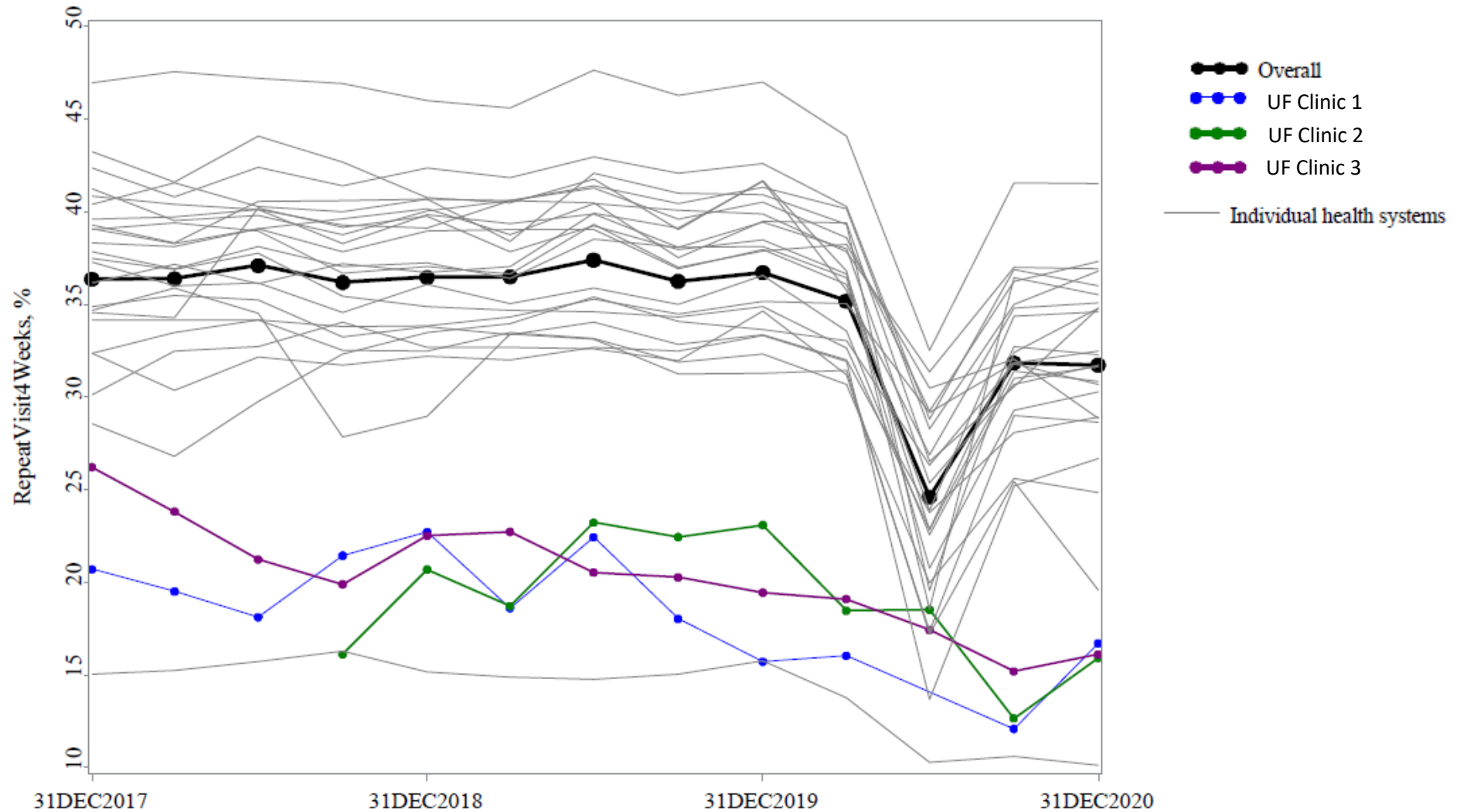
# UF Facility ID data

- Example of how these data can be really impactful
- UF – 3 internal medicine clinics
  - Different physical locations
  - Some overlapping providers
  - Serve different populations

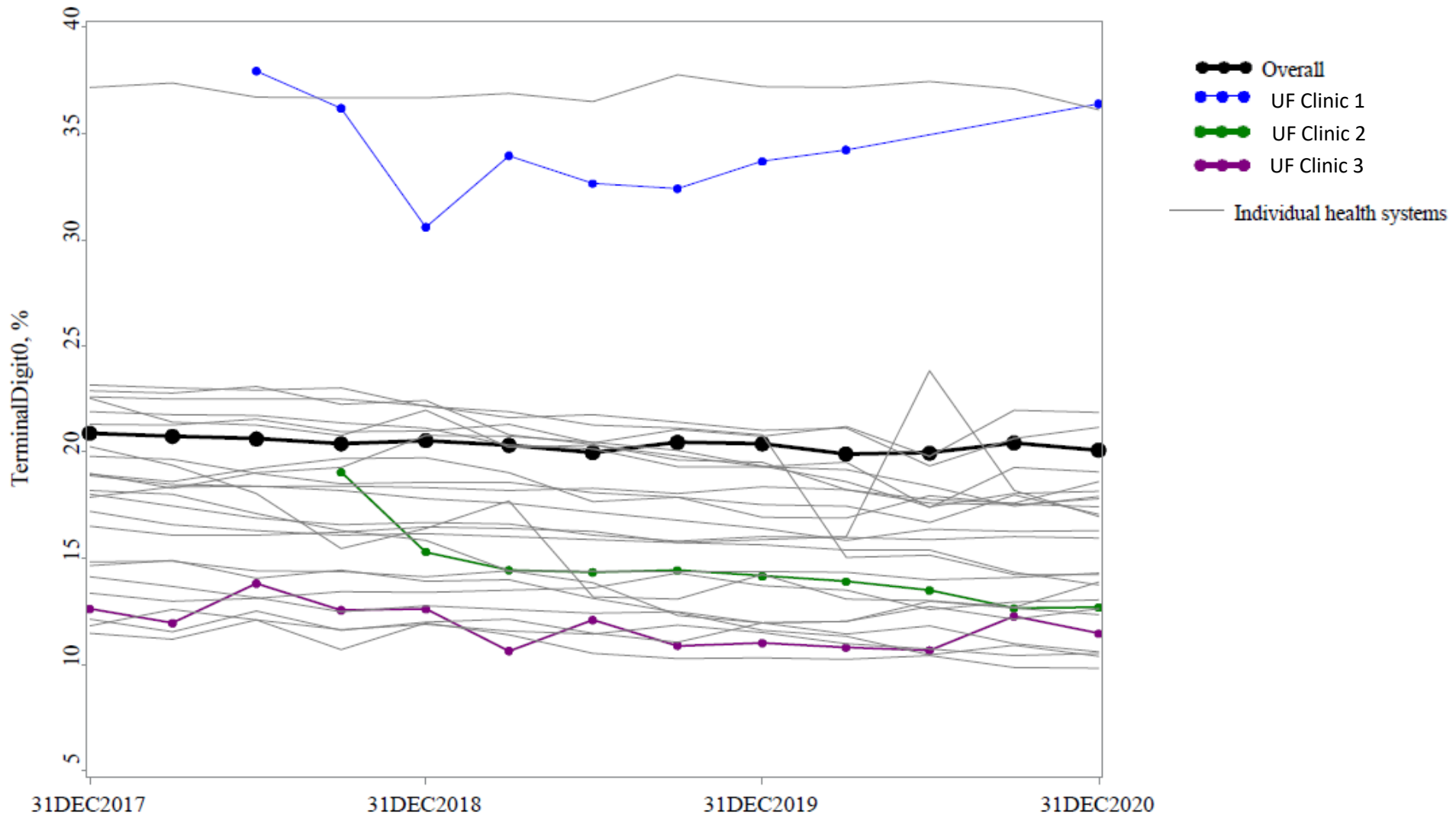
# BP Control (<140/<90 mmHg)



# Repeat visit in 4 weeks after uncontrolled BP



# Terminal digit zero



# Impact of COVID-19 Pandemic

Alanna Chamberlain



# Methods

- Included 24 health systems with data through 2020
- Series of 13 measurement periods
  - Each measurement period is 1 year
  - Used period 9 and 13 for pre-pandemic vs. during pandemic comparison

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- Included 24 health systems with data through 2020
- Series of 13 measurement periods
  - Each measurement period is 1 year
  - Used period 9 and 13 for pre-pandemic vs. during pandemic comparison

Measurement period	2017	2018	2019	2020
1	1/1/17-12/31/17			
2		4/1/17-3/31/18		
3		7/1/17-6/30/18		
4		10/1/17-9/30/18		
5		1/1/18-12/31/18		
6		4/1/18-3/31/19		
7		7/1/18-6/30/19		
8		10/1/18-9/30/19		
9			1/1/19-12/31/19	
10			4/1/19-3/31/20	
11			7/1/19-6/30/20	
12			10/1/19-9/30/20	
13				1/1/20-12/31/20

# Characteristics of patients with hypertension

Characteristic	2019	2020
<b>N patients</b>	1,770,547	1,726,794
<b>N encounters</b>	8,295,484	6,592,142
<b>Age</b>		
18-44 years	9.4%	9.3%
45-64 years	40.0%	39.3%
65-85 years	50.6%	51.4%
<b>Male Sex</b>	47.9%	48.0%
<b>Race/ethnicity</b>		
NH White	68.1%	67.5%
NH Black	15.7%	15.8%
NH Asian	2.5%	2.7%
Hispanic	8.6%	8.9%
Other/multiple	5.1%	5.1%

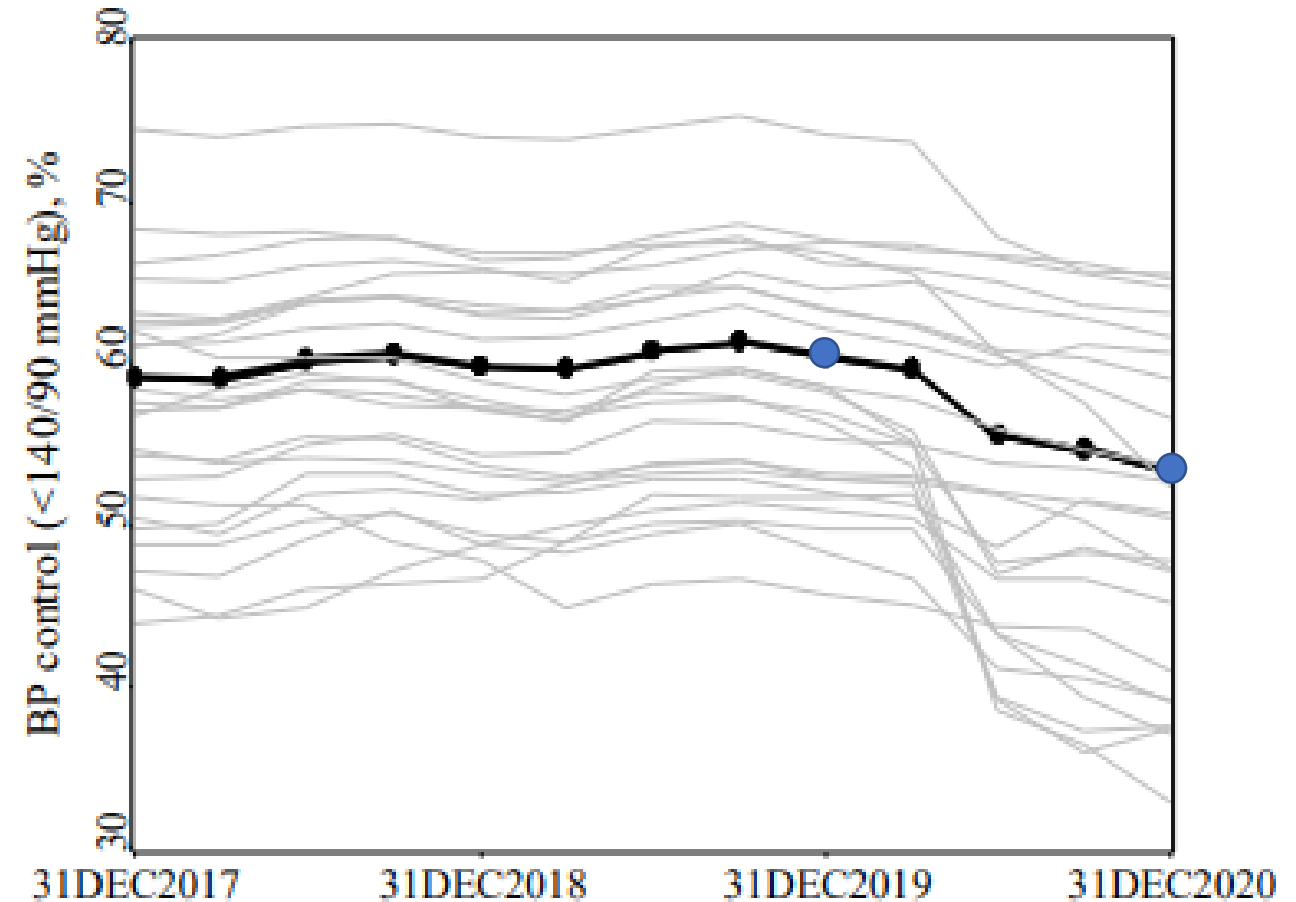
# Characteristics of patients with hypertension

Characteristic	2019	2020	Characteristic	2019	2020
<b>N patients</b>	1,770,547	1,726,794	<b>HTN Stage*</b>		
<b>N encounters</b>	8,295,484	6,592,142	Normal	16.3%	15.2%
<b>Age</b>			Elevated	14.7%	13.9%
18-44 years	9.4%	9.3%	Stage 1	32.4%	31.6%
45-64 years	40.0%	39.3%	Stage 2	33.5%	32.6%
65-85 years	50.6%	51.4%	Missing	3.1%	6.7%
<b>Male Sex</b>	47.9%	48.0%	*Normal (<120/<80), Elevated (120-129/80-89), Stage 1 (130-139/80-89), Stage 2 (≥140/≥90 mmHg); using first BP measurement in the year.		
<b>Race/ethnicity</b>			<b>Diabetes</b>	28.2%	28.8%
NH White	68.1%	67.5%	<b>CAD</b>	16.0%	15.9%
NH Black	15.7%	15.8%	<b>Heart failure</b>	6.3%	6.5%
NH Asian	2.5%	2.7%	<b>Depression</b>	15.3%	14.0%
Hispanic	8.6%	8.9%	<b>COPD</b>	5.5%	5.4%
Other/multiple	5.1%	5.1%			

# Results

BP Control, % (<140/90 mmHg)

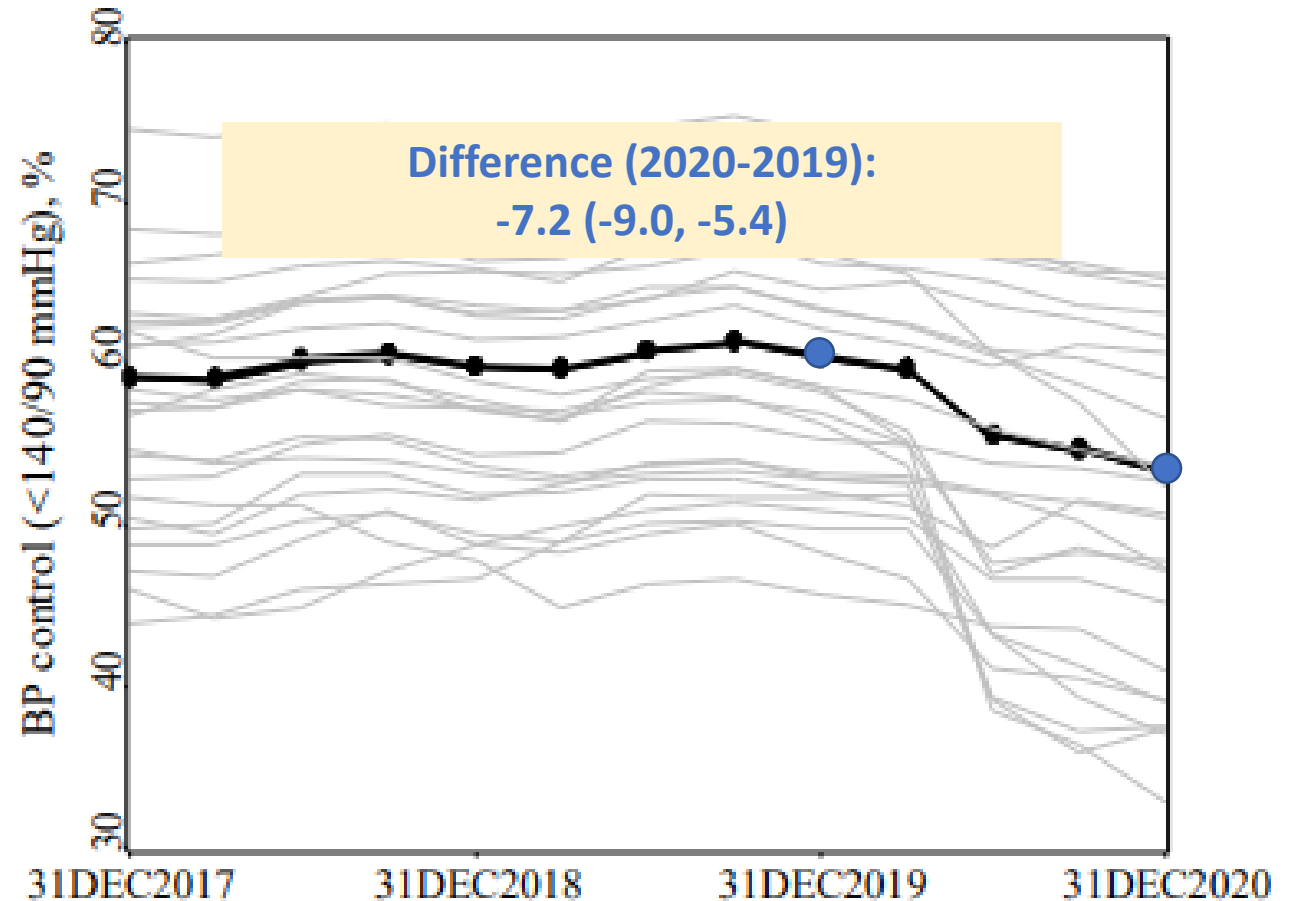
- **BP control definition**
  - % of hypertensive patients for whom last BP measurement at an ambulatory care visit was <140/<90 mmHg



# Results

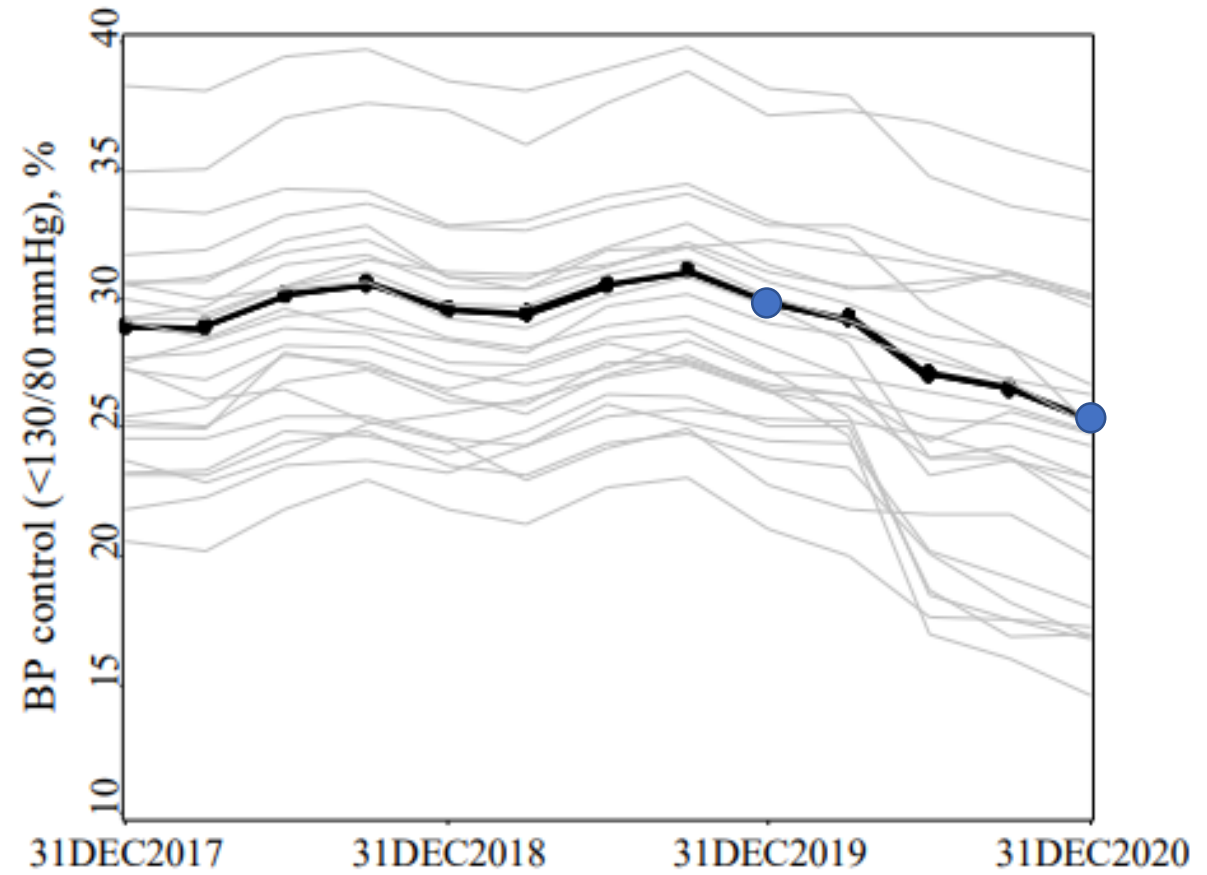
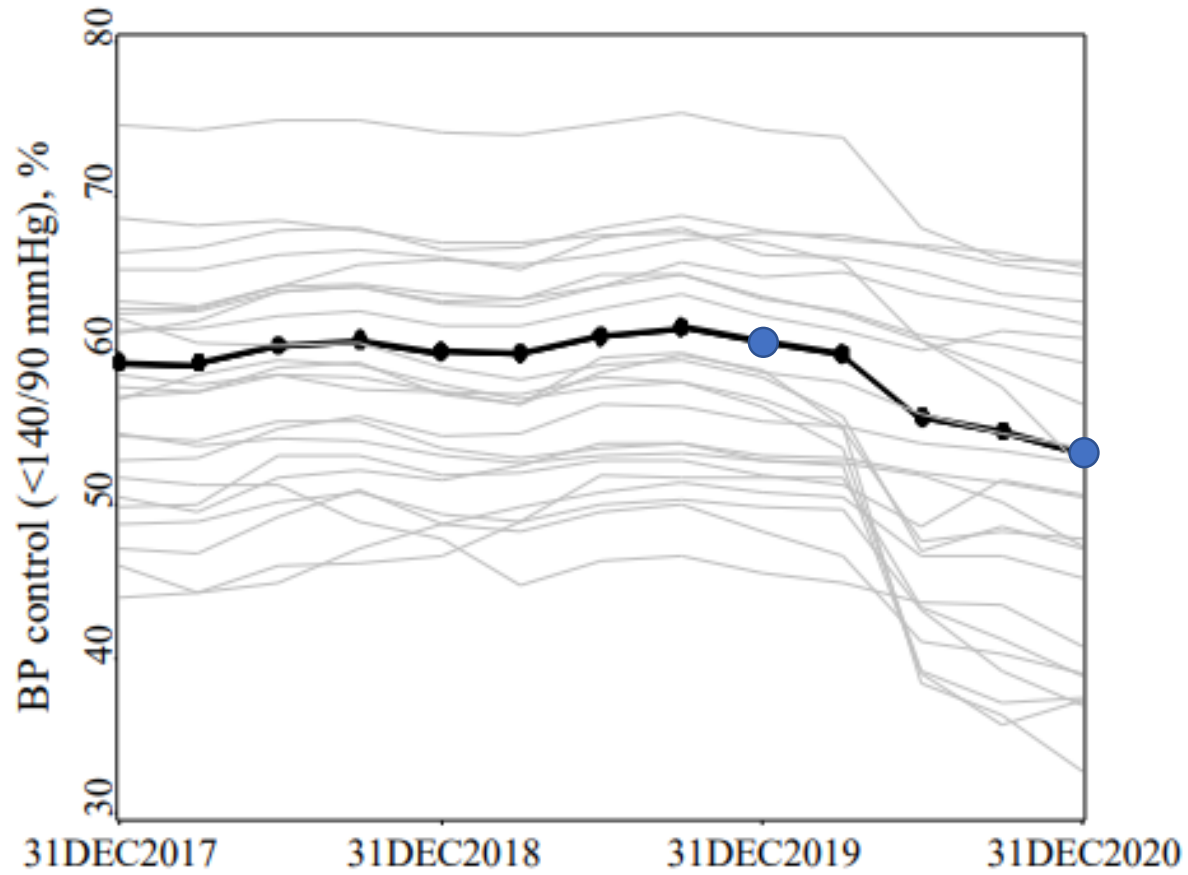
BP Control, % (<140/90 mmHg)

- **BP control definition**
  - % of hypertensive patients for whom last BP measurement at an ambulatory care visit was <140/<90 mmHg
- **Weighted averages**
  - 60.5% in 2019
  - 53.3% in 2020



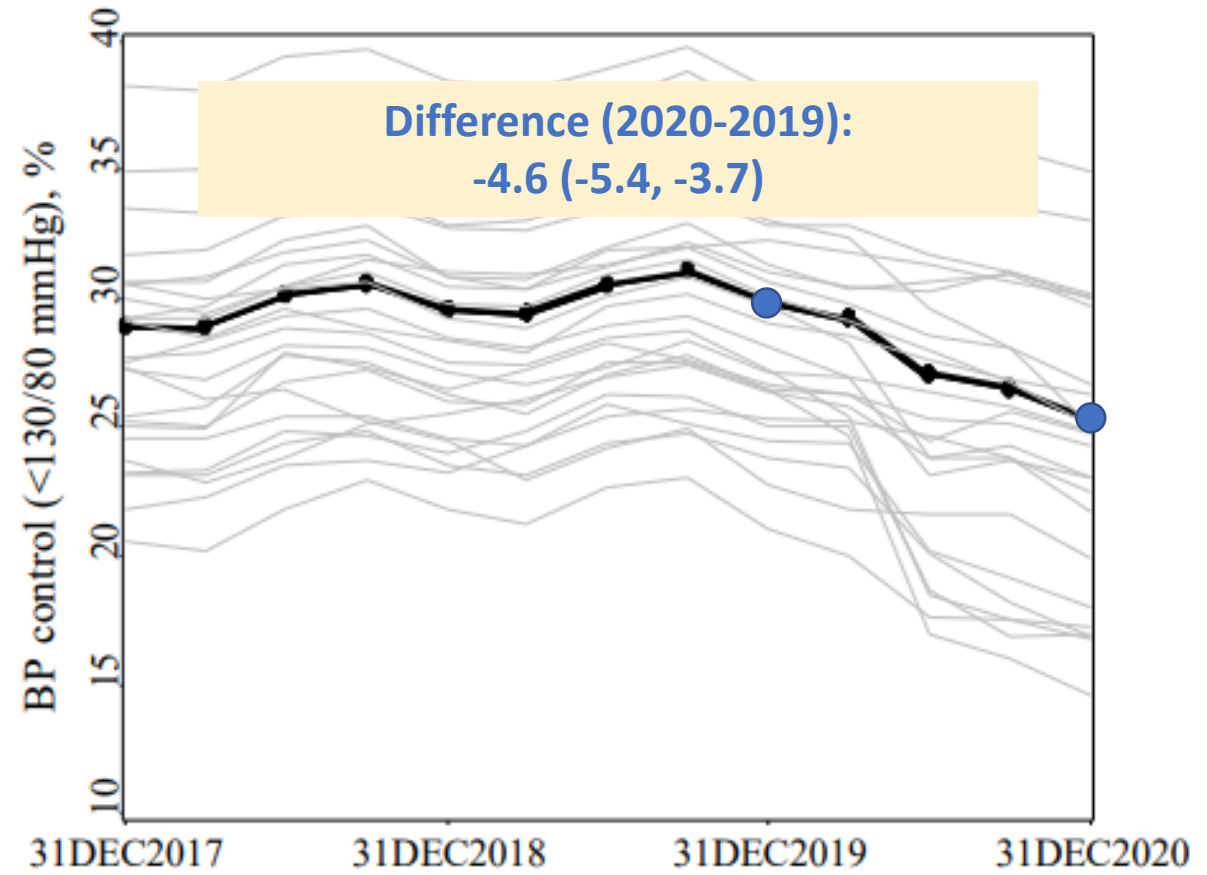
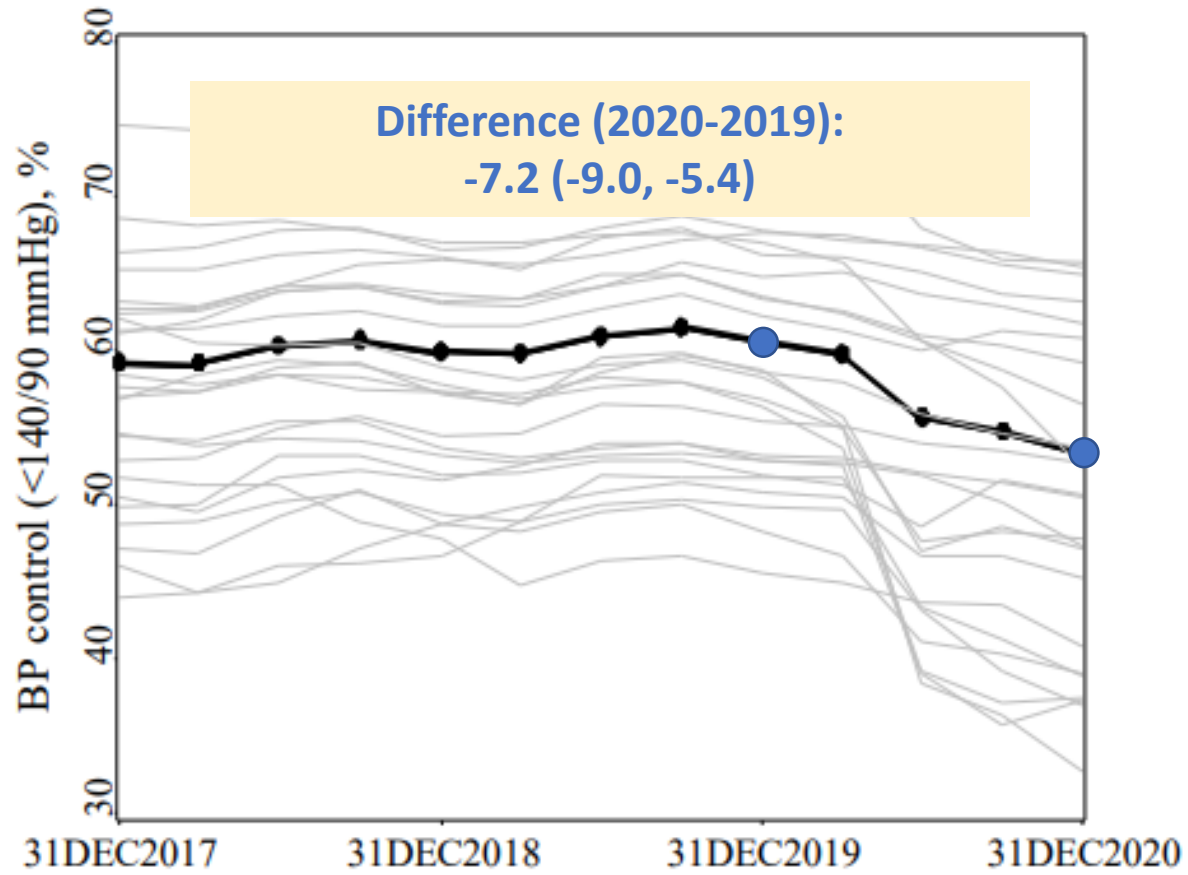
# Results

BP Control, % (<140/90 mmHg, <130/80 mmHg)



# Results

BP Control, % (<140/90 mmHg, <130/80 mmHg)

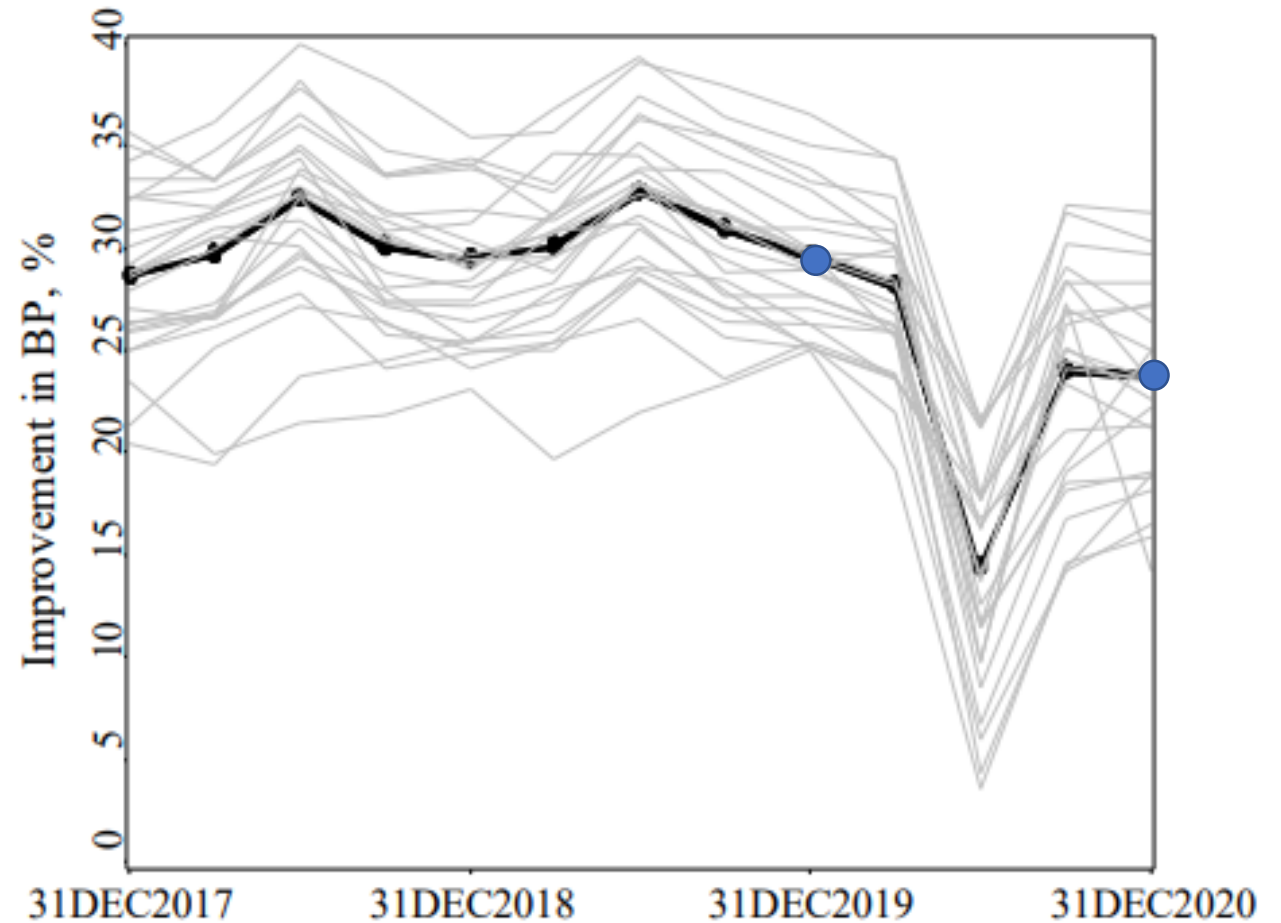




# Results

Improvement in BP Control, %

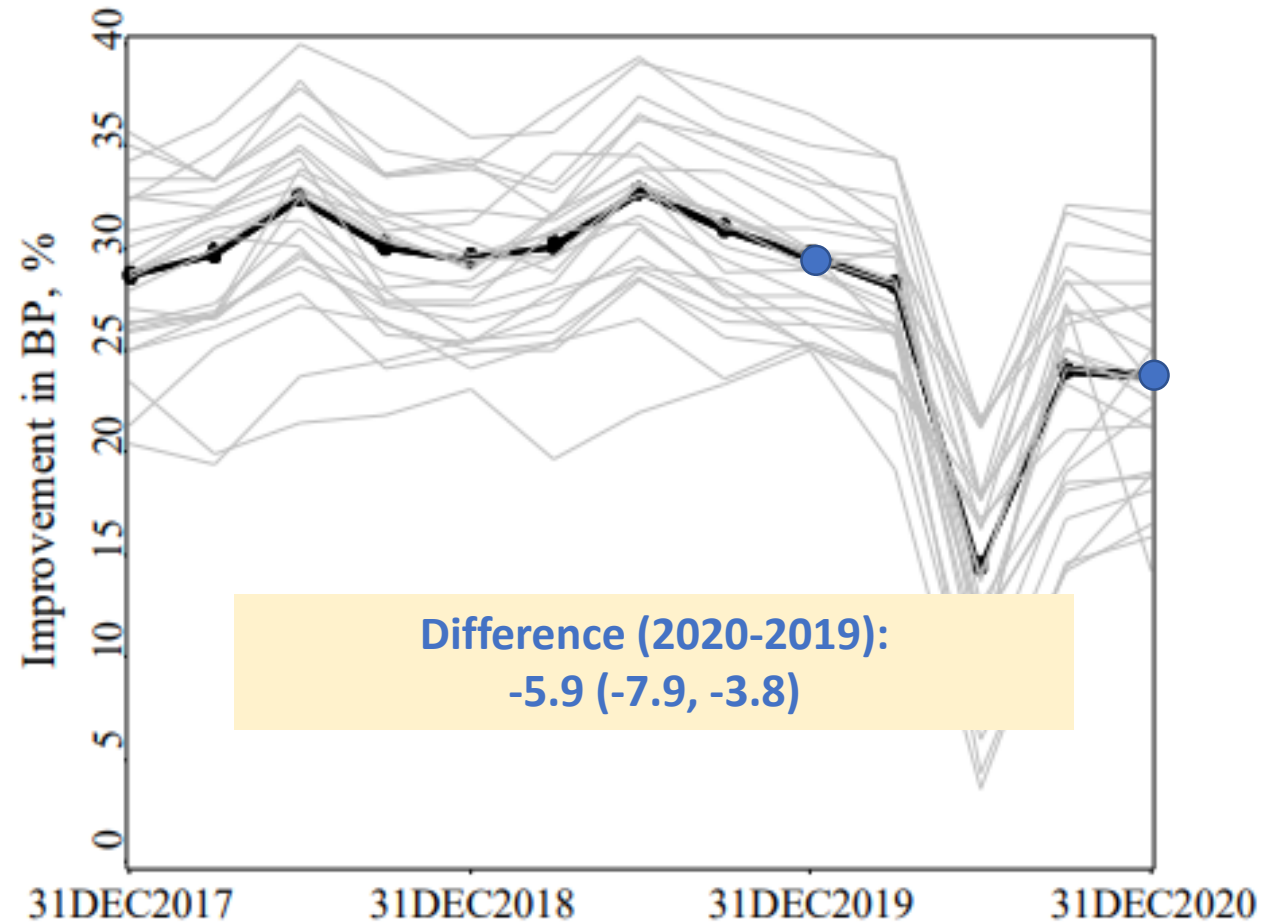
- Improvement in BP definition
  - % of hypertensive patients with previously uncontrolled SBP who achieve a SBP reduction of 10 mmHg or SBP <140 mmHg



# Results

Improvement in BP Control, %

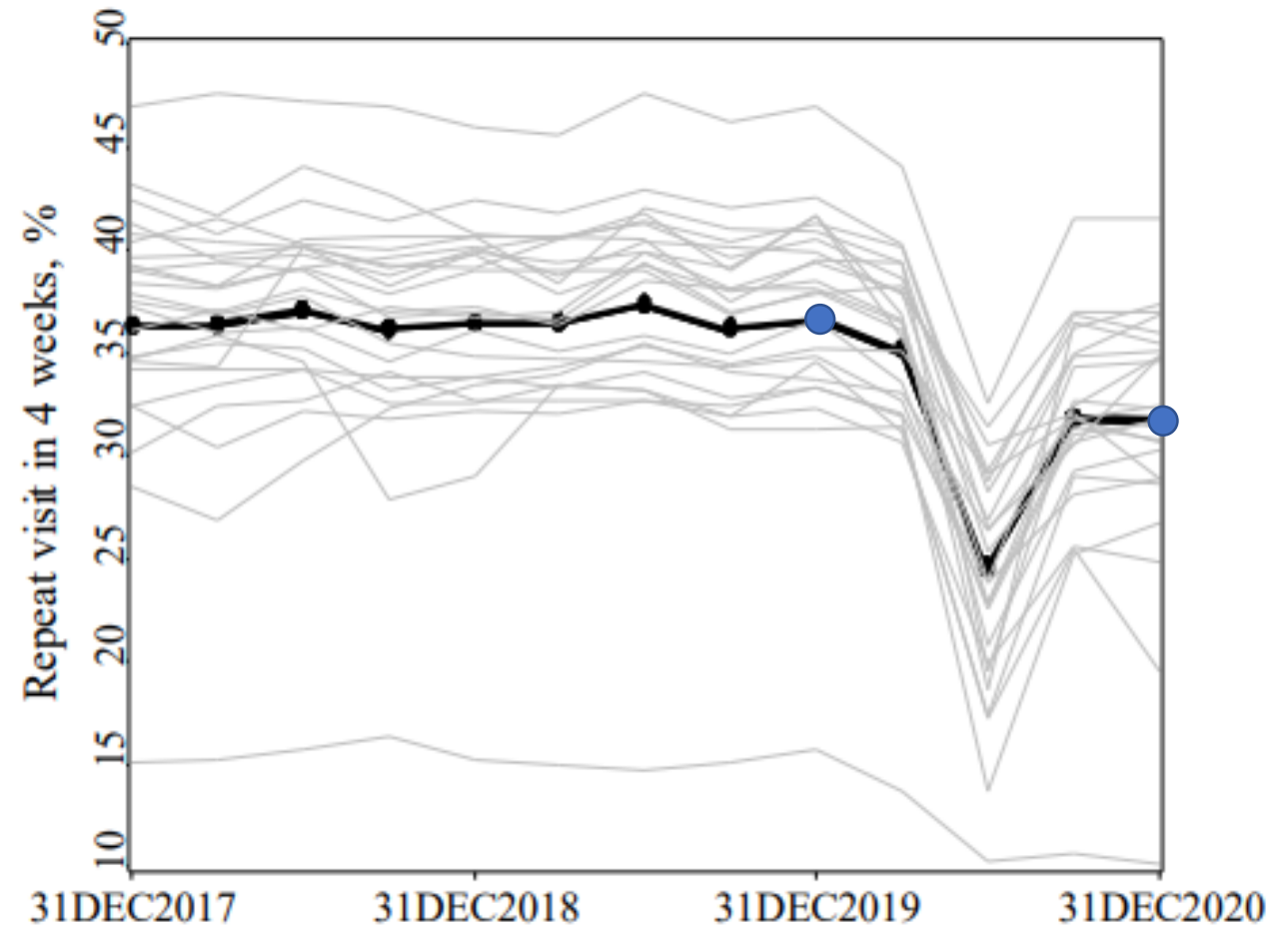
- Improvement in BP definition
  - % of hypertensive patients with previously uncontrolled SBP who achieve a SBP reduction of 10 mmHg or SBP <140 mmHg
- Weighted averages
  - 29.7% in 2019
  - 23.8% in 2020



# Results

## Repeat Visit in 4 Weeks, %

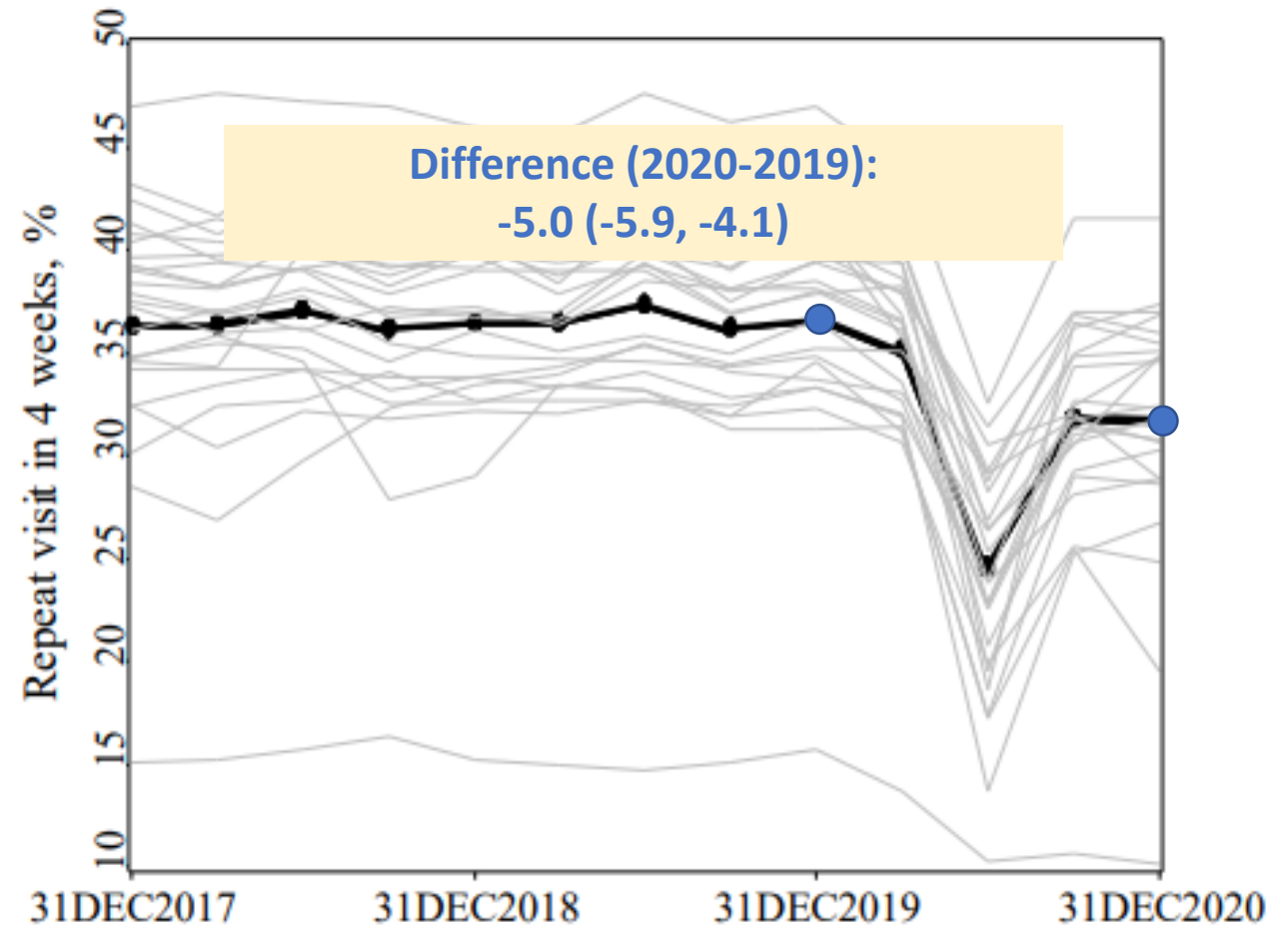
- Repeat visit definition
  - % of visits by persons with uncontrolled HTN that were followed by a subsequent visit within 4 weeks



# Results

## Repeat Visit in 4 Weeks, %

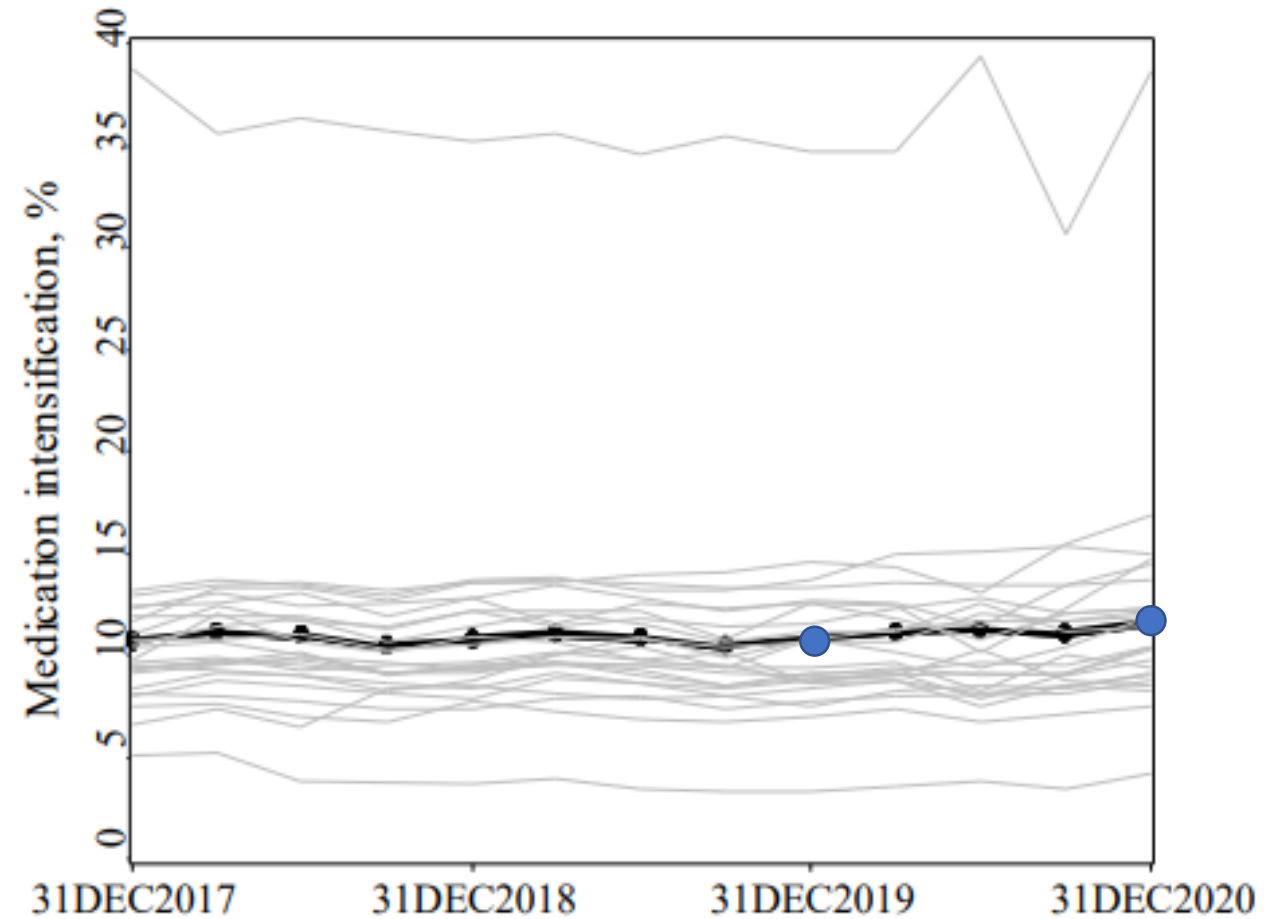
- Repeat visit definition
  - % of visits by persons with uncontrolled HTN that were followed by a subsequent visit within 4 weeks
- Weighted averages
  - 36.7% in 2019
  - 31.7% in 2020



# Results

## Medication Intensification, %

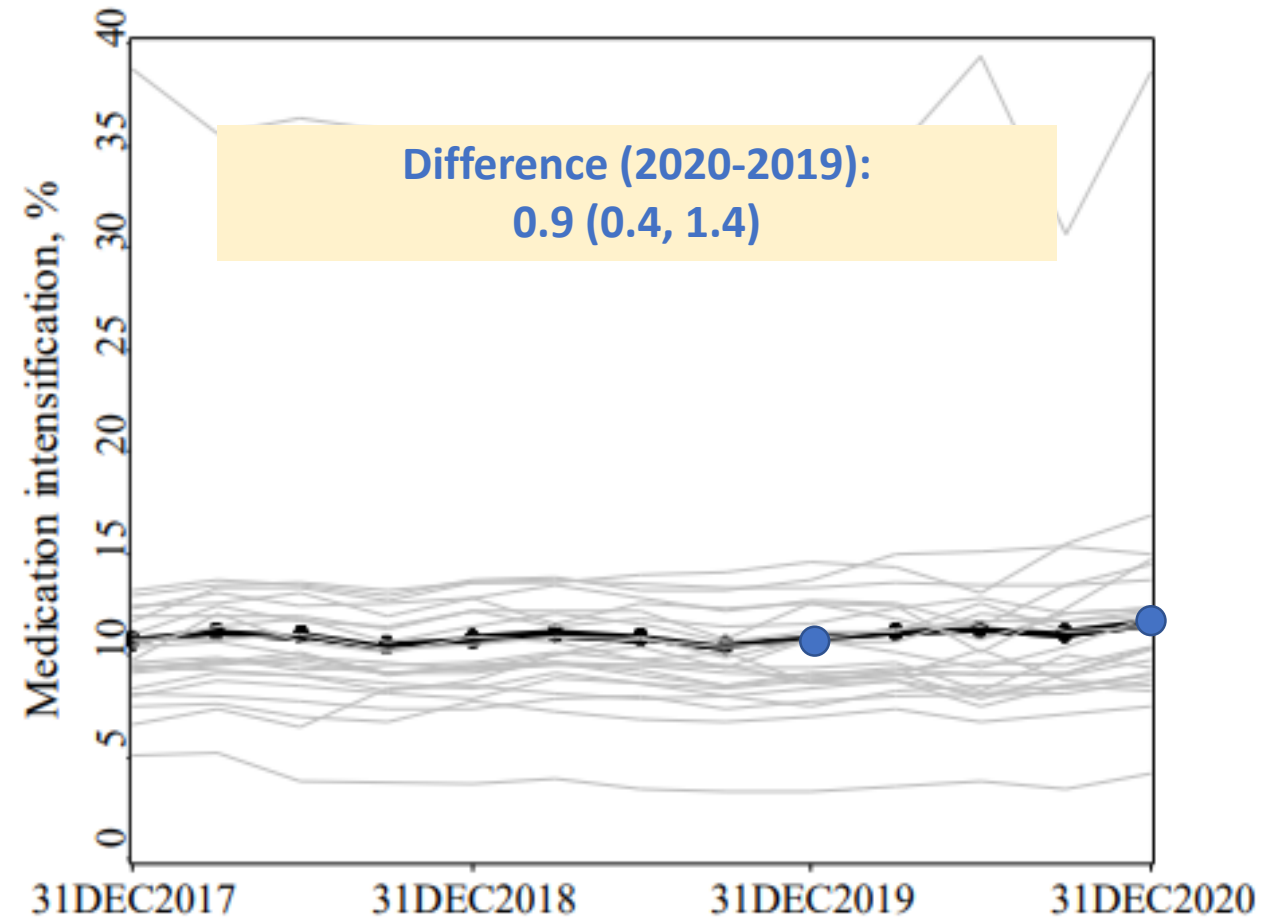
- Med intensification definition
  - % of visits by persons with uncontrolled HTN where a different class of BP medication is prescribed



# Results

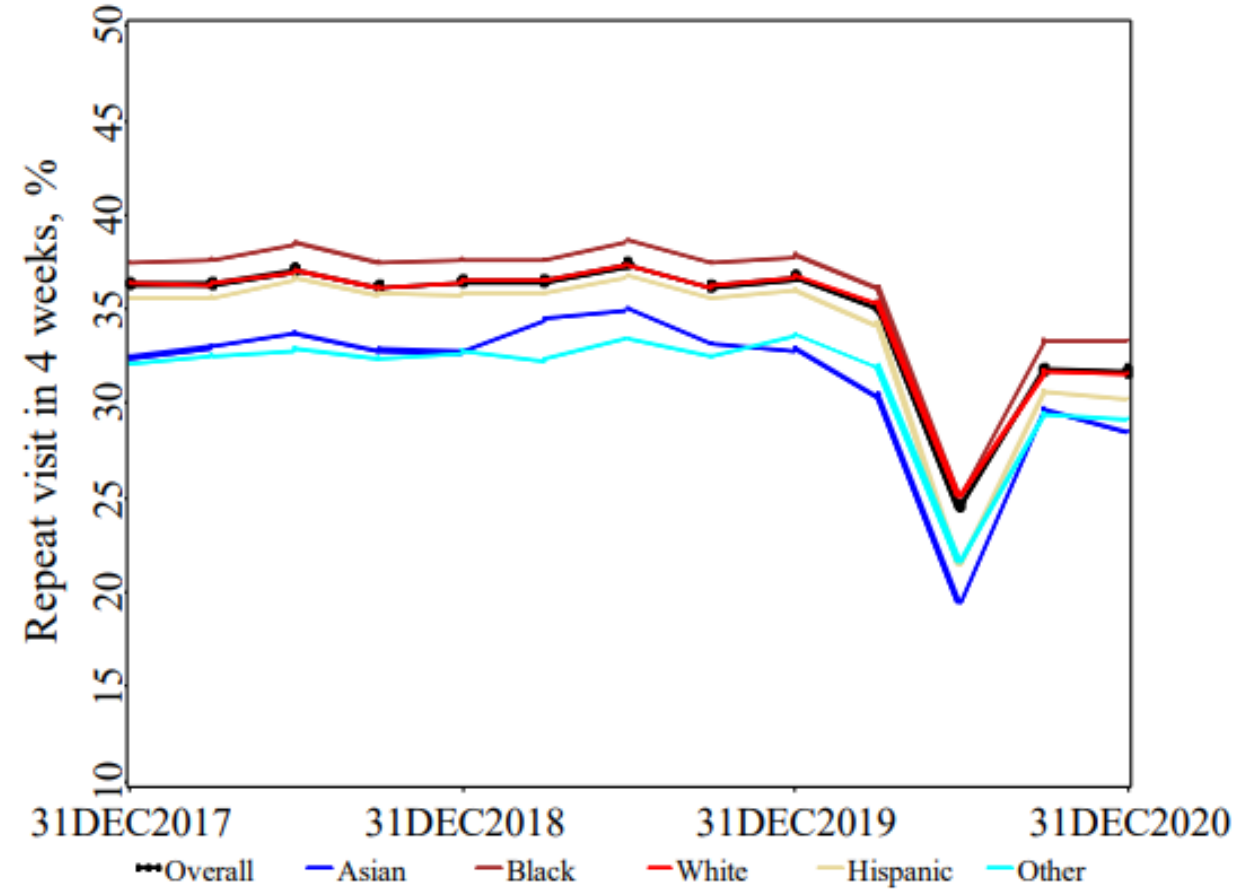
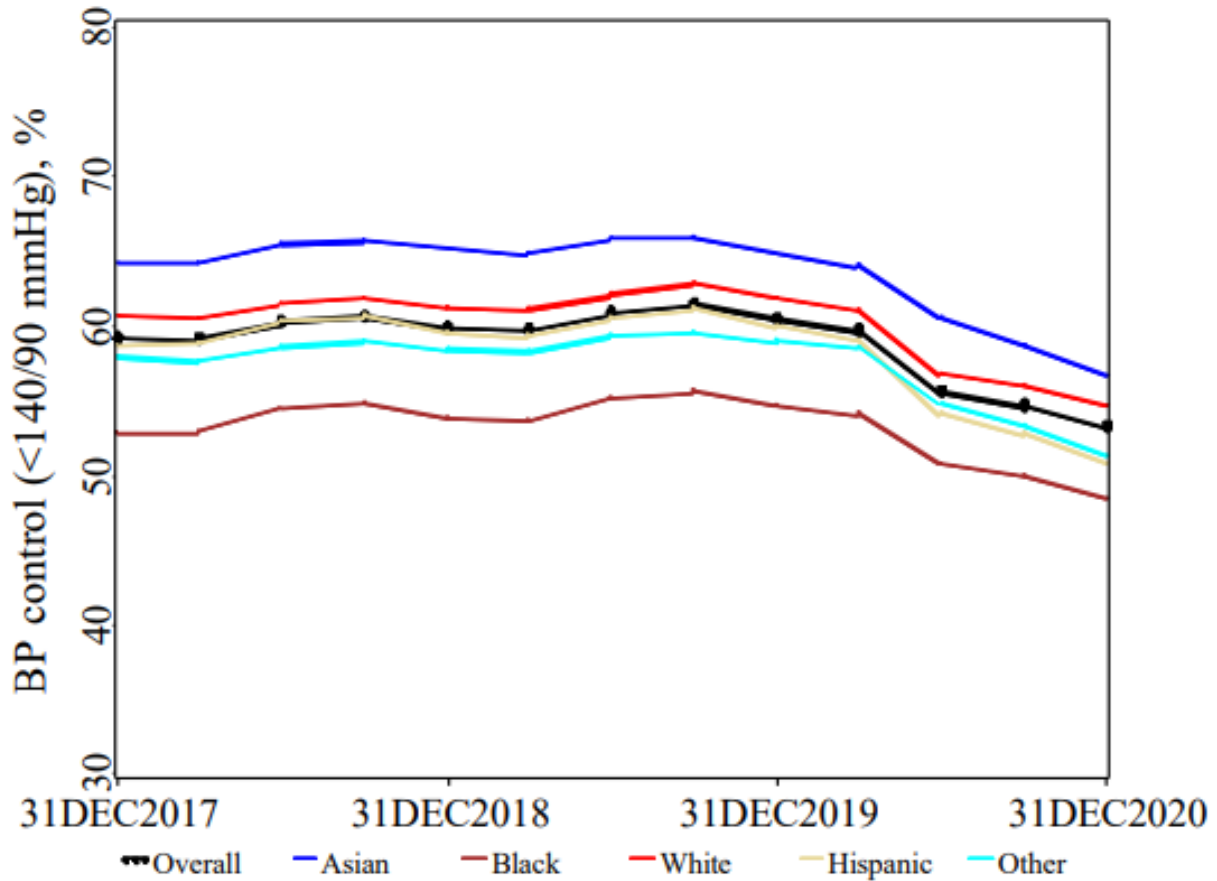
## Medication Intensification, %

- **Med intensification definition**
  - % of visits by persons with uncontrolled HTN where a different class of BP medication is prescribed
- **Weighted averages**
  - 10.8% in 2019
  - 11.7% in 2020



# Results

## BP Control and Repeat Visits by Race/Ethnicity



# Conclusion

- Large variability across health systems in BP control metrics.
  - Substantial opportunity for improvement.
  - Racial/ethnic disparities exist in BP control, and larger drops in BP control were observed in Asian and Hispanic patients.
- BP control decreased substantially during the COVID-19 pandemic.
  - Accompanied by corresponding reduction in follow-up health care visits among persons with uncontrolled hypertension.
  - BP control has not rebounded to pre-pandemic levels.
  - Continued surveillance is needed to determine whether the decline in BP control during the pandemic will result in future cardiovascular events.



# Acknowledgements



## PCORnet Clinical Research Networks



## Participating datamarts

Alliance Chicago	Tulane University
Allina Health System	University of Chicago
Baylor Scott & White Health	University of Florida Health
Duke University	University of Iowa
Intermountain Health Care	University of Kansas Medical Center
Johns Hopkins	University of Miami
Marshfield Clinic	University of Missouri Health Center
Mayo Clinic	University of Nebraska
Medical College of Wisconsin	University of Pittsburgh
Medical University of South Carolina	University of Utah
Meharry Medical College	University Medical Center New Orleans
Montefiore	UT Health Sciences San Antonio
Northwestern Medical	Vanderbilt University Medical Center
NYU Langone Medical Center	Weill Cornell Medicine
OCHIN	
Pennsylvania State Medical Center	