REMOTE MONITORING FOR AORTIC DISSECTION

Laerke Ghosh, Vik Kapil, TM Mastracci FRCSC

St. Bartholomew's Hospital, London

University College London

Disclosures

Cook Medical – Proctor and Consultation

CYDAR Medical – Chair, Medical Advisory Board

Medtronic – Womens Advisory Vascular Project

The work is done by…

Laerke Ghosh

Vikas Kapil

Ottavia Borghese

Iannis Ben Abdallah

Robert Pruna-Guillin

Deb Das and our friends at Ortus iHealth

The Cohort Undergoing Surveillance….

Circulation: Cardiovascular Imaging

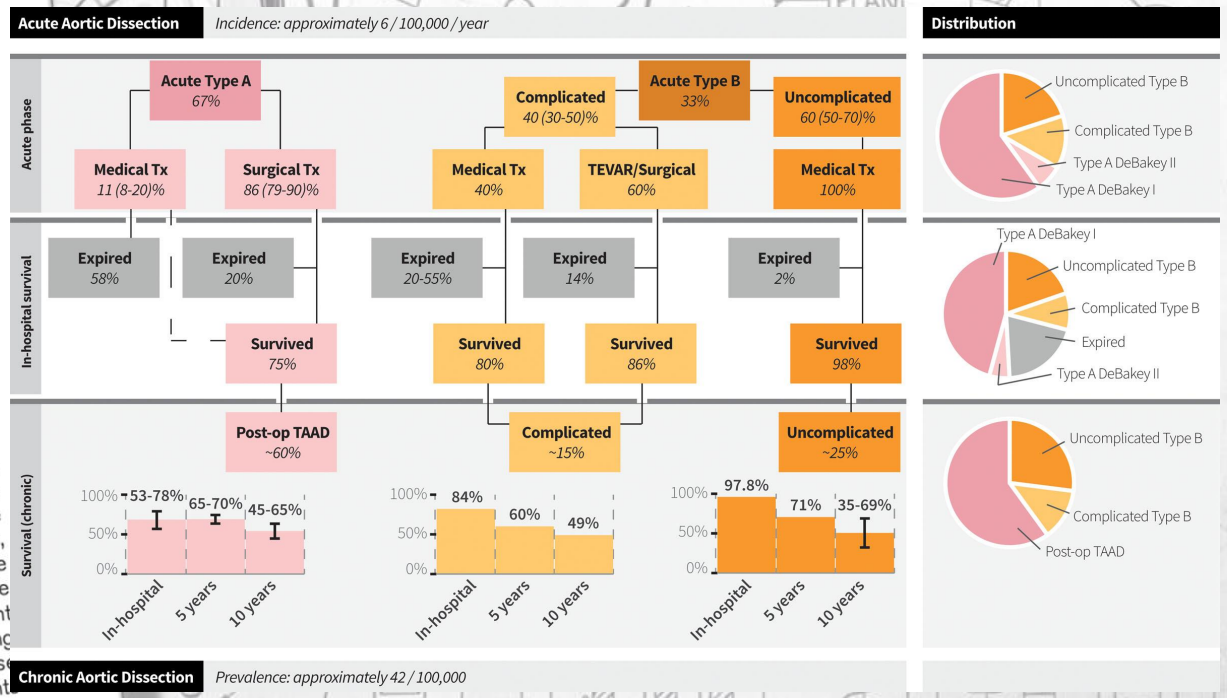
AHA SCIENTIFIC STATEMENT

Imaging and Surveillance of Chronic Aortic Dissection: A Scientific Statement From the American Heart Association

Dominik Fleischmann, MD, FAHA, Chair; Rana O. Afifi, MD; Ana I. Casanegra, MD, MS; John A. Elefteriades, MD; Thomas G. Gleason, MD; Kate Hanneman, MD, MPH; Eric E. Roselli, MD; Martin J. Willemink, MD, PhD; Michael P. Fischbein, MD, PhD, FAHA, Vice Chair; on behalf of the American Heart Association Council on Cardiovascular Radiology and Intervention; Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Clinical Cardiology; and Council on Cardiovascular Surgery and Anesthesia

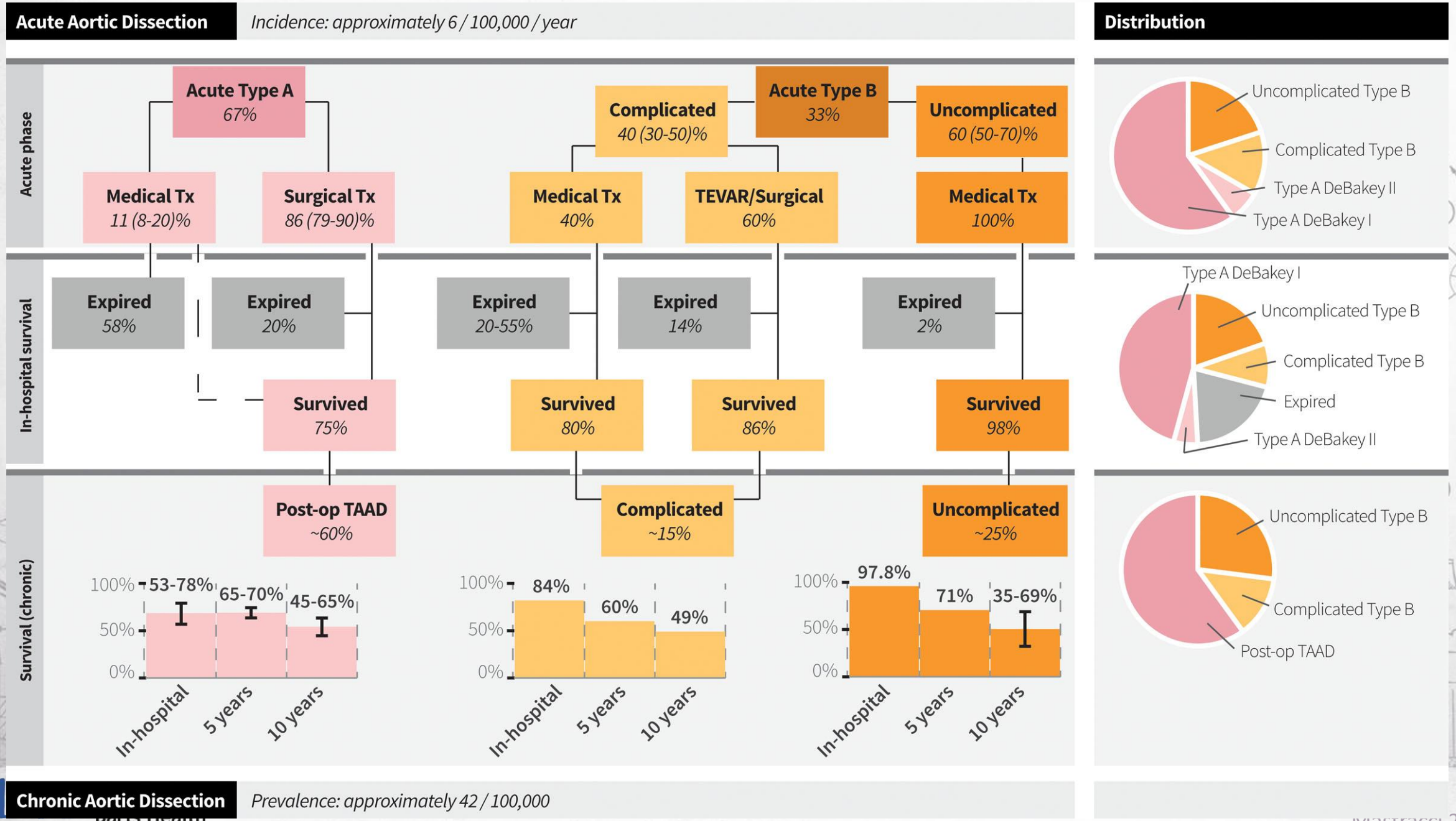
ABSTRACT: All patients surviving an acute aortic dissection require continued lifelong surveillance of their diseased aorta. Late complications, driven predominantly by chronic false lumen degeneration and aneurysm formation, often require surgical, endovascular, or hybrid interventions to treat or prevent aortic rupture. Imaging plays a central role in the medical decision-making of patients with chronic aortic dissection. Accurate aortic diameter measurements and rigorous, systematic documentation of diameter changes over time with different imaging equipment and modalities pose a range of practical challenges in these complex patients. Currently, no guidelines or recommendations for imaging surveillance in patients with chronic aortic dissection exist. In this document, we present state-of-the-art imaging and measurement techniques for patients with chronic aortic dissection and clarify the need for standardized measurements and reporting for lifelong surveillance. We also examine the emerging role of imaging and computer simulations to predict aortic false lumen degeneration, remodeling, and biomechanical failure from morphological and hemodynamic features. These insights may improve risk stratification, individualize contemporary treatment options, and potentially aid in the conception of novel treatment strategies in the future.

Key Words: AHA Scientific Statements ■ aortic diseases ■ aneurysm, dissecting ■ chronic disease ■ computed tomography angiography ■ multimodal imaging



Fleischmann et al, Circulation Cardiovascular Imaging 2022

Mastracci 2024



East London Cardiovascular Disease Prevention Group

NHS Trust

Fleischmann et al, Circulation Cardiovascular Imaging 2022

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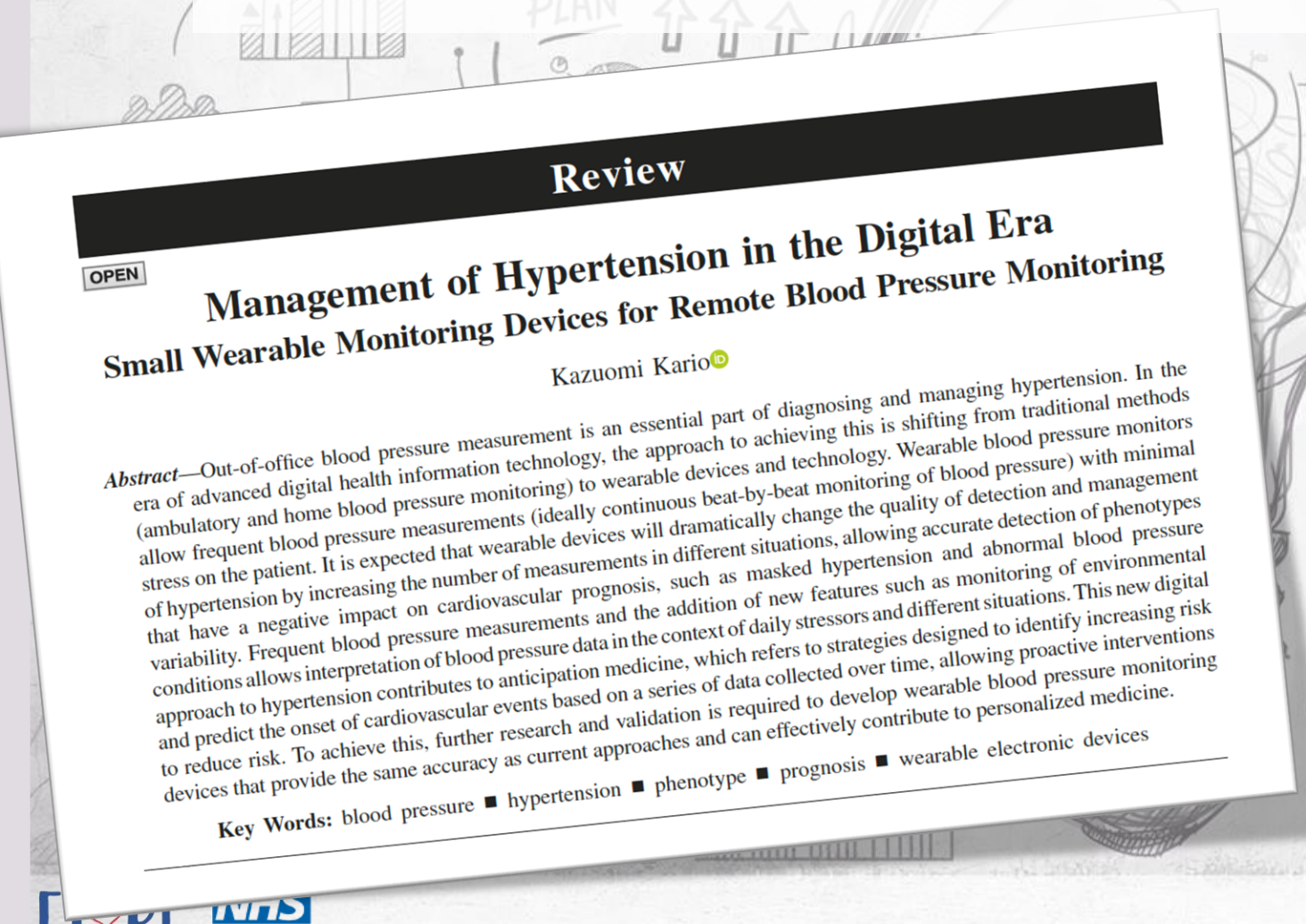
The Management of Hypertension Has Evolved



Review

OPEN

Management of Hypertension in the Digital Era

Small Wearable Monitoring Devices for Remote Blood Pressure Monitoring

Kazuomi Kario

Abstract—Out-of-office blood pressure measurement is an essential part of diagnosing and managing hypertension. In the era of advanced digital health information technology, the approach to achieving this is shifting from traditional methods (ambulatory and home blood pressure monitoring) to wearable devices and technology. Wearable blood pressure monitors allow frequent blood pressure measurements (ideally continuous beat-by-beat monitoring of blood pressure) with minimal stress on the patient. It is expected that wearable devices will dramatically change the quality of detection and management of hypertension by increasing the number of measurements in different situations, allowing accurate detection of phenotypes that have a negative impact on cardiovascular prognosis, such as masked hypertension and abnormal blood pressure variability. Frequent blood pressure measurements and the addition of new features such as monitoring of environmental conditions allows interpretation of blood pressure data in the context of daily stressors and different situations. This new digital approach to hypertension contributes to anticipation medicine, which refers to strategies designed to identify increasing risk and predict the onset of cardiovascular events based on a series of data collected over time, allowing proactive interventions to reduce risk. To achieve this, further research and validation is required to develop wearable blood pressure monitoring devices that provide the same accuracy as current approaches and can effectively contribute to personalized medicine.

Key Words: blood pressure ■ hypertension ■ phenotype ■ prognosis ■ wearable electronic devices

‘BP at Home provides better prognostic information about organ damage and cardiovascular risk management than office based strategies’

Kario K, Hypertension, 2020

Solves Hospital Capacity Issues

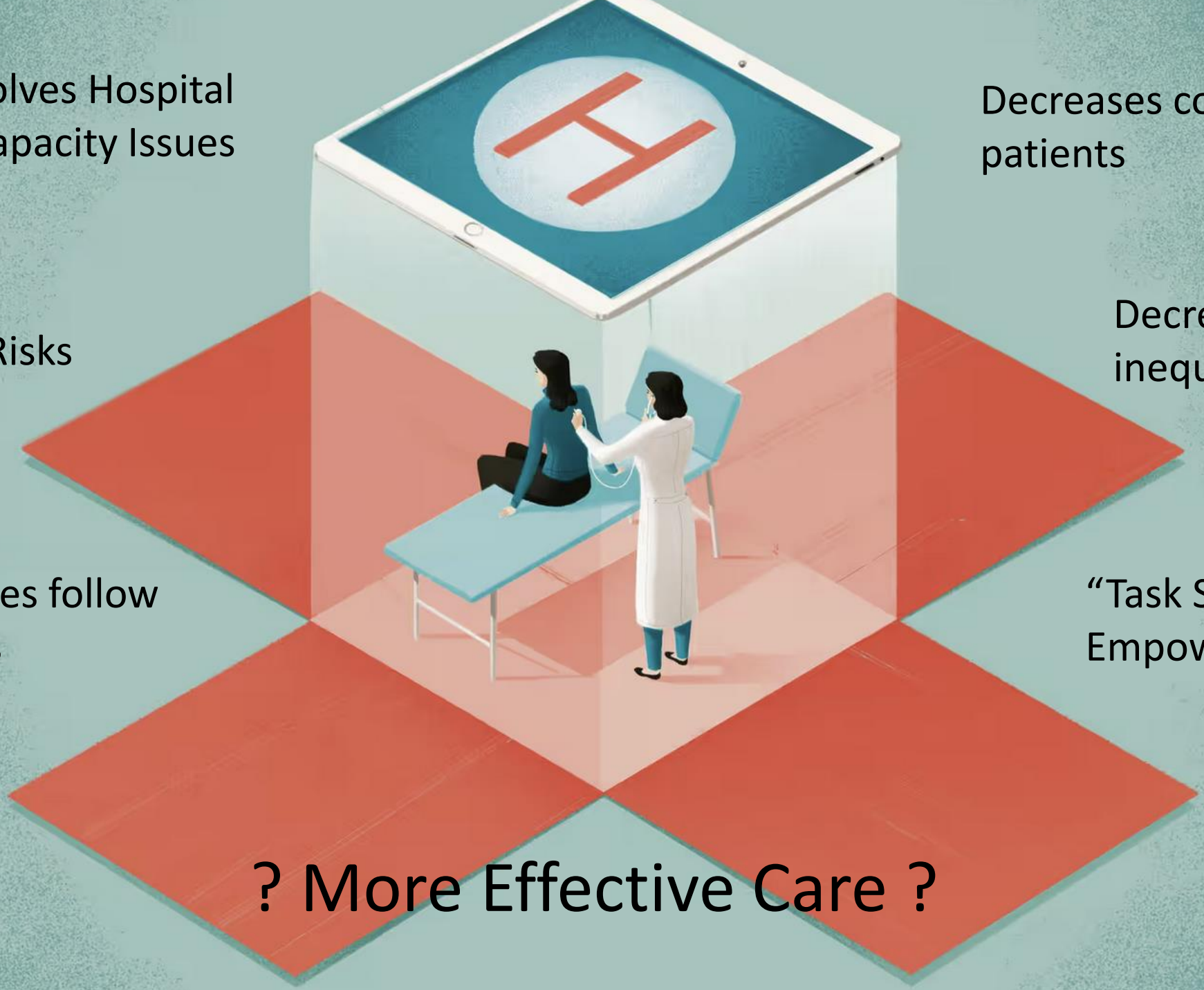
Decreases costs for patients

Decreases Infection Risks

Decreases health inequity

Decreases follow up costs

“Task Shifting” = Empowerment



? More Effective Care ?

RCT of Home BP Monitoring

RESEARCH

OPEN ACCESS

Check for updates

Home and Online Management and Evaluation of Blood Pressure (HOME BP) using a digital intervention in poorly controlled hypertension: randomised controlled trial

Richard J McManus,[1] Paul Little,[2] Beth Stuart,[2] Katherine Morton,[3] James Raftery,[2] Jo Kelly,[2] Katherine Bradbury,[3] Jin Zhang,[3] Shihua Zhu,[2] Elizabeth Murray,[4] Carl R May,[5] Frances S Mair,[6] Susan Michie,[7] Peter Smith,[2] Rebecca Band,[3] Emma Ogburn,[1] Julie Allen,[1] Cathy Rice,[8] Jacqui Nuttall,[9] Bryan Williams,[10] Lucy Yardley,[3,11] on behalf of the HOME BP investigators

For numbered affiliations see end of the article.

Correspondence to: R J McManus richard.mcmanus@phc.ox.ac.uk (or @RichardJMcManus on Twitter; ORCID 0000-0003-3638-028X)

Additional material is published online only. To view please visit the journal online.

Cite this as: *BMJ* 2021;372:m4858 http://dx.doi.org/10.1136/bmj.m4858

Accepted: 21 October 2020

ABSTRACT

OBJECTIVE

The HOME BP (Home and Online Management and Evaluation of Blood Pressure) trial aimed to test a digital intervention for hypertension management in primary care by combining self-monitoring of blood pressure with guided self-management.

DESIGN

Unmasked randomised controlled trial with automated ascertainment of primary endpoint.

SETTING

76 general practices in the United Kingdom.

PARTICIPANTS

622 people with treated but poorly controlled hypertension (>140/90 mm Hg) and access to the internet.

INTERVENTIONS

Participants were randomised by using a minimisation algorithm to self-monitoring of blood pressure with a digital intervention (305 participants) or usual care (routine hypertension care, with appointments and drug changes made at the discretion of the general practitioner; 317 participants). The digital intervention provided feedback of blood pressure results to patients and professionals with optional lifestyle advice and motivational support. Target blood pressure for hypertension, diabetes, and people aged followed UK national guidelines.

MAIN OUTCOME MEASURES

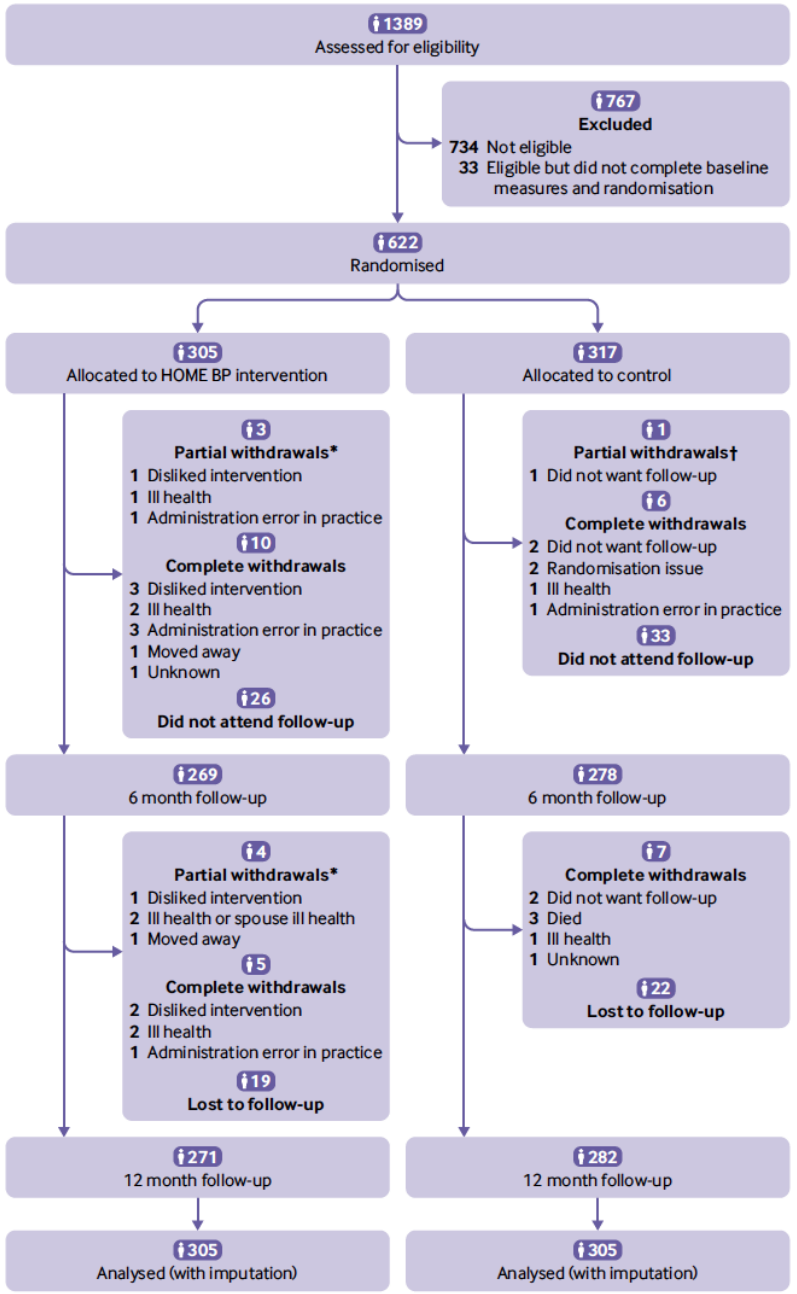
The primary outcome was the difference in systolic blood pressure (mean of second and third readings) after one year, adjusted for baseline blood pressure, blood pressure target, age, and practice, with multiple imputation for missing values.

RESULTS

After one year, data were available from 552 participants (88.6%) with imputation for the remaining 70 participants (11.4%). Mean blood pressure dropped from 151.7/86.4 to 138.4/80.2 mm Hg in the intervention group and from 151.6/85.3 to 141.8/79.8 mm Hg in the usual care group, giving a mean difference in systolic blood pressure of −3.4 mm Hg (95% confidence interval −6.1 to −0.8 mm Hg) and a mean difference in diastolic blood pressure of −0.5 mm Hg (−1.9 to 0.9 mm Hg). Results were comparable in the complete case analysis and adverse effects were similar between groups. Within trial costs showed an incremental cost effectiveness ratio of £11 ($15, €12; 95% confidence interval £6 to £29) per mm Hg reduction.

CONCLUSIONS

The HOME BP digital intervention for the management of hypertension by using self-monitored blood pressure led to better control of systolic blood pressure after one year than usual care, with low incremental costs. Implementation in primary care will require integration into clinical workflows and consideration of people who are digitally excluded.



McManus RJ et al BMJ 2020

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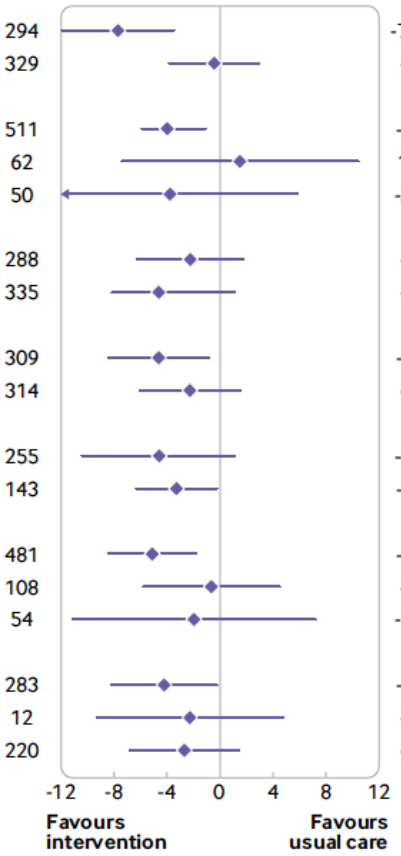
Subgroup	No	Difference (95% CI)	Difference (95% CI)
Age			
<67	294		-7.71 (-11.92 to -3.50)
≥67	329		-0.44 (-3.85 to 2.96)
Blood pressure target			
Standard	511		-3.99 (-5.89 to -1.10)
Older (>80 years)	62		1.50 (-7.42 to 10.43)
Diabetes	50		-3.78 (-13.40 to 5.84)
Sex			
Female	288		-2.25 (-6.26 to 1.76)
Male	335		-4.63 (-8.14 to 1.12)
Baseline systolic blood pressure			
<150	309		-4.63 (-8.37 to -0.90)
≥150	314		-2.28 (-6.06 to 1.50)
IMD score			
1-5	255		-4.59 (-10.41 to 1.11)
6-10	143		-3.29 (-6.32 to -0.25)
Comorbidity			
None	481		-5.12 (-8.44 to -1.81)
One	108		-0.65 (-5.78 to 4.50)
Two or more	54		-1.97 (-11.15 to 7.21)
Self-monitoring experience			
None	283		-4.22 (-8.18 to -0.26)
Previously monitored but stopped	12		-2.28 (-9.30 to 4.74)
Current	220		-2.69 (-6.81 to 1.43)



McManus RJ et al BMJ 2020

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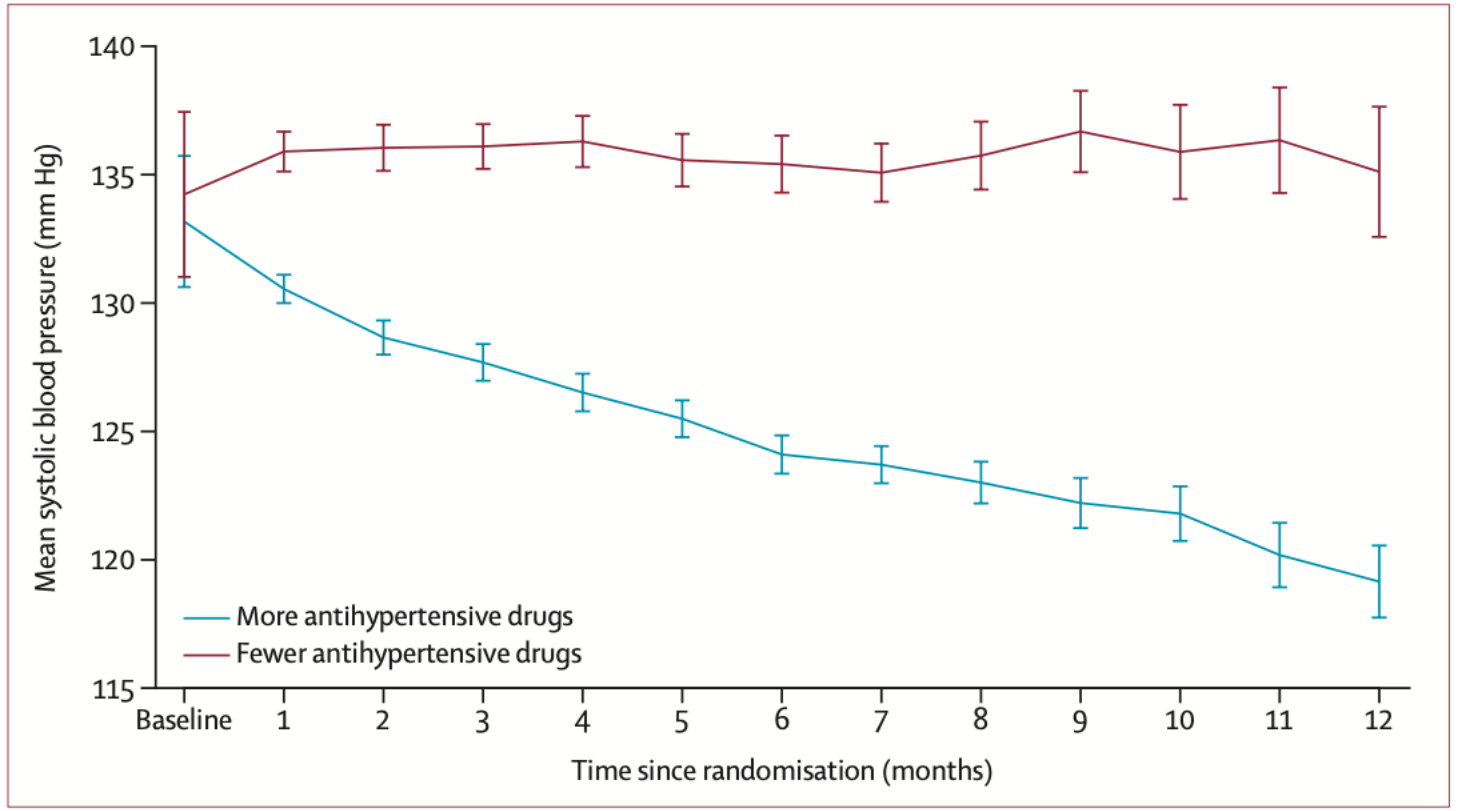
Home Monitoring May Actually Improve Outcomes



Articles

Efficacy of decentralised home-based antihypertensive treatment in older adults with multimorbidity and polypharmacy (ATEMPT): an open-label randomised controlled pilot trial

Jeannette Majert, Milad Nazarzadeh, Rema Ramakrishnan, Zeinab Bidel, Deborah Hedgecott, Abel Perez-Crespillo, Wendy Turpie, Naseem Akhtar, Moira Allison, Shishir Rao, Bernard Gudgin, Melanie McAuley, Christine A'Court, Laurent Billot, Dipak Kotecha, John Potter, Kazem Rahimi

Summary

Background Older patients with multimorbidity and polypharmacy have been under-represented in clinical trials. W aimed to assess the effect of different intensities of antihypertensive treatment on changes in blood pressure, maj safety outcomes, and patient-reported outcomes in this population.

Methods ATEMPT was a decentralised, two-armed, parallel-group, open-label randomised controlled pilot t conducted in the Thames Valley area, South East England. Individuals aged 65 years or older with multimorbi (three or more chronic conditions) or polypharmacy (five or more types of medications) and a systolic blood press of 115–165 mm Hg were eligible for inclusion. Participants were identified through a search of national hosp discharge databases, identification of patients registered with an online pharmacy, and via targeted advertising social media platforms. Participants were randomly assigned to receive up to two more classes versus up to two f classes of antihypertensive medications. Apart from routine home visits for conducting the baseline assessmen communication, monitoring, and management of participants by the trial team was conducted remotely. The pri outcome was change in home-measured blood pressure.

Findings Between Dec 15, 2020, and Aug 31, 2022, 230 participants were randomly assigned (n=126 to more *vs* to fewer antihypertensive medications). The frequency of serious adverse events was similar across both grou cardiovascular events occurred in the more antihypertensive drugs group, compared with six in the antihypertensive drugs group, of which two were fatal. Over a 13-month follow-up period, the mean systolic pressure in the group allocated to receive more antihypertensive medications decreased from 134·5 mm Hg (S at baseline to 122·1 mm Hg (10·5). By contrast, in the group allocated to receive fewer antihypertensive medi it remained relatively unchanged, moving from 134·8 mm Hg (SD 11·2) at baseline to 132·9 mm Hg (15 corresponded to a mean difference of –10·7 mm Hg (95% CI –17·5 to –4·0).

Interpretation Remotely delivered antihypertensive treatment substantially reduced systolic blood pressure adults who are often less represented in trials, with no increase in the risk of serious adverse events. The this trial will inform a larger clinical trial focusing on assessing major cardiovascular events, safety, functioning, and cognitive function that is currently in the planning stages. These results also under efficiency of decentralised trial designs, which might be of broader interest in other settings.

Funding National Institute for Health Research Oxford Biomedical Research Centre and the Oxford Martin

Introduction

Hypertension is one of the main risk factors for premature death and disability globally, and affects more than a billion individuals, resulting in an estimated 9·4 million deaths per year.[1] Numerous clinical trials have shown that pharmacological blood pressure reduction effectively specific patient populations remains unc growing patient population in whom there is about the effects of antihypertensive treatm patients with multimorbidity and p particularly those who only have mildly el pressure.[14] This uncertainty is also mirrored in inconsistent

Myint et al, Lancet Healthy Longev 2024

Home Monitoring May Actually Improve Outcomes

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	More antihypertensive medications (n=126)	Fewer antihypertensive medications (n=104)
Serious adverse event		
Hospital admission		
Myocardial infarction or acute coronary syndrome	0	1 (1%)
Stroke or transient ischaemic attack	0	3 (3%)
Heart failure	0	0
Coronary revascularisation	0	0
Other hospital admission	18 (14%)	15 (14%)
Deaths		
Myocardial infarction or acute coronary syndrome	0	1 (1%)
Stroke or transient ischaemic attack	0	1 (1%)
Heart failure	0	0
Coronary revascularisation	0	0
Other cause of death	1 (1%)	0

Myint et al, Lancet Healthy Longev 2024

It’s Not Simple…

PLOS ONE

RESEARCH ARTICLE

Investigating barriers & facilitators for the successful implementation of the BP@home initiative in London: Primary care perspectives

Eva Riboli-Sasco[1], Austen El-Osta[1]*, Marie Line El Asmar[1], Manisha Karki[1], Gabriele Kerr[2], Ganesh Sathaymoorthy[2], Azeem Majeed[1]

1 Self-Care Academic Research Unit (SCARU), Department of Primary Care & Public Health, Imperial College London, London, United Kindgom, 2 NIHR ARC North West Lo… London, United Kingdom

* a.el-osta@imperial.ac.uk

OPEN ACCESS

Citation: Riboli-Sasco E, El-Osta A, El Asmar ML, Karki M, Kerr G, Sathaymoorthy G, et al. (2024) Investigating barriers & facilitators for the successful implementation of the BP@home initiative in London: Primary care perspectives. PLoS ONE 19(2): e0298898. https://doi.org/10.1371/journal.pone.0298898

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Abstract

Background

The COVID-19 pandemic led to the implementation of a r… guard clinically vulnerable patients. To ensure consistent… hypertension, NHS England introduced the BP@home i… monitor their blood pressure by providing them with bloo… aimed to identify barriers and facilitators to the impleme… experience and perspectives of programme managers … (HCPs) involved in its implementation in London.

Methods and findings

We conducted five semi-structured focus groups and… 20 healthcare professionals involved at different level… tive across four of the five London Integrated Care Sy… interviews were audio-recorded, transcribed and ana… work Method. Respondents reported being challeng… and financial resources to support the substantial a… programme. These issues resulted in and reinforce… of PCNs, practices and patients, thus raising equity… respondents also identified several facilitators, incl… ria into the electronic health record (EHR), especia… practice-specific, pragmatic and opportunistic app… Respondents also recommended the provision of… scription, additional funding and training based o… BP@home into daily practice and simplification … son-centred care approach. Contextualised usin… Framework for Implementation Research (CFIR), these findings support …

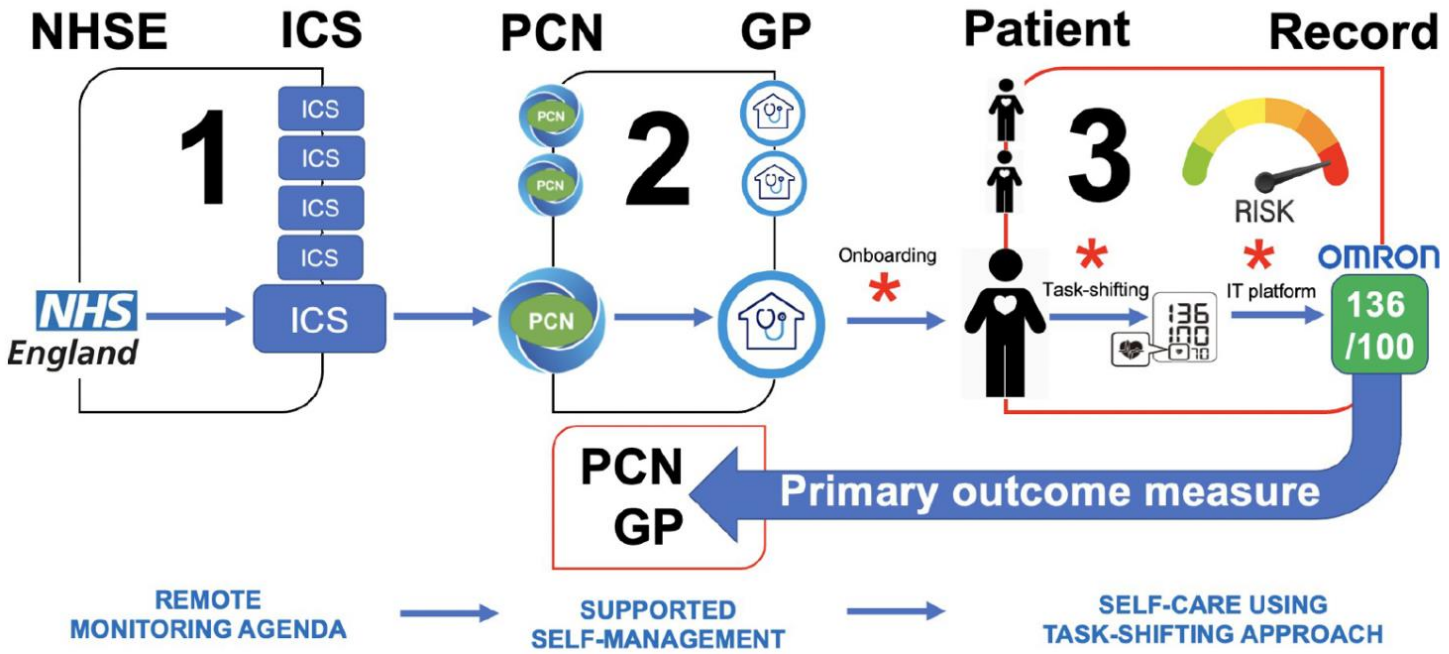


Fig 1. Schema of BP@home pathway.

https://doi.org/10.1371/journal.pone.0298898.g001

Riboli-Sasco, PLOS One 2024

Barts Health Aortic BP Guidelines

Barts Health NHS Trust

In Hospital Pathway

Target BP 100-120 systolic pressure
Heart rate below 60/min
B Blocker + Ca channel blocker
Second line agent Na Nitroprusside

Target BP after Initial Tx <130 Systolic, <80 Diastolic; Avoid isometric or high resistance training with peak SBP 180/90

BP >140, <180
Three Consecutive Readings

↓

ANP Calls Patient for
-updated med list
-history of event
-symptoms

↓

ANP reviews with HTN clinic doctor at weekly meeting

↓

ANP calls patient to adjust meds

BP >180
One Reading

↓

ANP Calls Patient for
-updated med list
-history of event
-symptoms

↓

ANP reviews with HTN clinic doctor through urgent phone call

↓

ANP calls patient to adjust meds

Escalation Pathway

1. Hypertension MD
2. CT Surgeon on call for dissection
3. Endovascular surgeon on call for dissection
4. Send to A&E

Acceptable Meds

- B-blocker
- Ca-channel Blocker
- ACEi/ARB

Long Term Management

- Aneurysm with no additional cardiovascular/cerebrovascular risk factors – below 140/90
- Aneurysm with additional cardiovascular/cerebrovascular risk factors – below 130/80
- Chronic Dissection – below 130/80
- Aortopathy patients – below 120/80

Barts Aortovascular Dissection Pathway

Presentation

Inpatient Work Up

Initiation & OP work up

Follow up

IV BP control
TTE
CT Scan (day 0,2,7)
Epworth Sleepiness Scale

Initiation onto Remote Monitoring Pathway

Sleep Study

Clinical Pharmacology

Aortovascular Follow up

1 month

3 month

6 month

12 month

ELOPE East London Cardiovascular Disease Prevention Group

NHS Barts Health NHS Trust

Mastracci 2024

The Ortus-iHealth Platform

Access

Web, apps and smart devices
Any time, any place, anywhere

Assessment

Pre & Post Clinic PROMs, PREMs,
Quality assessments & eConsent

Clinics & Consultations

Clinic and V-Clinic modelling, delivery, automation, appointments and Consults

Remote Monitoring Pre & Post Treatment

Pathway dashboards, need based prioritization & early discharge

Track, Discharge & Share Outcome Data

Clinic, Population, PAS & ERUP

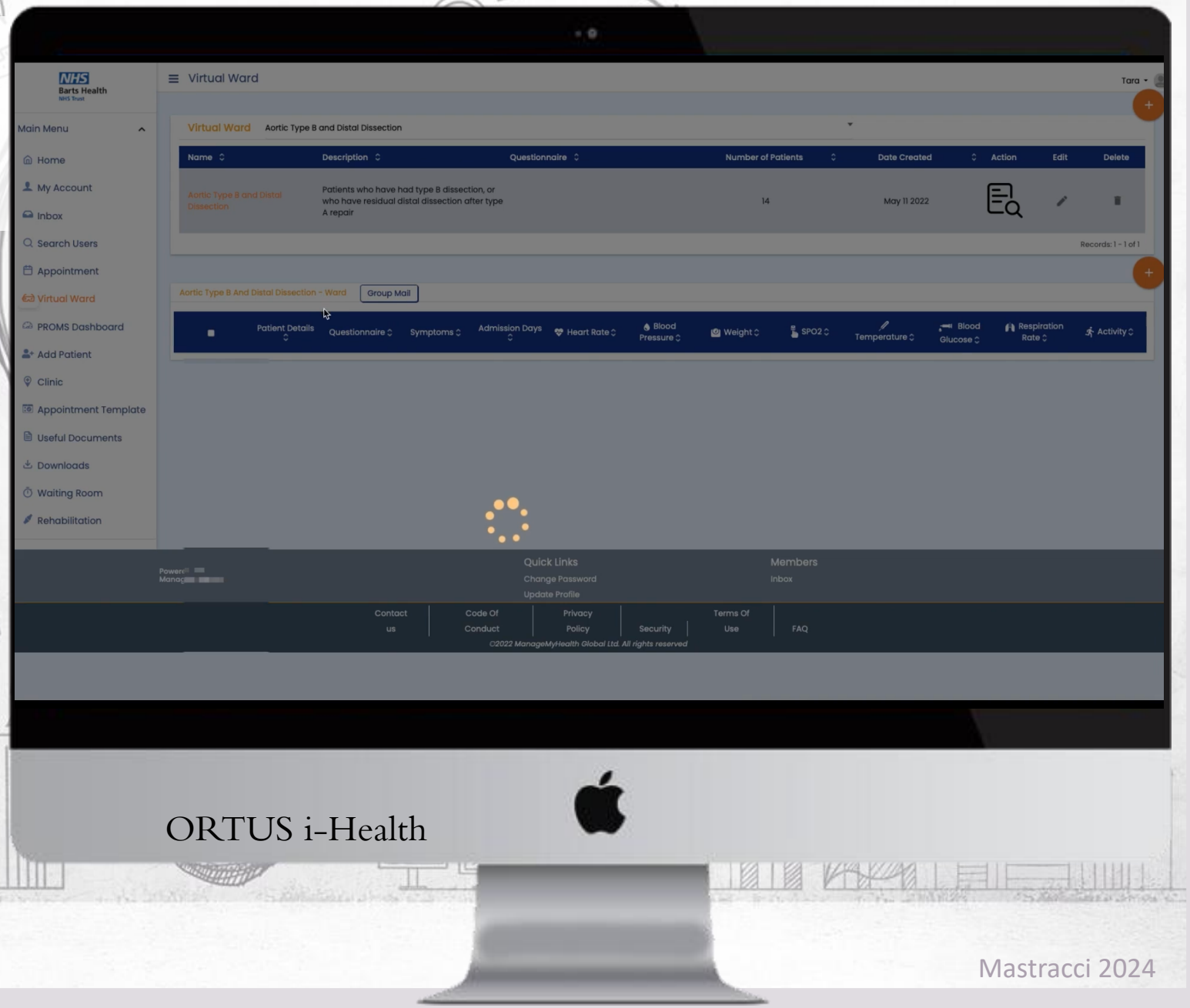
- **Comprehensive remote management & decision support tool**
- **Condition agnostic**
- **One stop digital tool kit for patients & clinicians**

Slide Courtesy Ortus i-Health

Digital Remote Monitoring

The team gets regular updates about patients with outliers

Easier communication with patients regarding symptoms



Who are our patients?

Days on the virtual ward

320 days

Sex

64% male

Average Readings

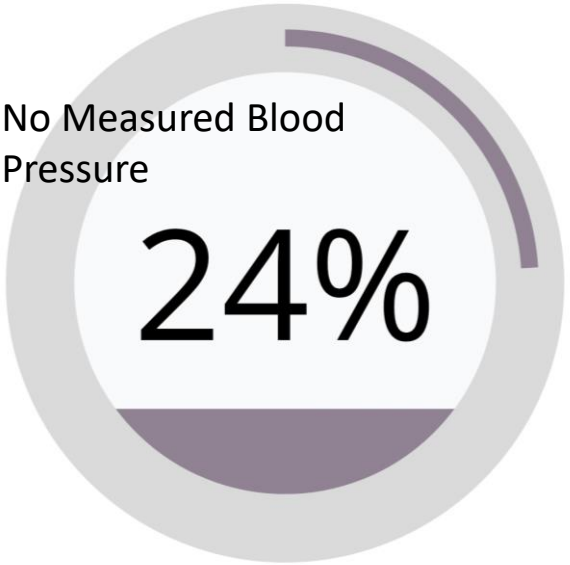
199 readings

Average Age

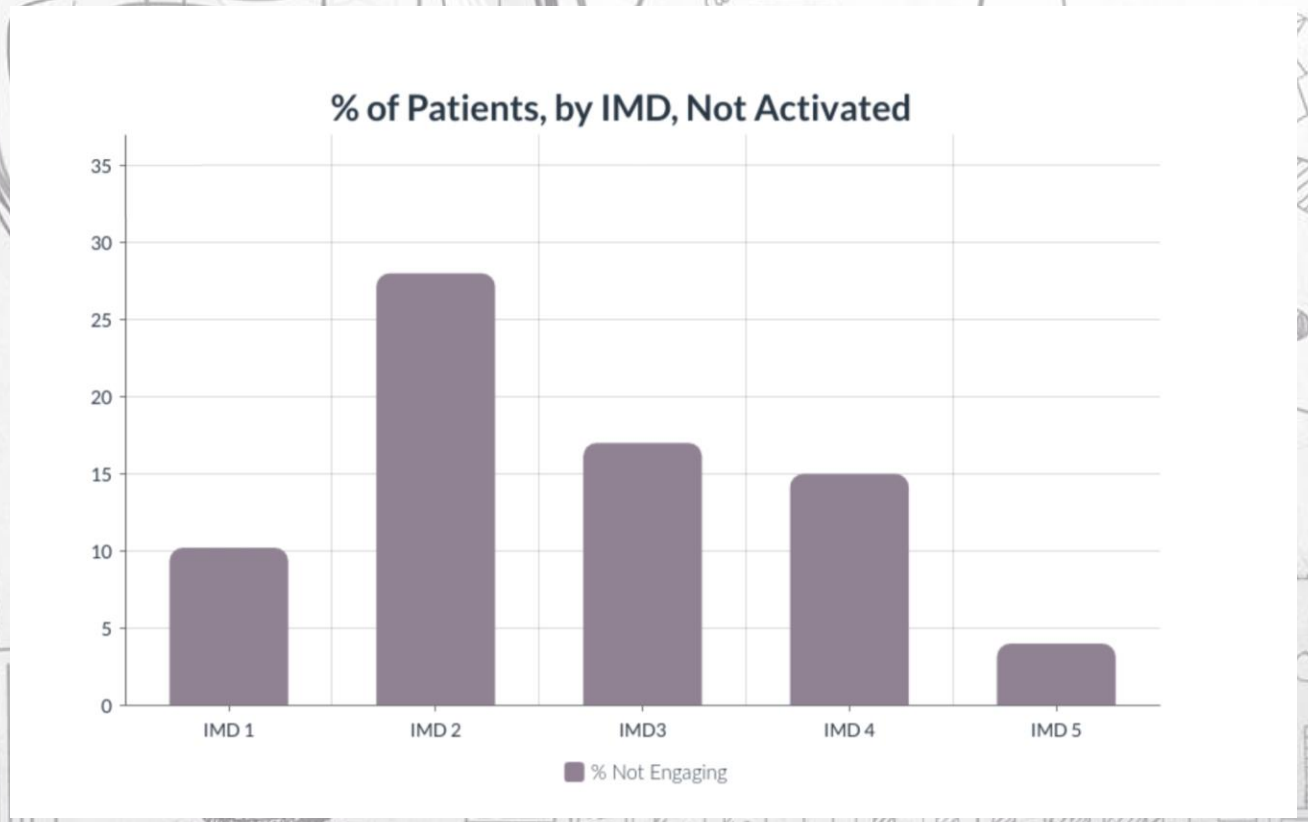
57 years

Digital Exclusion and Non-Engagement

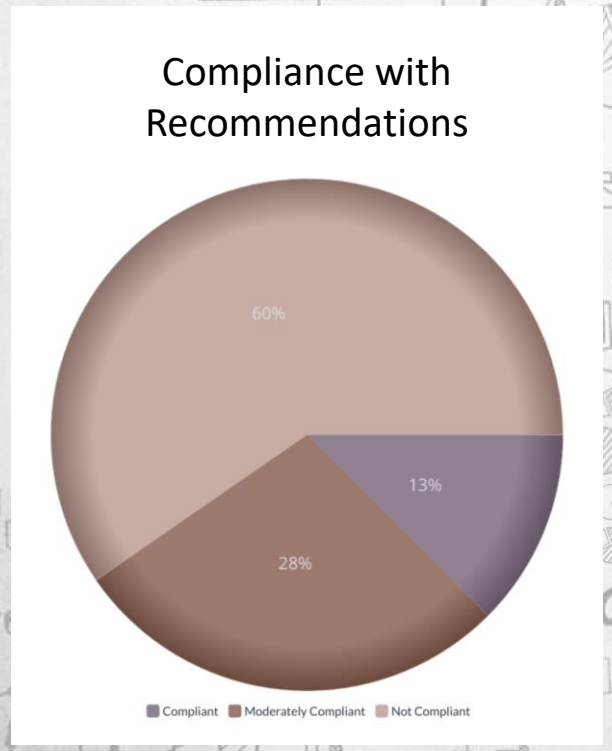
No Measured Blood Pressure



34/140:
20 Not Activated
14 Registered, Not engaging



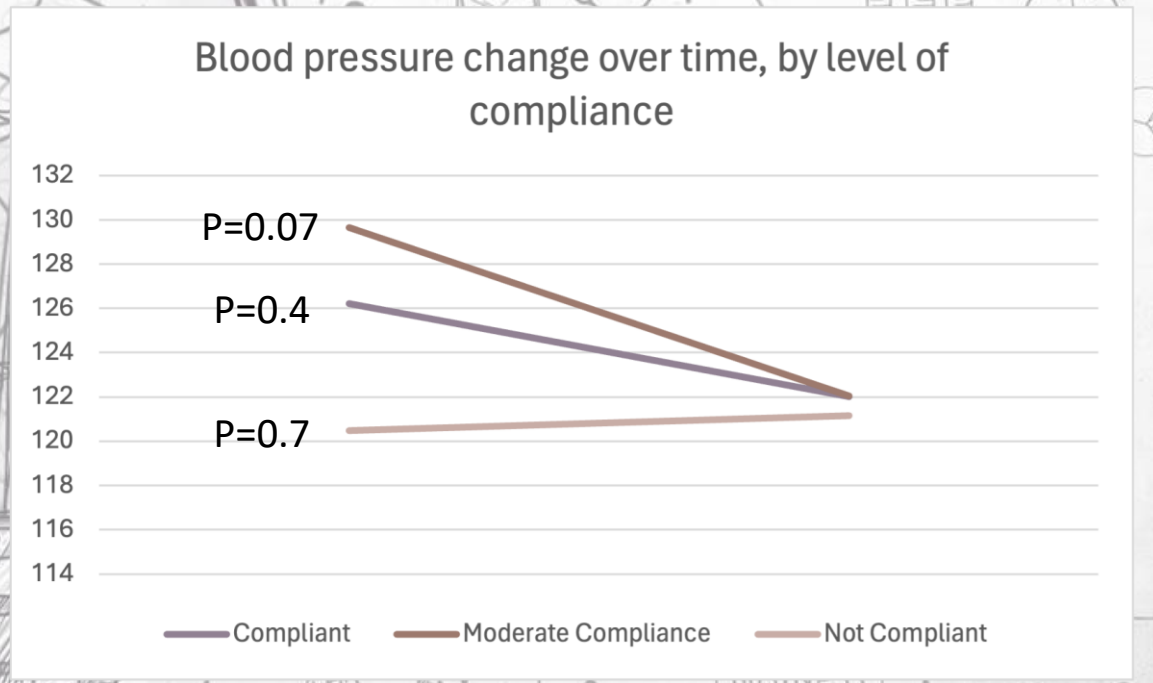
Blood Pressure Targets



Compliance Index:

Number of Blood Pressure Readings

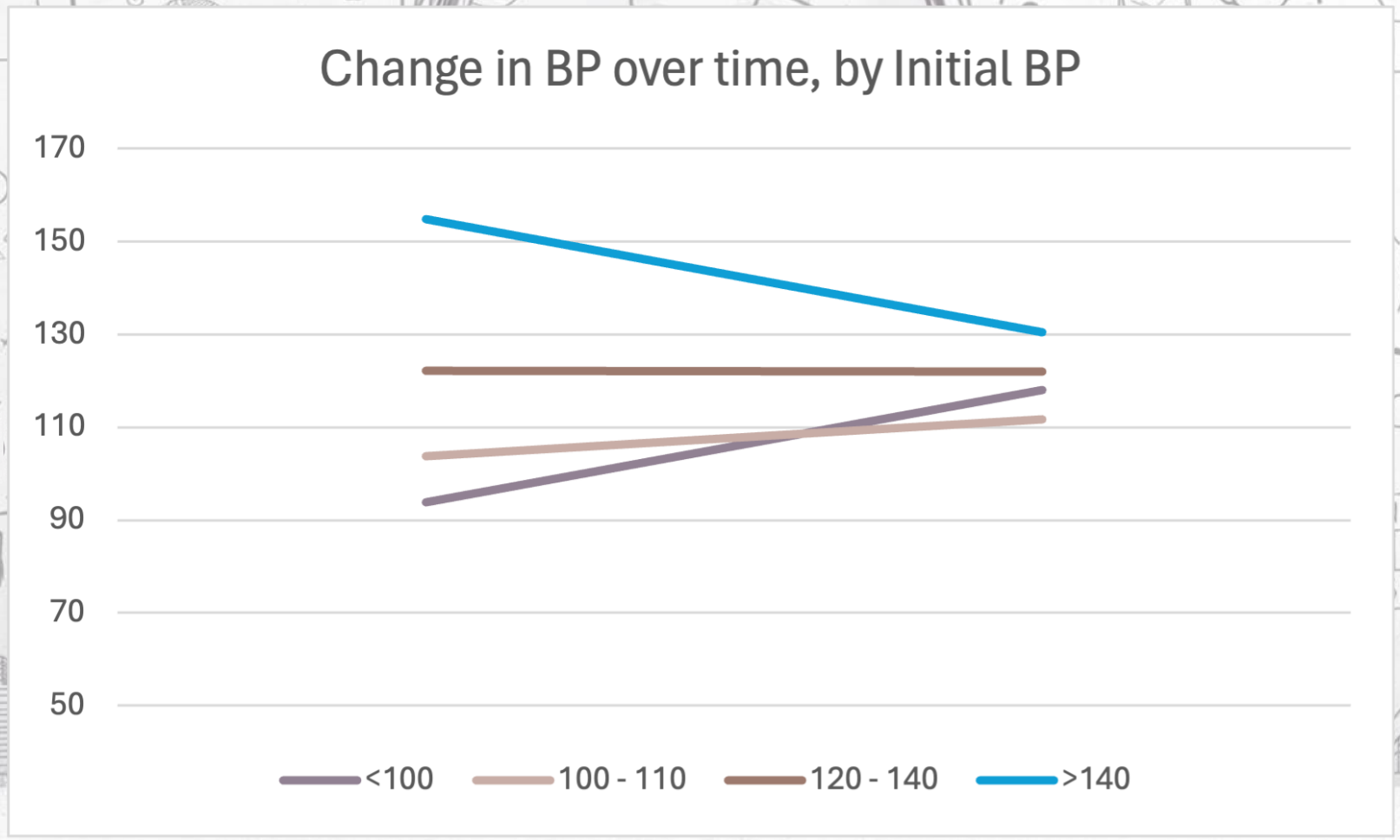
Number of Days Enrolled



Ghosh et al, Unpublished

Mastracci 2024

Change in SBP Over Time



Ghosh et al, Unpublished

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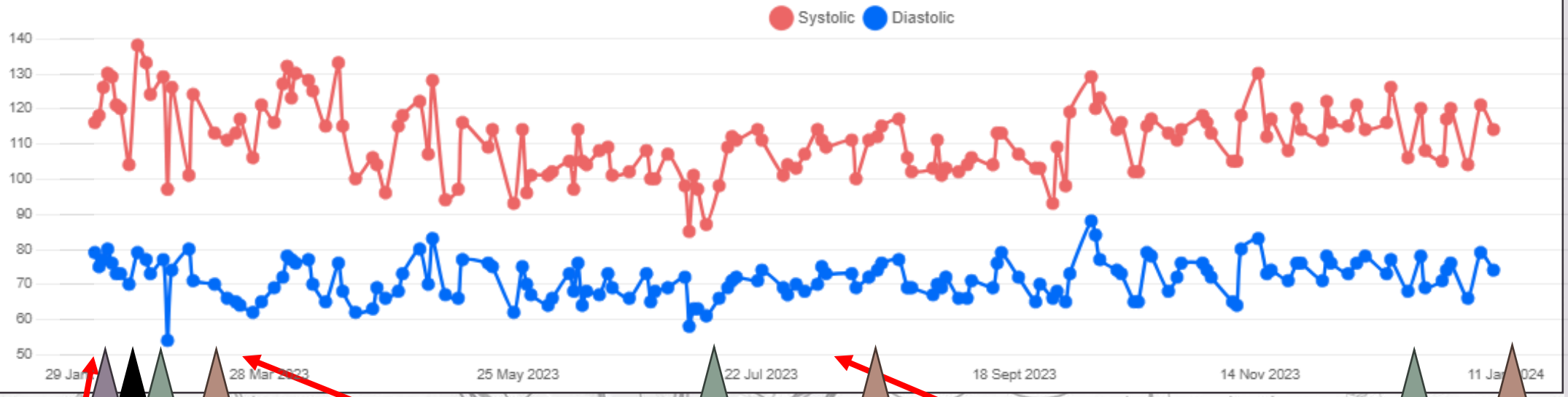
Inpatient

Outpatient Vascular

Outpatient Hypertension

Nursing Contact



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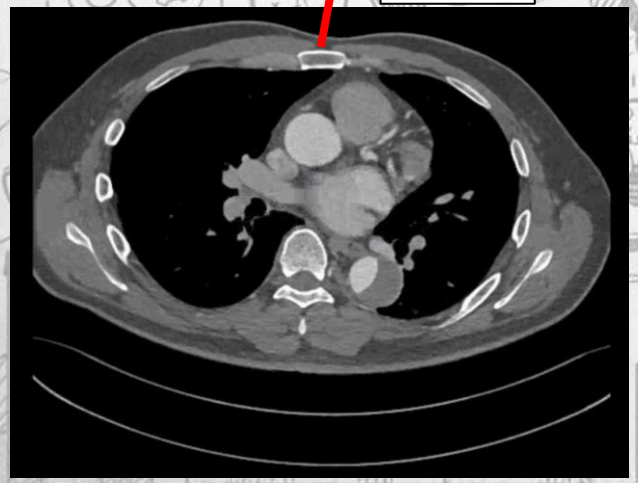

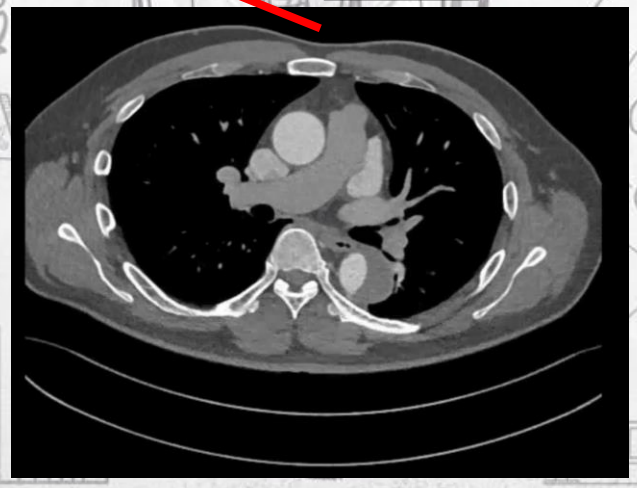

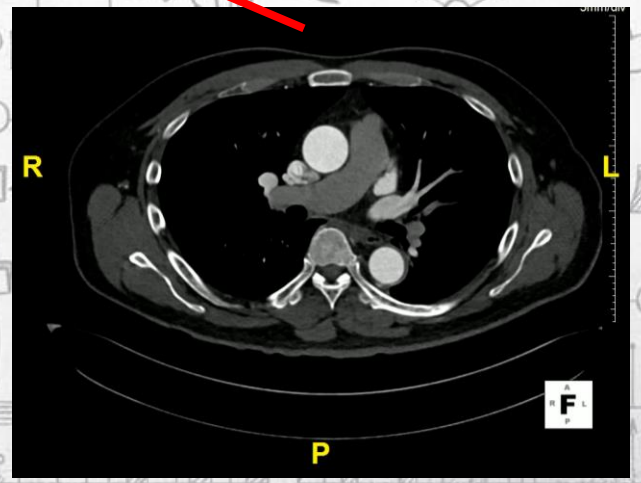

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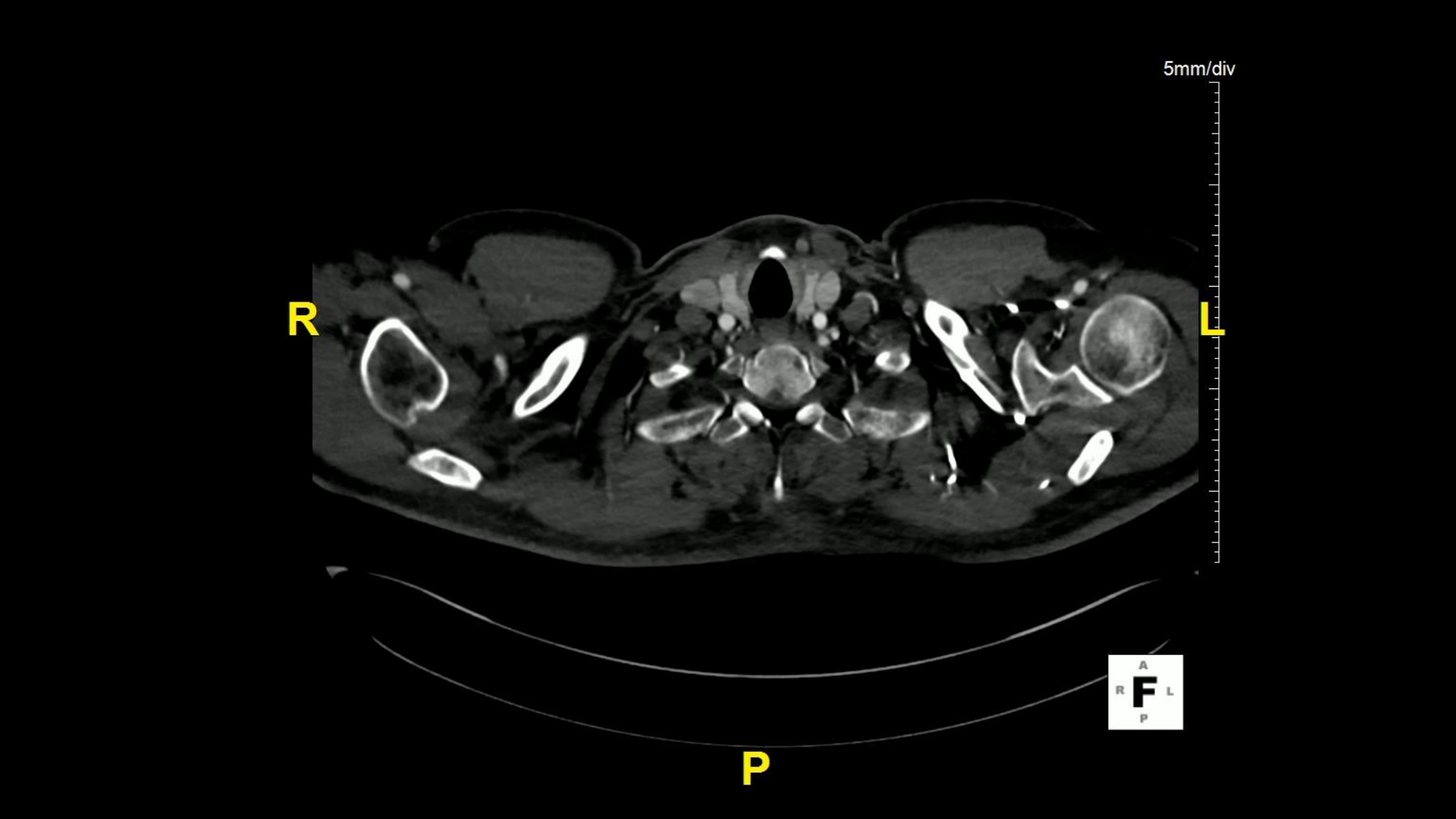
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Inpatient

Outpatient Vascular

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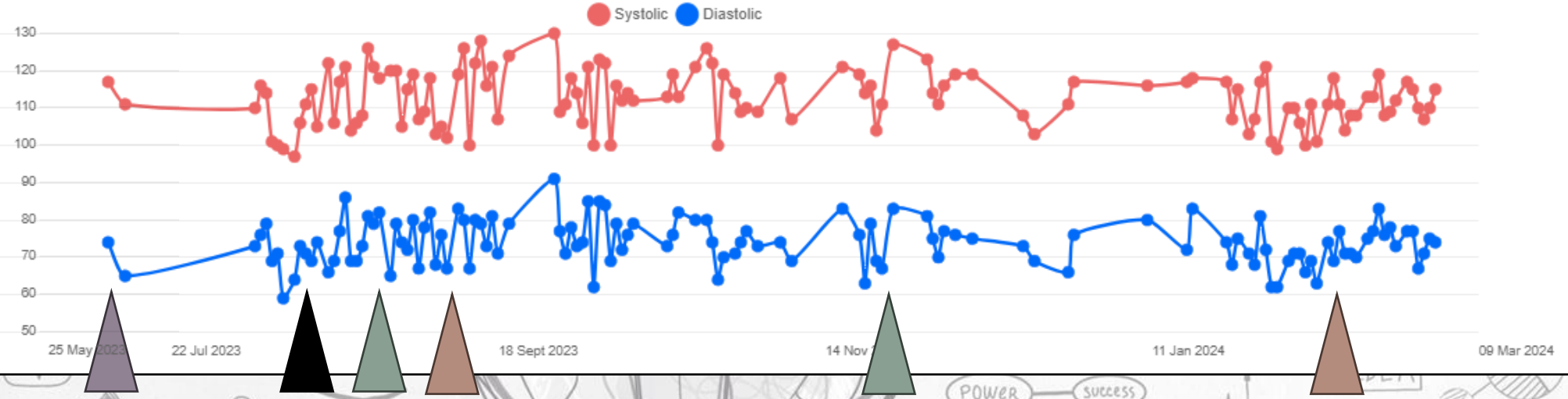

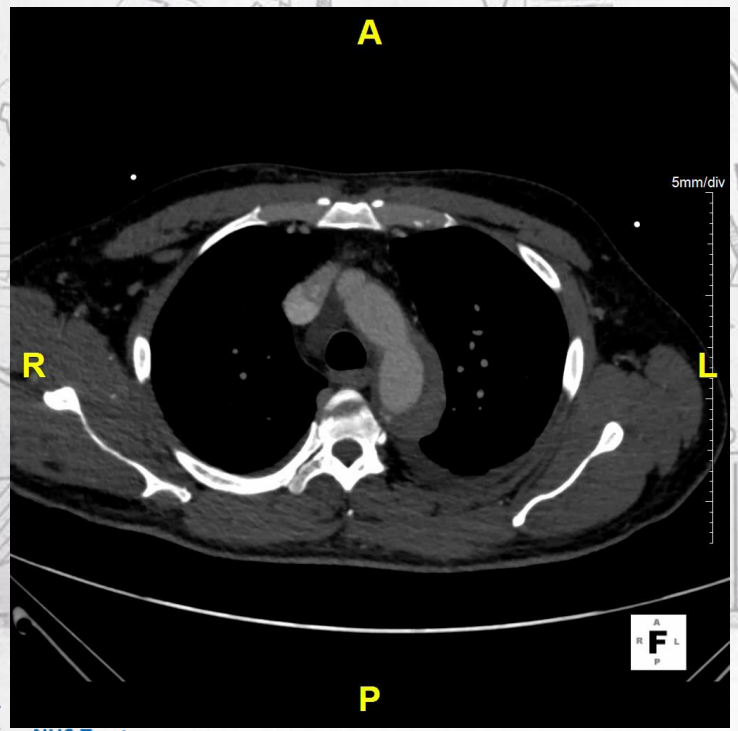

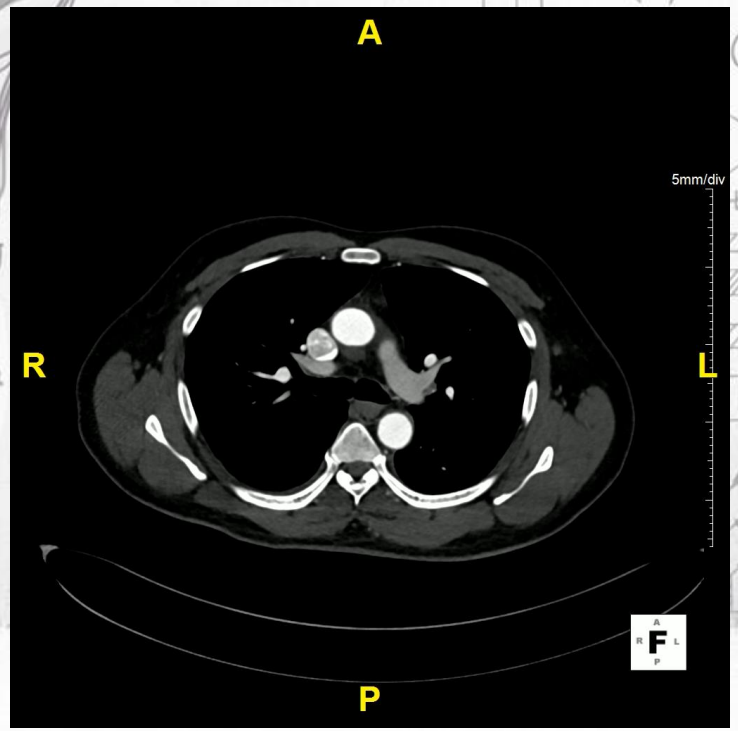

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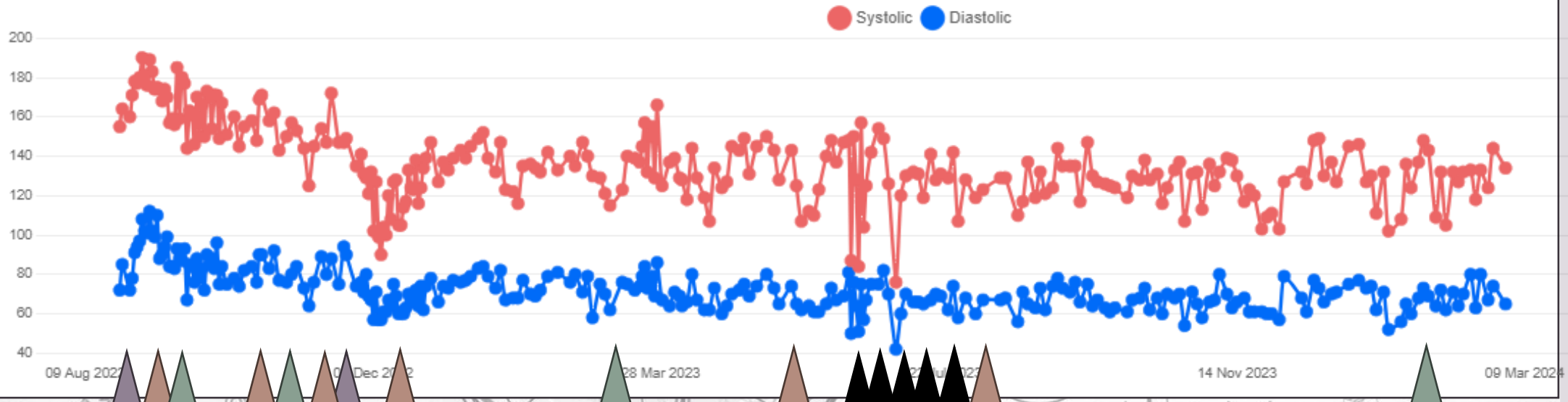

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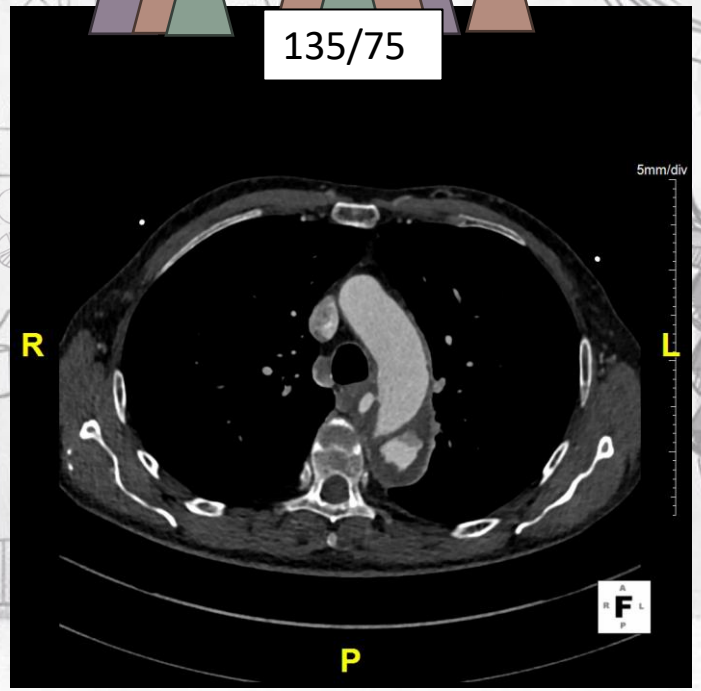

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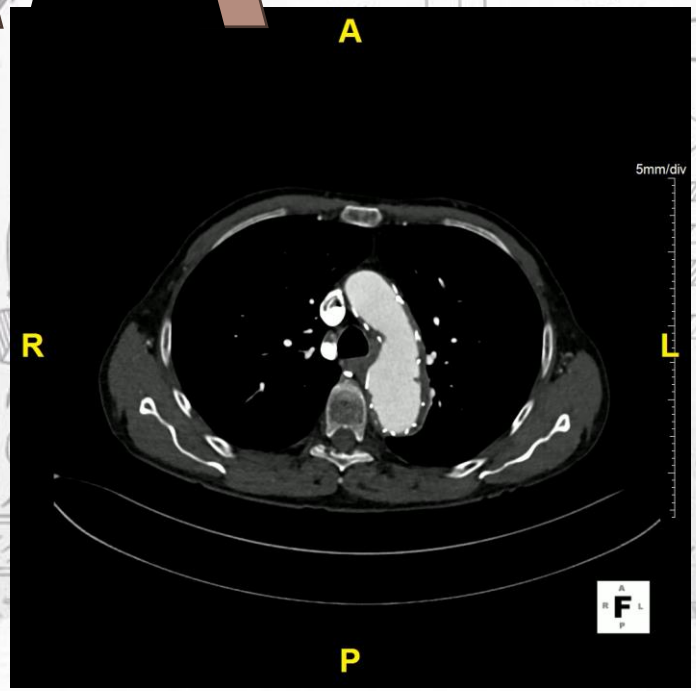

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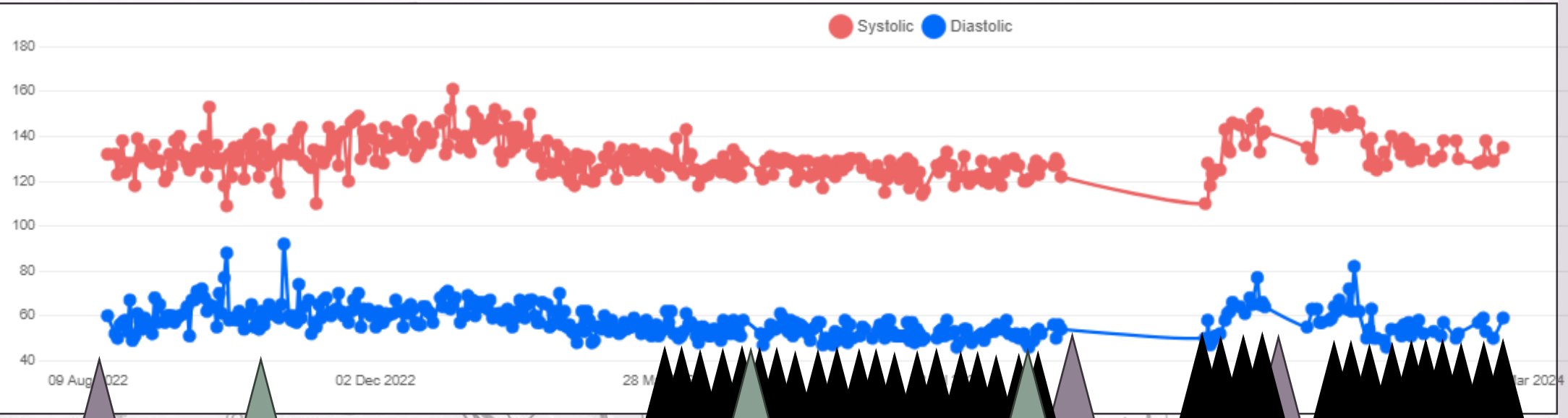

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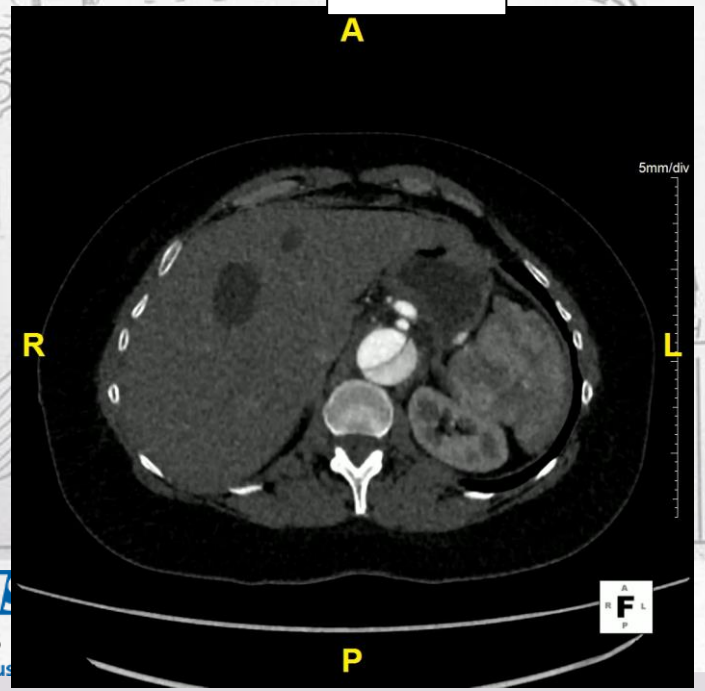

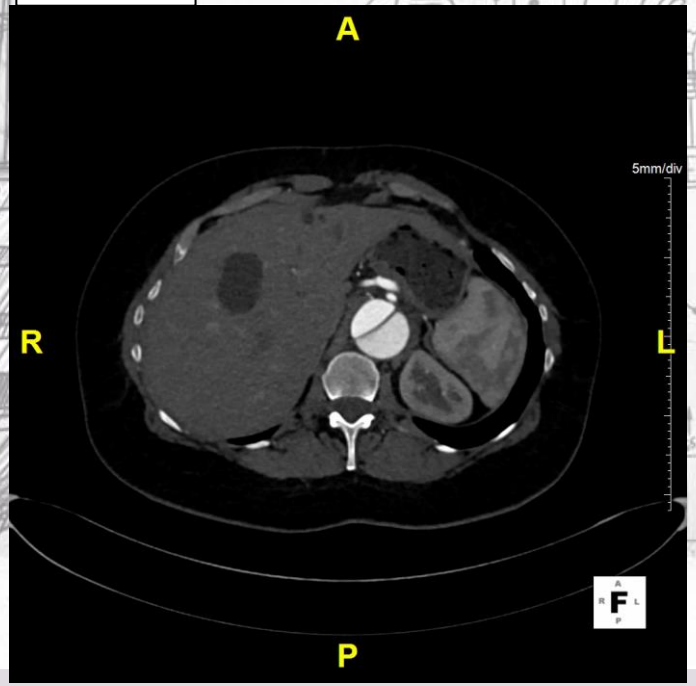

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Remote Monitoring in Dissection

- More experience and evidence needed
- Requires patient, clinician and system behavioural changes
- Is an intervention that *could* change the natural history of disease