SUPPLEMENTAL MATERIAL

Adapting and evaluating a health system intervention from Kaiser Permanente to improve hypertension management and control in a large network of safety-net clinics

Supplemental Methods

Program description and adoption (Appendix Table 1)

Key elements of the KPNC hypertension program included establishment of a longitudinal registry of patients with hypertension, development and sharing of performance metrics, evidence-based treatment intensification protocol, non-physician visits for blood pressure measurement, and fixed-dose combination (FDC) pharmacotherapy. Through community engagement of stakeholders from KPNC and SFHN, we adapted the components of the KPNC program to account for drug coverage and affordability, ease of use, patient complexity, and provider preferences that are pertinent to healthcare safety-net settings and the patient populations they care for. Our adapted program, Bring it Down San Francisco, consisted of 4 key elements that paralleled KPNC's program: a simplified evidence based treatment intensification protocol, a standardized BP measurement protocol, blood pressure check visits led by non-physician professional staff (pharmacists and nurses), and development of an internal hypertension patient registry to facilitate provider performance feedback and panel management outreach to schedule patients with uncontrolled HTN for BP visits.

(1) An evidence-based treatment intensification protocol: The algorithm is designed to accomplish (1) simple and fast titration of BP treatment to goal, (2) emphasis on increased use of fixed-dose combination pharmacotherapy, and (3) guidance for management of resistant HTN including increased use of aldosterone antagonists. We created the treatment protocol based on the KP HTN Management Program[1, 2] in continual consultation with KPNC with additional review of relevant publications,[3] the recent 2014 HTN guidelines,[4] and SFHN insurance policy drug formularies. We engaged SFHN stakeholders (clinic directors, division chiefs, primary physicians) in focus groups for revision and feedback. After presenting the revised version to other provider and staff stakeholders (non-physician providers, and nursing staff) for additional comments, we distributed and presented the guideline to the entire faculty and staff across the primary care clinics for final comments and eventual endorsement. Dissemination of the protocol occurred through distribution of printed documents posted in examination and conference rooms, emails, lectures, partnering with pharmacy managers, and links in the EHR.

(2) Standardization of blood pressure measurement: We partnered with nurse leadership and nursing staff to develop a standardized protocol for BP measurement and entry of values in the EHR. Automated sphygmomanometers are used and Medical assistants repeat the BP in one to three minutes whenever the first measurement is elevated.

(*3) Nurse and pharmacist-led BP check visits :* BP management by entry level (medical assistants) or allied health professionals (nurses or pharmacists) are increasingly used as an effective strategy to increase access, facilitate more frequent patient visits, and increase rates of treatment intensification in management of hypertension.[5, 6] The type of allied health professional or entry-level staff used varied by clinic site. Typically, a non-physician professional measured the BP and then used the BID-SF treatment protocol to discuss recommended treatment decisions and follow-up plan that the provider would then execute via electronic prescription. In some clinics, pharmacists used the protocol to execute treatment prescriptions without discussion with a physician.

(4) *Hypertension Patient Registry:* we created a longitudinal HTN patient registry from the EHR identifying active patients who made at least one visits over the past 24 months and had any HTN diagnosis coded in the past 24 months. The registry was used to generate *quality performance reports* (at the clinic level) and for *patient outreach* – contacting patients with persistently uncontrolled HTN to schedule or reschedule visits as necessary. The type and frequency of quality performance reports varied by clinic site as did patient outreach efforts.

Supplemental Tables

Table 1. Implementation of BID components at varying clinics in the San Francisco Health Network compared to Kaiser Permanente's HTN program

	Kaiser Permanente	RFPC	SFHN
Tx Algorithm	• Local didactic teaching sessions • Distribution of printed guideline documents • Email updates • Physician laminated pocket cards • Partnering pharmacy managers • Regional videoconferences • Use of EMR to optimize drug selection	• Interactive provider training sessions on HTN treatment and the algorithm • Interactive training sessions with nurses • Distribution of printed guideline as posters in every exam room and provider meeting rooms • Distribution of electronic copy of guideline by email and instructions for evernote attachment • Laminated pocket cards for nurses	• Presentation of guideline to QI leaders • Collaboration with network pharmacy leaders to modify and endorse the guideline ○ Official acceptance by drug formulary review committee • Electronic copy of guideline emailed to all clinic managers and QI leaders • Use of printed guidelines varied by clinic site • We held one Interactive training of faculty and staff at each of nine clinic sites
BP check visits led by non-physician professional staff	• Led by medical assistants • Visits scheduled two to four weeks after BP medication adjustment • Workflow ○ Medical assistant measures BP ○ Medical assistant informs physician or pharmacist ○ Physician or pharmacist enter electronic prescription based on guideline algorithm	• Led by nurses • Visits scheduled two weeks after any visit with uncontrolled BP • Workflow ○ Nurses review previous provider note ○ Nurse measures BP ○ Nurse decides appropriate medication intensification based on guideline algorithm ○ Nurse precepts with provider ○ Provider enters electronic prescription ○ Nurse informs patient of changes	• Type of professional staff (i.e. nurse vs pharmacist) varied by clinic site • Visits scheduled two to four weeks after any visit with uncontrolled BP • Workflow ○ Staff review previous provider note ○ Staff measures BP ○ Professional staff decides appropriate medication intensification based on guideline algorithm ○ Staff precepts with provider ○ Provider enters electronic prescription ○ Staff informs patient of changes
Standard BP measurement protocol	• Kaiser Permanente already had standardized methods for BP measurement	• Partnered with nurse leaders to design a standardized BP measurement protocol • Trained nurses and MEAs on protocol	• Trained QI leaders on BP measurement protocol to implement in their respective clinics
Performance reports	• Initially distributed every 3 months and then available by query at any time to authorized individuals. • Content: ○ BP control ○ Medications ○ Laboratory results ○ Relevant co-morbidities ○ Clinical encounter history	• Clinic-level reports of BP control rates overall and for black patients shared with physicians and clinic leaders monthly	• Clinic-level reports BP control rates overall and for black patients shared with physicians and clinic leaders monthly

Patient outreach	Unknown	• Medical assistants or nurses made phone appointment reminder calls prior to scheduled nurse-led BP check visits • Cycles of outreach phone calls focused on specified based on risk (e.g. persistently uncontrolled BP) were attempted but not continued because of limited effectiveness	• Patient outreach activities varied by clinic • **Conducted Brainstorming exercise** during site visits to encourage clinics to employ feasible strategies to increase capacity for more patient visits	

Appendix Table 2. BP control rates by race at baseline and 15 months post-intervention for patients with hypertension at 11 primary care clinics in the San Francisco Health Network

	BP control at baseline 5/2015	BP control at 15 months 8/2016	Change in BP control
Overall	13,468 (69.55%)	13,155 (74.46%)	4.91%
White	2,335 (68.69%)	2,210 (74.71%)	6.02%
Black	3,103 (59.68%)	3,009 (65.74%)	6.06%
Asian	4,788 (78.09%)	4,560 (82.17%)	4.08%
Hispanic	2,783 (67.16%)	2,902 (71.88%)	4.72%
Other	459 (66.01%)	474 (70.25%)	4.24%

Appendix Table 3. Trends in BP control at RFPC and the other 11 SFHN clinic based on different BP targets

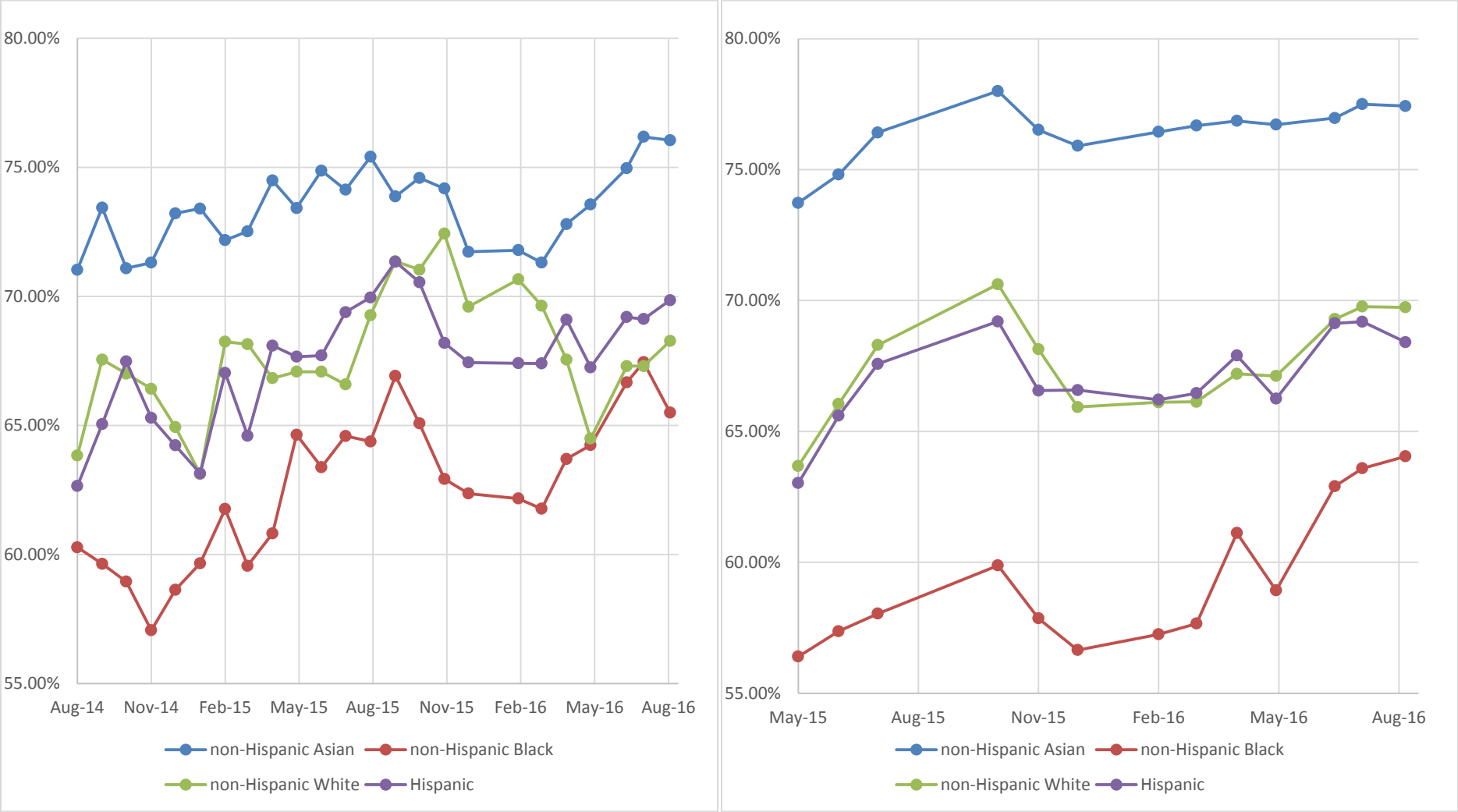
BP control defined by different BP targets	RFPC			SFHN		
	Baseline	At 24 months	P for trend	Baseline	At 15 months	P for trend
BP Control per JNC8	68.27%	73.95%	<0.01	69.55%	74.46%	<0.01
BP Control (< 140/90 for all)	65.05%	70.60%	<0.01	65.44%	70.72%	<0.01

Appendix Table 4. Predicted Trend in BP control rates by race over 15 months adjusted for gender and age

Post-intervention months	0	3	6	9	12	15	Monthly rate of change
NH White	0.8213	0.8246	0.8278	0.8310	0.8341	0.8372	**0.10%**
NH Black	0.7278	0.7404	0.7526	0.7644	0.7758	0.7868	**0.35%**
Hispanic	0.8013	0.8093	0.8171	0.8246	0.8319	0.8390	**0.23%**
Asian	0.8602	0.8619	0.8637	0.8654	0.8672	0.8689	**0.06%**

BP control defined as <150/90 mmHg for patient who are 60 years or older and do not have diabetes and <140/80mgHg for all other patients.

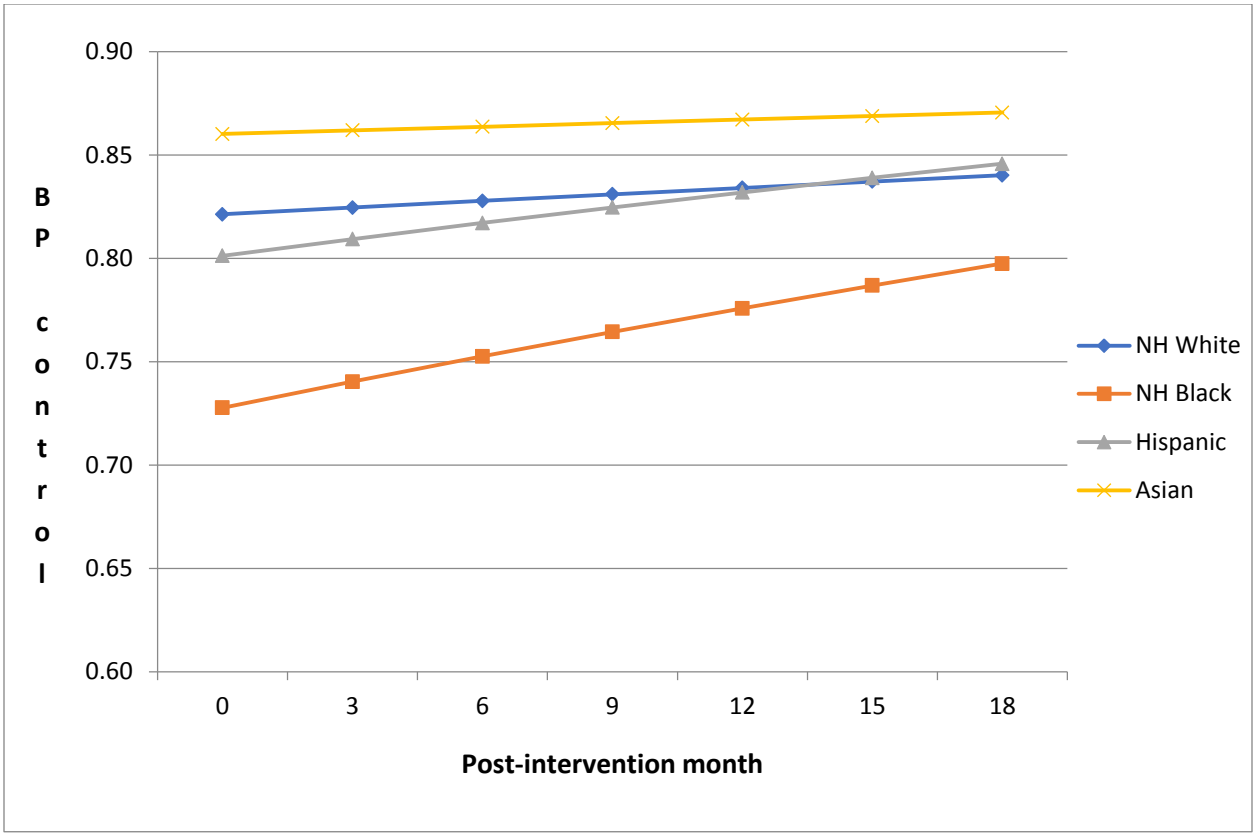
Supplemental Figures



Appendix Figure 1: Trend in BP control by race over 24 months at Richard Fine People's Clinic (RFPC) and 15 months at the other 11 clinics in the San Francisco Health Network (SFHN)

The panel on the left displays trends at RFPC. The panel on the right displays trends at the other 11 clinics.

Unadjusted trend in monthly BP control rates; BP control was defined as <140/90 mmHg regardless of age or CKD and Diabetes status. The points on the graph represent BP control monthly BP control rates calculated at the clinic level (# of patients with BP control divided by # of active patients with hypertension).



Appendix Figure 2: Predicted Trend in BP control by race over 15 months at the other 11 clinics in the San Francisco Health Network (SFHN) adjusted for gender and age

Trend in monthly BP control rates by race adjusted for gender and age based on our mixed-effect logistic regression model with random slope; BP control was defined as <150/90 mmHg for patient who are 60 years or older and do not have diabetes and <140/80mgHg for all other patients.

Supplemental References

1. Jaffe MG, Lee GA, Young JD, Sidney S and Go AS. Improved blood pressure control associated with a large-scale hypertension program. *Jama*. 2013;310:699-705. doi: 10.1001/jama.2013.108769
2. Goyal A and Bornstein WA. Health system-wide quality programs to improve blood pressure control. *Jama*. 2013;310:695-6. doi: 10.1001/jama.2013.108776
3. Frieden TR, King SM and Wright JS. Protocol-based treatment of hypertension: a critical step on the pathway to progress. *JAMA : the journal of the American Medical Association*. 2014;311:21-2. doi: 10.1001/jama.2013.282615
4. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, Lackland DT, LeFevre ML, MacKenzie TD, Ogedegbe O, Smith SC, Jr., Svetkey LP, Taler SJ, Townsend RR, Wright JT, Jr., Narva AS and Ortiz E. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *Jama*. 2014;311:507-20. doi: 10.1001/jama.2013.284427
5. Glynn LG, Murphy AW, Smith SM, Schroeder K and Fahey T. Interventions used to improve control of blood pressure in patients with hypertension. *The Cochrane database of systematic reviews*. 2010:CD005182. doi: 10.1002/14651858.CD005182.pub4
6. Morgado MP, Morgado SR, Mendes LC, Pereira LJ and Castelo-Branco M. Pharmacist interventions to enhance blood pressure control and adherence to antihypertensive therapy: Review and meta-analysis. *American journal of health-system pharmacy : AJHP : official journal of the American Society of Health-System Pharmacists*. 2011;68:241-53. doi: 10.2146/ajhp090656