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Connecting Rheumatology Patients to Primary Care for High Blood Pressure: Specialty clinic protocol improves follow-up and population blood pressures

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Abstract

Objective—Recognizing high blood pressure (BP) as the most prevalent cardiovascular risk factor in rheumatology patients and all adults, experts recommend clinic protocols to improve BP control. We aimed to adapt and implement a specialty clinic protocol, *BP Connect*, to improve timely primary care follow-up after high BPs in rheumatology clinics.

Methods—We examined *BP Connect* in a six-month pre- post- quasi-experimental design with 24-month follow-up in three academic rheumatology clinics. Medical assistants and nurses were trained to (1) *check*, re-measuring BPs 140/90, (2) *advise*, linking rheumatic and cardiovascular diseases, and (3) *connect*, timely (<4 weeks) primary care follow-up using protocolled electronic health record (EHR) orders. We used EHR data and multivariable logistic regression to examine

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the primary outcome of timely primary care follow-up for patients with in-network primary care. Staff surveys assessed perceptions. Interrupted time-series analysis examined sustainability and clinic population BP trends.

Results—Across both 4,683 pre-implementation and 689 post-implementation rheumatology visits with high BP, 2,789 (57%) were eligible for in-network primary care follow-up. Post-implementation, the odds of timely primary care BP follow-up doubled (OR 2.0, 95% CI 1.4–2.9). Median time to follow-up declined from 71 to 38 days. Moreover, rheumatology visits with high BP declined from 17% to 8% over 24-months, suggesting significant population-level declines ($p<0.01$).

Conclusion—Implementing the *BP Connect* specialty clinic protocol in rheumatology clinics improved timely follow-up and demonstrated reduced population-level high BP rates. Findings highlight a timely strategy to improve BP follow-up amid new guidelines and quality measures.

High blood pressure (BP) is the most prevalent and reversible cardiovascular disease (CVD) risk factor among all adults, (1) with even higher risk in rheumatology patients like those with rheumatoid arthritis (RA). (2, 3) Still, we reported that only 10% of eligible RA visits recommended follow-up of high BP (4) and that RA patients were less likely to have their hypertension diagnosed than peers meeting identical longitudinal BP thresholds. (5) Treating high BP in 11 at-risk patients could prevent one CVD event, (6) yet half of US adults with hypertension lack BP control. (7) To address this, many primary care clinics have used staff-led protocols, executed by nurses or medical assistants (MAs) during vital sign assessment, to improve BP control, (8) reduced variability, and save clinicians time. (9) However, BP protocols have not been adapted for rheumatology or other specialty clinics, which at over 423 million annual visits outpaced primary care visits in 2013. (10)

As of 2017, 24 specialties, including the American College of Rheumatology, endorsed screening and follow-up of high BP as a quality measure in the Medicare Merit-Based Incentive Payments System (MIPS #317). (11) Specifically, “timely BP follow-up,” defined as 4 weeks, (12) is relevant across specialties, and referral back to primary care for follow-up meets this MIPS quality measure. (11) We aimed to adapt an evidence-based primary care clinic protocol (8) for use by specialty staff to improve timely follow-up after high BPs in rheumatology clinics.

Our multidisciplinary team developed a specialty BP protocol intervention and implementation plan adapted for rheumatology nurses and medical assistants. (8, 13–15) Based-upon the Chronic Care model (16) and Self-Regulation Theory, (14) we hypothesized that when supported by a protocol, staff and patients would acquire BP data, compare to norms, and take action to reach goals. A clinic rooming protocol empowers staff to work at the top of their licensure (17) by clarifying staff target behaviors, such as re-measuring high BPs and ordering primary care follow-up when confirmed high. Likewise, patients who receive clinic feedback on high BPs could follow-up with primary care, and regulate to improve antihypertensive medication adherence or lifestyle factors for BP control. We hypothesized that implementing a protocol would improve timely primary care follow-up after confirmed high BPs at rheumatology visits and potentially improve population trends versus usual care.

MATERIALS and METHODS

We evaluated pre-post implementation and clinic population outcomes of our specialty clinic BP protocol, named *BP Connect*, at three academic rheumatology clinics. We compared timely primary care BP follow-up and population-level rates of high BPs during the protocol project compared to pre-implementation usual care. For the study period, 140/90 mmHg (18) was the guideline-based high BP threshold for protocol steps and performance feedback, (19) although now 130/80 mmHg meets high BP definitions. (20) The Institutional Review Board (IRB) certified exemption and neither individual written consent nor full IRB approval was required for this standard of care improvement initiative, and certification included permission to publish.

Setting/Participants

The project occurred in three adult rheumatology specialty clinics within the tenth largest US academic multispecialty group. These three sites were in separate buildings with separate staff (MAs, nurses, and schedulers). We compared a baseline two-year period (January 2012–September 2014) to a staggered-start six-month intervention period (November 2014–June 2015). Outcomes were followed 24-months through 2016.

Intervention

The *BP Connect* specialty clinic protocol consisted of three steps: (1) *check*, (2) *advise*, and (3) *connect*, based upon successful primary care protocols. (8, 15) First, adult rheumatology visits with a BP 140/90 mmHg were eligible for protocol initiation with BP re-measurement *checks*. Next, if confirmed 140/90 mmHg, patients were eligible for brief *advice* regarding follow-up due to associations between BP, CVD, and rheumatic diseases. Finally, staff offered orders to *connect* patients to primary care follow-up. Specialty patients with in-network primary care were eligible for the primary endpoint of timely primary care follow-up (4 weeks). (12) Clinic schedulers directly scheduled in-network follow-up, while all patients were eligible for printed primary care follow-up recommendations. Staff cues and patient eligibility were automated within the electronic health record (EHR; Health Link [Epic Systems Corporation; Verona, WI]). For comparison, we examined visits with a BP 140/90 mmHg in the same clinics two years before implementation.

Primary Outcome and Process Measures

Process measures compared the three *BP Connect* steps (1) re-measurement checks, (2) educational advice, and (3) primary care follow-up connection offers across eligible visits. The primary outcome measure was timely follow-up with primary care within four weeks among patients with confirmed high BPs and in-network primary care. Pre- and post-implementation rates were compared among those eligible for timely in-network primary care follow-up to assure capture in our dataset. Additional analyses examined sustainability of improved follow-up in multivariable models and monthly clinic population-level rates of high BPs over 24-months before and after implementation.

Implementation Methods

BP Connect was supported by an evidence-based implementation package. (21, 22) We used four evidence-based implementation strategies (23): (a) *engage*, (b) *educate*, (c) *remind*, and (d) *feedback*. First, we *engaged* nursing staff and leadership using presentations and focus groups. Second, we *educated* staff on high BP including links between rheumatologic diseases and CVD risk and steps of the protocol. Next, we *reminded* staff of the *BP Connect* steps using EHR decision support alerts. Last, we *fed back* performance data to individual staff through brief monthly audit and feedback.

Staff Engagement—We engaged rheumatology clinic nurses, MAs, and schedulers in co-designing and implementing the *BP Connect* specialty clinic protocol. We obtained broad buy-in and identified champions (24) at multiple levels through presentations to system leaders and clinic staff. Pre-implementation focus groups engaged staff as partners in designing the workflows and supporting materials such as patient brochures, electronic reminders, and staff talking points. Midpoint focus groups engaged staff in identifying clinic-specific barriers and sharing best practices.

Staff Education—First, an expert nurse educator offered a 45-minute didactic and skills training session with each of the three clinic staff groups. The session refreshed participants on the rationale for BP control in at-risk rheumatology patients, proper BP measurement, and the *BP Connect* protocol steps. Training content was driven by pre-implementation focus group recommendations from nurses and MAs. The nurse educator also observed each participants' technique measuring BP on a peer, while other pairs practiced three scenarios with protocol talking points. On the first intervention day, we offered individual staff a 10-minute hands-on computer training to practice navigating the EHR alerts and steps. Each clinic received a manual, and a laminated reminder card with protocol steps was placed in each room.

Reminders to Staff—Co-designed electronic health record (EHR) tools and desktop brochures provided staff with reminders and talking points for the three *BP Connect* protocol steps. The initial EHR decision support alert triggered when clinic staff recorded a BP 140/90 prompting them to *check*, re-measuring the BP after three to five minutes. If BP was again 140/90, a second alert triggered. This prompted staff to *advise* the patient on rheumatology-specific high BP risk and to offer to *connect* timely follow-up in primary care. If the patient agreed, staff clicked the EHR protocolized order to send the scheduler follow-up orders or documented refusal. Upon checking out of clinic, the patient received assistance scheduling with their in-network primary care clinic if applicable, and all patients received printed follow-up recommendations.

Staff Feedback—A team member (CB) provided staff with four monthly one-on-one performance feedback sessions during the six-month intervention period. Sessions included participatory audit, feedback, and action planning with individual nurses and MAs based upon a Cochrane review and evidence on audit and feedback. (19, 25) These brief sessions were designed to support staff needs for relationship, autonomy, and competence consistent with Self Determination Theory. (26) Staff were offered a choice to discuss how things were

going or view their data first. They were shown individual data, clinic data, and anonymized peer data regarding re-measurement and follow-up orders. Individuals were then asked to set goals for the following month, and to identify a plan to reach new goals in light of challenges they identified. Sessions averaged seven minutes each during months 2–5, with monthly individual feedback emails thereafter.

Data Sources

We used pre- post-implementation EHR data to assess timely primary care follow-up after rheumatology visits with high BPs among patients with an in-network primary care provider. EHR data also provided patient-level covariate data. The same data were used to generate monthly audit-feedback reports. Time study (27) provided baseline workflows and pre- post-implementation data, and staff completed a 14-item post-implementation survey.

Measures and Covariates

We used the RE-AIM framework, (28) common to evaluating health intervention implementations, to define measures for *Reach, Effectiveness, Adoption, Implementation, and Maintenance*. We assessed protocol initiation *checks* re-measuring high BPs, and *connection* offers for BP follow-up referrals. We also measured the proportion of accepted referrals. Our primary outcome was timely primary care follow-up using a national definition for timely follow-up within four weeks. (12) We examined maintenance over 24 months including these process measures, outcomes, and population-level blood pressure trends.

Covariates—We used EHR data to establish baseline patient-level control variables defined over the year prior to the index visit with high BP. Covariates included patient sociodemographics such as age, gender, race, marital status, tobacco history, and ever receiving Medicaid status was used as a socioeconomic marker. Composite comorbidity was calculated using the Johns Hopkins Adjusted Clinical Groups (ACG) System (version 10), (29) and baseline healthcare utilization included counts of visits the year prior to the rheumatology index visit with high BP. The model also included the clinic where the index visit occurred. We used published algorithms reviewing inpatient and outpatient encounters prior to the index visit date for International Classification of Diseases codes to control for baseline rheumatoid arthritis, (30) hypertension (codes (31) or antihypertensive medications), cardiovascular disease (myocardial infarction, ischemic heart disease, heart failure, peripheral vascular disease, or transient ischemic attack or stroke), (32–35) diabetes mellitus, (36) and chronic kidney disease. (37)

Statistical Analysis

To compare pre- and post-implementation, we calculated p-values using two-sample t-test for numeric variables and chi-squared tests for categorical data. To examine our primary endpoint, we performed multivariable logistic regression to estimate the odds ratio and 95% confidence interval (OR, 95%CI) of timely primary care follow-up during the intensive 6 month implementation period versus the 2 years before implementation, while controlling for baseline socio-demographics, comorbidities, utilization, year and clinic. These analyses were executed for primary care follow-up for those with in-network providers. Given the

visit-level structure of the dataset, we used robust estimates of variance for conservative interpretation. A sensitivity analysis with clustering by individual did not change results. *A priori* we planned an as treated (AKA per protocol, including only patients in whom the protocol was initiated as indicated by re-measurement) analysis for this pragmatic design, (38) although we also performed intention to treat analysis. Intention to Treat included all those eligible for re-measurement, regardless of whether it occurred, unless BP was re-measured and normalized. We estimated that 239 eligible pre-implementation and 239 post-implementation visits would offer 80% power to demonstrate a timely follow-up increase from baseline 33% to 45% with a two-sided test at $p < 0.05$ significance. Secondary analysis examined any timely follow-up at either primary care or a specialty clinic. Kaplan-Meier analysis was used to compare time to primary care follow-up after high BP visits between pre- and post-implementation visits among those with in-network primary care. Last, we used interrupted time series regression with Newey-West standard errors to compare clinic-wide population level-BP trends in the two years before and two years after implementation. Dataset construction and final analysis were performed using SAS version 9.4 (Cary, NC).

RESULTS

The primary analysis compared 689 intensive six-month post-implementation visits to 4,683 two year pre-implementation visits, all with BPs $\geq 140/90$ mmHg (Figure 1). Overall, patient visits were comparable before and during intervention (Table 1). There was one year difference in mean age between groups and a lower mean number of visits in the intervention period. In both groups, 57% had in-network primary care; after exclusion due to normal second BP or lack of in-network primary care, 2,789 encounters were eligible for primary outcome assessment.

Process Measures

Compared to $<1\%$ of pre-implementation visits, $>80\%$ of eligible visits re-measured BP during intervention months 4–6. Over the entire six month post-implementation period, improvement was indicated by 60% re-measurement ($p < 0.001$). After implementation, follow-up orders were offered to 77% of eligible patients (84% received either education or follow-up offered), in contrast to only 10% of visits even recommending follow-up in our prior published abstraction study from these clinics. (4) Protocol visit rooming averaged four minutes longer than baseline.

Primary Outcome

As hypothesized and shown in Table 2, more eligible patients received timely primary care follow-up following high BPs in rheumatology clinics during the intervention implementation compared to pre-implementation (42% vs 29%, $p < 0.001$). Multivariable logistic regression showed that visits with protocol intervention had two-fold higher odds of timely primary care follow-up compared to pre-implementation, OR 2.04, 95% CI 1.42–2.92 ($p < 0.001$) (Table 2). Sensitivity testing with intention to treat analysis remained significant (OR 1.50, 1.15–1.95). As predicted, virtually all pre-specified sub-groups benefited from the protocol. Notable improvements occurred among those of black race and with prior CVD. Only overweight predicted slightly worse primary care follow-up. Overall, post-

implementation, 57% of patients completed timely follow-up in either primary or specialty care versus 46.5% baseline (Adjusted OR 1.73, 1.20–2.49). Moreover, median time to BP follow-up decreased from 71 to 38 days post-implementation for those with protocol initiation (Figure 2), leading to a statistically significant difference in time to primary care follow-up (log-rank test, $p < 0.001$).

Other Measures and Maintenance

This six-month project was limited by sample size, and no difference was noted in individual BP control within six months of the index visit when comparing those with protocol-confirmed high BP to pre-implementation (data not shown). Analysis of the primary endpoint over 24 months did show maintained improvement of timely primary care follow-up (adjusted OR 1.9, 1.4–2.5). Low rates of declined follow-up offers over the entire period (6–13%), suggested sound implementation fidelity.

Population Impact and Staff Perspectives

Finally, we examined the clinic population-level impact using interrupted time series analysis of BP trends in the two years before and two years after implementation. We compared the proportion of monthly rheumatology visits with initial high BPs before and during the intervention period. We observed an associated decline from a monthly mean of 17% visits having high BPs to a mean of 8% during the intervention period ($p < 0.001$, Figure 3). Moreover, we observed a continued significant decrease in the post-implementation period (slope -0.15 , CI $-0.24, -0.05$, $p 0.03$) through 24 months.

Staff favorably reviewed the protocol on post-implementation surveys. Comparing their post-implementation to prior self-efficacy for BP care, 90% versus 20% reported being very or extremely confident in their ability to address high BPs. Rheumatology providers were pleased by favorable outcomes without additional burdens on them.

DISCUSSION

Our *BP Connect* protocol intervention significantly increased timely follow-up after high BP measurements in rheumatology clinics, doubling baseline rates of timely primary care follow-up. Moreover, using the clinic protocol strategy particularly benefited patients of black race or with prior CVD, consistent with evidence that protocol-driven strategies can reduce health disparities in CVD treatment and prevention. (39) Building upon the primary care hypertension protocol literature, (8) we added important features for specialty clinics including rheumatology staff co-design, rheumatology-targeted training, EHR alerts with talking points, cross-specialty follow-up orders, and participatory audit-feedback to facilitate behavior change and culture shift. We ultimately observed a significant population-level decline in clinic visits with high BPs, suggesting support for our approach to adapt BP protocols for use in rheumatology or other specialty clinics.

Our positive clinic intervention results contrast with a negative provider-focused educational EHR-reminder study for in rheumatology. (40) This contrast demonstrates the limits of education alone to change provider behavior, (41) and value of engaging clinic staff (42, 43) to systematically support primary care with population management using protocol-defined

steps. Post-implementation, staff self-reported high feasibility and improved competence. (44, 45) Our evidence-based implementation strategies (23, 46) also support future dissemination.

These findings also have timely practice and policy relevance. Experts estimate that 31 million more Americans have high BP based on new guidelines, (20, 47) and 24 different medical specialties now report BP follow-up for MIPS quality. (48) Our baseline quality performance mirrored a nationwide rheumatology RISE registry mean, and our improvement would have moved us from the fifth to the ninth decile (10th being best) for MIPS quality performance. (49) Despite strong relative improvements and comparisons to national ACR RISE registry data, moderate timely follow-up post protocol might be explained by access limitations or patient preference. Although our median time to follow-up fell by 46% (71 days to 38 days), it was still outside our stated goal (<4 weeks, 28 days) which might have been due to primary care follow-up appointment availability or scheduling “around four weeks later.” Patient preference to avoid travel, time off work, or co-payments, and gaps in understanding the importance of timely follow-up might also explain results.

For rheumatology and other specialties, BP is a wise population health target given that it is measured at all visits and is the leading modifiable predictor of CVD. (1) When discussing the potential impact of wider dissemination of BP protocols, the former Centers for Disease Control and Prevention director stated “Nothing would save more lives.” (1, 9) Healthcare system leaders welcomed our specialty clinic protocol to improve group BP metrics. Primary care providers – who were previously penalized for patients deemed uncontrolled after specialty visits outside their clinics – also welcomed follow-up protocol interventions.

Despite strengths of our adaptation and implementation of an evidence-based BP protocol in rheumatology clinics, limitations must be considered. First, we used a pre-post comparison design without blinding or randomization. However, per Table 1, groups were comparable. Reduced annual visits in the post-implementation period would conservatively bias the outcome of timely follow-up toward the null. Moreover, blinding and patient-level randomization were not feasible because the intervention targeted the clinic staff. Use of a contemporaneous control clinic could have some advantages, and a future multisite trial could match or randomize clinics, which here was limited by the number of clinics. Likewise, although timing of changes and comparison with system-wide trends supported evidence of change specific to the protocol, one cannot exclude other system changes. While initial declines might have reflected improved BP measurement, a positive outcome in itself, ongoing declines after initial training offer further support that the BP Connect protocol was effective in improving primary care follow-up. Primary outcome analysis was limited to those with in-network primary care, but intention to treat analysis across the entire population remained significant and may have in fact underestimated timely out of network primary care follow-up. Notably, because this project predated publication of the MIPS measures, eligibility and outcomes were not identical to the BP follow-up measure, yet the project demonstrates a new evidence-base for future improvement interventions in rheumatology or other specialty clinics. (11) Lastly, this single center project with a predominantly white English-speaking population may not be directly generalizable,

therefore future studies are planned to study protocol implementation with more diverse and vulnerable populations.

Currently we are implementing *BP Connect* in a rheumatology clinic in another healthcare system using our dissemination toolkit (hipxchange.org/BPConnectHealth). (50) The toolkit contains engagement and training materials, workflows, EHR build overviews, and audit-feedback tools. A future multisite study will examine the scalability and efficacy of the intervention on individual patient BP self-management and BP control, which were beyond the scope of this project.

Our findings highlight a timely population health strategy to improve guideline-based BP care and quality measures across rheumatology clinics and other specialties. The *BP Connect* protocol doubled rates of timely primary care follow-up after high BPs and we observed reduced population-level rates of visits with high BP, suggesting efficacy and feasibility for usual specialty clinic staff. Future studies should examine *BP-Connect* in other specialties and health systems, including its impact on BP control to reduce CVD risk across rheumatology and other specialty patients.

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References

1. Farley TA, Dalal MA, Mostashari F, Frieden TR. Deaths preventable in the US by improvements in use of clinical preventive services. *Am J Prev Med*. 2010; 38(6):600–9. [PubMed: 20494236]
2. Avina-Zubieta JA, Thomas J, Sadatsafavi M, Lehman AJ, Lacaille D. Risk of incident cardiovascular events in patients with rheumatoid arthritis: a meta-analysis of observational studies. *Ann Rheum Dis*. 2012; 71(9):1524–9. [PubMed: 22425941]
3. Crowson CS, Rollefstad S, Ikdahl E, Kitas GD, van Riel P, Gabriel SE, et al. Impact of risk factors associated with cardiovascular outcomes in patients with rheumatoid arthritis. *Ann Rheum Dis*. 2018; 77(1):48–54. [PubMed: 28877868]
4. Bartels CM, Johnson H, Voelker K, Ogdie A, McBride P, Jacobs EA, et al. Frequency and Predictors of Communication about High Blood Pressure in Rheumatoid Arthritis Visits. *J Clin Rheumatol*. 2017
5. Bartels CM, Johnson H, Voelker K, Thorpe C, McBride P, Jacobs EA, et al. Impact of rheumatoid arthritis on receiving a diagnosis of hypertension among patients with regular primary care. *Arthritis Care Res (Hoboken)*. 2014; 66(9):1281–8. [PubMed: 24585741]

6. Ogden LG, He J, Lydick E, Whelton PK. Long-term absolute benefit of lowering blood pressure in hypertensive patients according to the JNC VI risk stratification. *Hypertension*. 2000; 35(2):539–43. [PubMed: 10679494]
7. Roger VL, Go AS, Lloyd-Jones DM, Benjamin EJ, Berry JD, Borden WB, et al. Heart disease and stroke statistics -- 2012 update: a report from the American Heart Association. *Circulation*. 2012; 125(1):e2–e220. [PubMed: 22179539]
8. Jaffe MG, Lee GA, Young JD, Sidney S, Go AS. Improved blood pressure control associated with a large-scale hypertension program. *JAMA*. 2013; 310(7):699–705. [PubMed: 23989679]
9. Frieden TR, King SM, Wright JS. Protocol-based treatment of hypertension: A critical step on the pathway to progress. *JAMA*. 2014; 311(1):21–2. [PubMed: 24231925]
10. Aitken, M, Kleinrock, M, Lyle, J, Caskey, L. *Medicine Use and Shifting Costs of Healthcare: A review of the use of medicines in the United States in 2013*. Parispany, NJ: IMS Institute for Healthcare Informatics; 2014.
11. Centers for Medicare & Medicaid Services. Quality Payment Program: Quality Measures. 2017. [cited 2018 February 5]; Available from: <https://qpp.cms.gov/mips/quality-measures>
12. 2013 Physician Quality Reporting System (PQRS) Group Practice Reporting Option (GPRO): Participation for the PQRS incentive payment made simple. Centers for Medicare & Medicaid Services: Centers for Medicare & Medicaid Services; 2013. 1–4.
13. Carver CS, Scheier MF. Scaling back goals and recalibration of the affect system are processes in normal adaptive self-regulation: understanding ‘response shift’ phenomena. *Soc Sci Med*. 2000; 50(12):1715–22. [PubMed: 10798327]
14. Deci EL, Ryan RM. The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychol Inq*. 2000; 11(4):227–68.
15. Vidrine JI, Shete S, Cao Y, Greisinger A, Harmonson P, Sharp B, et al. Ask-Advise-Connect: A new approach to smoking treatment delivery in health care settings. *JAMA Intern Med*. 2013; 173(6):458–64. [PubMed: 23440173]
16. Glasgow RE, Orleans CT, Wagner EH. Does the chronic care model serve also as a template for improving prevention? *Milbank Q*. 2001; 79(4):579–612. iv–v. [PubMed: 11789118]
17. Sinsky, C. Expanded rooming and discharge protocols. 2014. [cited 2015 September 15]; Available from: <https://www.stepsforward.org/modules/patient-discharge-and-rooming>
18. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr, et al. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. 2003; 289(19):2560–72. [PubMed: 12748199]
19. Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French SD, et al. Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Db Syst Rev*. 2012; (6):CD000259.
20. Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, et al. ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol*. 2017
21. Grimshaw J, Eccles M, Tetroe J. Implementing clinical guidelines: current evidence and future implications. *J Contin Educ Health Prof*. 2004; 24(Suppl 1):S31–7. [PubMed: 15712775]
22. Prior M, Guerin M, Grimmer-Somers K. The effectiveness of clinical guideline implementation strategies--a synthesis of systematic review findings. *J Eval Clin Pract*. 2008; 14(5):888–97. [PubMed: 19018923]
23. Powell BJ, Waltz TJ, Chinman MJ, Damschroder LJ, Smith JL, Matthieu MM, et al. A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. *Implement Sci*. 2015; 10:21. [PubMed: 25889199]
24. Soo S, Berta W, Baker GR. Role of champions in the implementation of patient safety practice change. *Healthc Q*. 2009; 12(Spec No Patient):123–8. [PubMed: 19667789]
25. Ivers NM, Sales A, Colquhoun H, Michie S, Foy R, Francis JJ, et al. No more ‘business as usual’ with audit and feedback interventions: towards an agenda for a reinvigorated intervention. *Implement Sci*. 2014; 9:14. [PubMed: 24438584]

26. Deci EL, Olafsen AH, Ryan RM. Self-determination theory in work organizations: the state of a science. *Annu Rev Organ Psych.* 2017; 4(1):19–43.
27. Matias, AC. Work Measurement: Principles and Techniques. In: Salvendy, G, editor. *Handbook of Industrial Engineering: Technology and Operations Management*. 3. John Wiley & Sons, Inc; 2001. 1409–62.
28. Glasgow RE, Nelson CC, Strycker LA, King DK. Using RE-AIM metrics to evaluate diabetes self-management support interventions. *Am J Prev Med.* 2006; 30(1):67–73. [PubMed: 16414426]
29. Reid RJ, Roos NP, MacWilliam L, Frohlich N, Black C. Assessing population health care need using a claims-based ACG morbidity measure: a validation analysis in the Province of Manitoba. *Health Serv Res.* 2002; 37(5):1345–64. [PubMed: 12479500]
30. MacLean CH, Louie R, Leake B, McCaffrey DF, Paulus HE, Brook RH, et al. Quality of care for patients with rheumatoid arthritis. *JAMA.* 2000; 284(8):984–92. [PubMed: 10944644]
31. Tu K, Campbell NR, Chen ZL, Cauch-Dudek KJ, McAlister FA. Accuracy of administrative databases in identifying patients with hypertension. *Open Med.* 2007; 1(1):e18–26. [PubMed: 20101286]
32. 2011 Chronic Condition Reference List. 2011. [cited 2012 August 3]; Available from: http://www.ccwdata.org/cs/groups/public/documents/document/ccw_conditionreferencelist2011.pdf
33. Borzecki AM, Wong AT, Hickey EC, Ash AS, Berlowitz DR. Identifying hypertension-related comorbidities from administrative data: What's the optimal approach? *Am J Med Qual.* 2004; 19(5):201–6. [PubMed: 15532912]
34. Levy L, Fautrel B, Barnetche T, Schaefferbeke T. Incidence and risk of fatal myocardial infarction and stroke events in rheumatoid arthritis patients. A systematic review of the literature. *Clin Exp Rheumatol.* 2008; 26(4):673–9. [PubMed: 18799105]
35. Newton KM, Wagner EH, Ramsey SD, McCulloch D, Evans R, Sandhu N, et al. The use of automated data to identify complications and comorbidities of diabetes: a validation study. *J Clin Epidemiol.* 1999; 52(3):199–207. [PubMed: 10210237]
36. Hebert PL, Geiss LS, Tierney EF, Engelgau MM, Yawn BP, McBean AM. Identifying persons with diabetes using Medicare claims data. *Am J Med Qual.* 1999; 14(6):270–7. [PubMed: 10624032]
37. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. *Med Care.* 1998; 36(1):8–27. [PubMed: 9431328]
38. Hernan MA, Robins JM. Per-Protocol Analyses of Pragmatic Trials. *N Engl J Med.* 2017; 377(14):1391–8. [PubMed: 28976864]
39. Sonel AF, Good CB, Mulgund J, Roe MT, Gibler WB, Smith SC Jr, et al. Racial variations in treatment and outcomes of black and white patients with high-risk non-ST-elevation acute coronary syndromes: insights from CRUSADE (Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes With Early Implementation of the ACC/AHA Guidelines?). *Circulation.* 2005; 111(10):1225–32. [PubMed: 15769762]
40. Akenroye AT, Kumthekar AA, Alevizos MK, Mowrey WB, Broder A. Implementing an Electronic Medical Record-Based Reminder for Cardiovascular Risk Screening in Rheumatoid Arthritis. *Arthritis Care Res (Hoboken).* 2017; 69(5):625–32. [PubMed: 27390217]
41. Grimshaw JM, Shirran L, Thomas R, Mowatt G, Fraser C, Bero L, et al. Changing provider behavior: an overview of systematic reviews of interventions. *Med Care.* 2001; 39(8 Suppl 2):II2–45. [PubMed: 11583120]
42. Ramly, E, Lauver, D, Bartels, CM. American College of Rheumatology. San Francisco, U.S: *Arthritis Rheumatol*; 2015. Engaging Clinic Staff in Work System Redesign to Adapt a Hypertension Protocol for Rheumatology [abstract]; 1885–6.
43. Carter BL, Rogers M, Daly J, Zheng S, James PA. The potency of team-based care interventions for hypertension: a meta-analysis. *Arch Intern Med.* 2009; 169(19):1748–55. [PubMed: 19858431]
44. Ramly, E; Lauver, DR; Bartels, C. Work System Redesign and Implementation of Evidence-Based Hypertension Protocol in Specialty Clinics Using Electronic Health Record Prompts. *AcademyHealth 9th Annual Conference on the Science of Dissemination and Implementation*; 2016; Washington, DC. 2016.

45. Wattiaux, A; Ramly, E; Bartels, CM. Specialty Clinic Staff Perceptions of Protocols for High Blood Pressure & Smoking Cessation: Building feasibility, self-efficacy, and clinic capacity. Combined Annual Meeting of CSCTR and MWAFMR; 2017; Chicago, IL. 2017.
46. Waltz TJ, Powell BJ, Matthieu MM, Damschroder LJ, Chinman MJ, Smith JL, et al. Use of concept mapping to characterize relationships among implementation strategies and assess their feasibility and importance: results from the Expert Recommendations for Implementing Change (ERIC) study. *Implement Sci.* 2015; 10:109. [PubMed: 26249843]
47. Muntner, P, Carey, RM, Gidding, S, Jones, DW, Taler, SJ, Wright, JT. , Jr, et al. *Circulation*. Waltham, MA: American Heart Association; 2017. Potential U.S. Population Impact of the 2017 American College of Cardiology/American Heart Association High Blood Pressure Guideline.
48. PQRS. Measure #317: Preventive Care and Screening: Screening for High Blood Pressure and Follow-Up Documented - National Quality Strategy: Community/Population Health. 2017. [cited 2018 February 5]; Available from: https://mdinteractive.com/files/uploaded/file/CMS2017/2017_Measure_317_Registry.pdf
49. Yazdany, J, Johansson, T, Myslinski, R, Kazi, S. American College of Rheumatology. San Diego, CA: Arthritis Rheumatol; 2017. Performance on Quality Measures in the RISE Registry and the Merit-Based Incentive Payment System (MIPS) [abstract].
50. Bartels, CM; Ramly, E; Panyard, D; Lauver, DR; Johnson, HM; Lewicki, K; , et al. BP Connect Health Toolkit. 2017. [cited 2018 February 5]; Available from: <https://www.hipxchange.org/BPConnectHealth>

SIGNIFICANCE AND INNOVATIONS

- Engaging staff nurses and medical assistants with protocols to address high blood pressures (BP) is feasible, but had not been previously adapted for rheumatology clinics despite heightened CVD risk in rheumatology populations.
- Following implementation of the BP protocol adapted for rheumatology staff, visits with high BP declined from 17% to 8% over 24-months, showing efficacy with a significant population-level decline.
- Engaging rheumatology staff with BP protocols was an effective, evidence-based strategy to improve guideline concordant BP follow-up among at-risk rheumatology populations.

Figure 1.
Flow diagram of project design and inclusion.

Figure 2. Kaplan-Meier survival curve to compare days to PC follow-up visits between pre- and post-implementation visits for patients with high BP and in-network PC (n=2650 pre-implementation visits; n=139 post-implementation visits with confirmed high BP). Median days to follow-up decreased from 71 to 38 days during the protocol period, log-rank test ($p = 0.0003$). Shading shows 95% confidence intervals.

Figure 3. Interrupted time series graph

of the percent of monthly rheumatology clinic visits with high blood pressures (BP) before and after protocol implementation. (n=56,394 visits; 28,109 pre- and 28,285 post-implementation) Average monthly rates of high BP decreased from 17% pre- to 8% post-implementation with a significant decline after implementation and continued improvement over time ($p<0.003$ and $p=0.03$).

Table 1

Description of visit-level patient characteristics pre- and post-implementation

		Visits with High Blood Pressure Measurement (n=5372 visits)		p ^a
		Pre-implementation visits n=4683 n (%)	Protocol eligible visits n=689 n (%)	
Age, years (mean, SD)		59.1 (14.1)	60.4 (13.6)	0.03
	18–39	390 (8.3)	43 (6.2)	0.02
	40–59	1949 (41.6)	261 (37.9)	
	60–79	1981 (42.3)	332 (48.2)	
	80	363 (7.8)	53 (7.7)	
Gender	Female	3105 (66.3)	458 (66.5)	0.93
Race	White	4210 (90.5)	604 (88.6)	0.26
	Black	261 (5.6)	47 (6.9)	
	Other	179 (3.9)	31 (4.6)	
Language	English	4637 (99)	685 (99.4)	0.31
	Non-English	46 (1)	4 (0.6)	
Married/Partnered		2714 (58.1)	416 (60.5)	0.37
	Single	1046 (22.4)	152 (22.1)	
	Separated/divorced/widowed	913 (19.5)	120 (17.4)	
Medicaid (Ever)		572 (12.2)	81 (11.8)	0.73
Tobacco	Never	2287 (49.8)	333 (49.5)	0.6
	Current	474 (10.3)	70 (10.4)	
	Quit	1797 (39.2)	262 (38.9)	
	Passive	32 (0.7)	8 (1.2)	
BMI quartile	(mean, SD)	32.3 (8.3)	31.6 (8.0)	0.054
	Underweight-Normal	865 (19.0)	139 (20.5)	0.42
	Overweight	1210 (26.5)	187 (27.6)	
	Obese	2487 (54.5)	352 (51.9)	
BASELINE COMORBIDITIES AND UTILIZATION				
	Rheumatoid Arthritis	1414 (30.2)	224 (32.5)	0.22
	Hypertension	3078 (65.7)	464 (67.3)	0.40
	Cardiovascular disease	1165 (24.9)	181 (26.3)	0.43
	Diabetes mellitus	800 (17.1)	114 (16.6)	0.73
	Chronic kidney/ESRD	287 (6.1)	52 (7.6)	0.15
	ACG Comorbidity score (mean, SD)	1.1 (0.8)	1.1 (0.9)	0.98
	Mean Annual Ambulatory visits	7.6 (6.9)	6.8 (5.8)	<0.01
	Mean Annual PC visits	2.4 (3.3)	2.1 (2.6)	<0.01
	Mean Annual Rheumatology visits	2.1 (1.9)	1.9 (1.7)	<0.01
	In Network PC	2650 (56.9)	393 (57.3)	0.83

^a p-values calculated using a two-sample t-test for numeric variables & chi-square for categorical.

^b Abbreviations: ACG= Johns Hopkins Adjusted Clinical Groups Groups System; BMI=Body mass index; ESRD=End stage renal disease; PC=Primary care.

Table 2

Odds (95% CI) of timely primary care follow-up after specialty visit with high blood pressure

		Timely Primary Care ^a Follow-Up		
		Per Protocol (n=2789)	Intent to Treat (n=3043) ^b	
		Unadjusted OR (95% CI)	Adjusted OR ^c (95% CI)	Adjusted OR ^c (95% CI)
Protocol		1.88 (1.33, 2.66)	2.04 (1.42, 2.92)	1.50 (1.15, 1.95)
Age	18–39	ref	ref	ref
	40–59	0.91 (0.66, 1.27)	0.96 (0.67, 1.37)	0.99 (0.70, 1.41)
	60–79	1.07 (0.77, 1.48)	1.09 (0.75, 1.59)	1.14 (0.79, 1.66)
	80	1.42 (0.95, 2.12)	1.43 (0.89, 2.32)	1.41 (0.88, 2.25)
Gender (female)		1.16 (0.97, 1.39)	1.00 (0.82, 1.22)	1.01 (0.83, 1.22)
Race	White	ref	ref	
	Black	2.25 (1.62, 3.13)	1.72 (1.18, 2.49)	1.60 (1.12, 2.28)
	Other	1.32 (0.89, 1.95)	1.40 (0.93, 2.12)	1.30 (0.88, 1.93)
Married/Partnered		ref	ref	
	Single	1.17 (0.95, 1.44)	0.96 (0.77, 1.20)	0.91 (0.73, 1.14)
	Separated/divorced	1.43 (1.16, 1.75)	1.02 (0.81, 1.29)	1.00 (0.80, 1.26)
Medicaid (Ever)		1.51 (1.18, 1.94)	1.26 (0.93, 1.70)	1.25 (0.93, 1.68)
Tobacco	Never	ref	ref	
	Current	1.04 (0.77, 1.39)	1.05 (0.76, 1.44)	1.08 (0.80, 1.47)
	Quit	1.17 (0.98, 1.39)	1.07 (0.89, 1.29)	1.05 (0.88, 1.25)
BMI	Underweight/Normal	ref	ref	
	Overweight	0.73 (0.57, 0.94)	0.73 (0.56, 0.96)	0.76 (0.59, 0.98)
	Obese	1.01 (0.81, 1.26)	1.01 (0.80, 1.28)	1.05 (0.83, 1.32)
BASELINE COMORBIDITIES AND UTILIZATION				
Rheumatoid Arthritis		0.93 (0.78, 1.09)	0.87 (0.74, 1.06)	0.89 (0.75, 1.07)
Baseline Hypertension		1.37 (1.12, 1.67)	0.90 (0.72, 1.13)	0.95 (0.76, 1.18)
Cardiovascular disease		1.66 (1.40, 1.98)	1.28 (1.04, 1.58)	1.28 (1.04, 1.56)
Diabetes mellitus		1.61 (1.33, 1.96)	1.25 (0.99, 1.56)	1.23 (0.99, 1.53)
Chronic kidney/ESRD		1.47 (1.10, 1.95)	0.85 (0.59, 1.23)	0.81 (0.57, 1.16)
ACG Comorbidity		1.43 (1.30, 1.57)	1.12 (0.96, 1.29)	1.12 (0.97, 1.28)
Baseline Mean Annual Ambulatory visits ^d		1.06 (1.04, 1.07)	1.04 (1.02, 1.05)	1.04 (1.03, 1.05)

^aPrimary care follow-up analysis required an in network PC.^bIntention to Treat included all those eligible for re-measurement, regardless of whether it occurred, unless BP was re-measured and normalized; As Treated included only patients in whom the protocol was initiated as indicated by re-measurement.^cModels also included clinic; non-English primary language was insufficient for estimation.^dBaseline Mean Ambulatory Visits indicates odds ratios per one visit increase.

Abbreviations: ACG= Johns Hopkins Adjusted Clinical Groups System; BMI=Body mass index; ESRD=End stage renal disease.