Title: Leveraging Health Information Technology and Team Change to Improve Cardiovascular Disease Prevention in Rheumatoid Arthritis

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1. Structured Abstract

Purpose: Rheumatoid arthritis (RA) confers a 1.5-2.0-fold increased risk of cardiovascular disease (CVD). Current guidelines recommend accounting for this in prevention decisions. However, CVD risk factor identification and management occur less often in RA compared to patients without RA. We implemented a multifaceted rheumatology practice intervention to improve CVD risk factor measurement, risk assessment and management.

Scope: We included rheumatologists from a large group practice and we targeted internists and other primary care providers managing RA patients in that healthcare system.

Methods: We collected CVD risk factor data in RA patients (cholesterol, blood pressure, diabetes status, smoking, and antihypertensive and lipid lowering therapy). Interventions included: clinician education, point-of-care decision support, clinician performance feedback, and care management directed at RA patients with missing risk factor data or unmet preventive cardiology needs. We repeatedly measured preventive cardiology quality indicators from electronic health record data and compared pre-intervention to intervention over time using interrupted time series methods.

Results: RA patients with all major CVD risk factors assessed increased during the initial intervention period (53% to 72.2%). The rate of increase was significantly greater during the intervention period compared to baseline, a difference of 0.74 percent per month (P=0.0016). By phase one end, more patients received moderate or high intensity statins (21.6% to 28.2%) but the rate of change was not significantly different (P=0.13). No other measure increased during the initial intervention. During phase 2, rates of increase in statin prescribing, hypertension diagnosis and hypertension control improved more rapidly (P<0.001 for each).

Key Words: Care Management, Cardiovascular Risk, Rheumatoid Arthritis, Intervention, Clinical Decision Support

2. Purpose (Objectives)

The overall goals of this project was to implement and test a practical multi-faceted system-based interventions to: (1) increase CVD risk factor assessment (blood pressure, total and HDL cholesterol, diabetes mellitus [DM] status, and smoking status) among RA patients; (2) systematically identify unaddressed increased CVD risk or uncontrolled risk factors in a manner that is both consistent with current U.S. guidelines and also accounts for the increased CVD risk in RA; (3) increase rheumatologist counseling about CVD risk; and (4) increase appropriate pharmacotherapy for CVD risk reduction (specifically moderate-to-high intensity statins and antihypertensive drug treatment) by promoting co-management and improving physician-to-physician communication. We pursued these goals using provider education, provider-facing computerized clinical decision support, electronic health record (EHR)-supported quality measurement and provider feedback, and rheumatology care-team redesign using a care manager.

Objectives: Our primary measurable objectives were to (1) increase to 75% the proportion of eligible RA patients with all major CVD risk factors assessed, (2) increase to 55% the proportion of patients with a 10-year CVD risk of at least 5% (based on risk factors or established CVD) who are prescribed a moderate or high intensity statin, (3) achieve LDL (or non-HDL) cholesterol reduction of ≥ 30 mg/dL for at least 20% of RA patients previously untreated with statins who have a 10-year CVD risk of at least 5%, (5) increase

the rate of appropriate hypertension diagnosis among RA patients with persistently elevated blood pressure.

3. Scope (Background, Context, Settings, Participants, Incidence, Prevalence

Background/Context: Current Assessment of Need Nationally and in the Target Population

Cardiovascular disease is the leading cause of death in individuals with RA. Patients with RA are at 1.5-2.0-fold increased risk of CVD morbidity relative to the general population.[1-4] In a meta-analysis of 24 studies, the risk of coronary heart disease mortality was increased 1.59 fold and the risk of cerebrovascular mortality was increase 1.5-fold in individuals with RA compared to the general population.[1] Many RA patients have modifiable CVD risk factors.[5] Despite the high burden of CVD and recommendations by the European League Against Rheumatism (EULAR) for routine cardiovascular risk assessment and management, it was recently shown that both rheumatologists and primary care physicians identify and manage cardiovascular risk factors less often in RA patients compared with controls from the general population. [2, 6-9]

Prevalence of Unmeasured and Uncontrolled CVD Risk Factors in our Target Area

Inadequate CVD risk factor screening and treatment is prevalent in the population of RA patients served by the Northwestern Medical Faculty Foundation (NMFF). We performed queries from the Northwestern Medicine enterprise data warehouse (NMEDW) using Structured Query Language and identified RA patients who had 2 or more rheumatology office visits in the preceding 18 months with 2 or more ICD9-CM or ICD10-CM diagnosis codes for rheumatoid arthritis. We assessed whether patients had established CVD, and collected data for cholesterol, blood pressure, antihypertensive and lipid lowering medication therapy, and smoking and DM status as we have done in our prior work conducted among non-RA populations.[10, 11] We calculated atherosclerotic CVD risk (the risk of symptomatic coronary or cerebrovascular disease) using equations from the 2013 ACC/AHA risk assessment guideline and identified patients whose 10-year estimated risk exceeded 5%.[12] We chose CVD risk of ≥ 5% because at this level the ACC/AHA guideline recommends statin therapy be considered, and strongly recommends it at a level of ≥ 7.5%.[13] RA patients with CVD risk estimated at 5% likely have a true level of risk exceeding 7.5% because CVD risk is increased approximately 1.5 fold in RA.[1, 7] As depicted in Table 1, among a diverse group of 1249 RA patients cared for in the NMFF group practice, ***only half had all major risk factors assessed*** (data missing for lipids [49%] and DM [7%]). Among those potentially eligible for a statin (known CVD or 10-year CVD risk of ≥ 5%), ***only 40% of potentially eligible RA patients were treated with a moderate or high intensity statin and nearly half were prescribed no statin***. Most recent blood pressure was <140/90 for 86% of the cohort. Diabetes and current smoking prevalence were low (7.4% and 5.4% respectively). Therefore, the largest unaddressed needs and major intervention targets in our clinical practice were promoting complete risk factor assessment and the appropriate use of statins. Addressing uncontrolled hypertension, newly discovered DM and smoking were secondary targets due to their low prevalence in our cohort.

Settings and Participants: Primary Target Audience for the Intervention

This included primarily the group of rheumatologists from a large group practice. Secondarily, we targeted internists, and other primary care clinicians within and outside the Northwestern Medicine healthcare system who provide primary care to these RA patients. We anticipated direct benefit will accrue to RA patients who receive interventions to reduce CVD risk. In addition, other organizations can

benefit from the lessons learned here (both in terms of the approaches that were successful, and those that were less effective).

4. **Methods (Study design, data measures, intervention)**

There are multiple reasons why healthcare systems may deliver sub-optimal performance. We anticipated the following barriers to addressing CVD risk in RA. ***Patient-level barriers:*** Patients may be unaware of the increased CVD risk in RA, pay more attention to RA than other health risks, and if they are women, under-appreciate CVD which is often thought of as a man's disease. ***Provider-level barriers:*** RA patients may see generalist physicians infrequently, generalists may not appreciate the CVD risk in RA, or they may be concerned about drug-drug or drug-disease interactions that reduce their likelihood of prescribing medications to lower CVD risk. Rheumatologists have competing demands during visits (e.g. managing disease activity) or may not view CVD prevention as within their scope of work. Also, RA patients may have low LDL despite high CVD risk, and the opportunity to use a statin (which is predominantly risk-based, not LDL-based, in the current guideline [13]) may go unrecognized.

Intervention phase 1: Our initial set of interventions addressed barriers on multiple fronts in an attempt to achieve a meaningful improvement in CVD risk factors and increases in appropriate treatment. The intervention consisted of four main components: (1) clinician education, (2) point-of-care clinical decision support, (3) performance feedback to clinicians, and (4) care management.

Clinician Education: To increase awareness of the magnitude of CVD risk among RA patients and to generate a sense of accountability among clinicians we delivered two interactive lectures (in January and March of 2015) to the rheumatology clinicians describing the higher CVD risk in RA, recommendations for risk factor monitoring, and strategies to modify risk. Some of the internists who refer patients to the rheumatology practice also received a presentation on this topic in at a local academic conference at the end of September 2014. These sessions emphasized the currently low rates of risk factor screening and modification among RA patients compared with non-RA patients, and described how health information technology and care team change can be used to improve cardiovascular risk factor assessment and management. The March lecture included a demonstration of the forthcoming clinical decision support applications that rheumatology clinicians would be exposed to.

Point-of-care clinical decision support: We implemented clinical decision support prompting into the EHR to trigger for rheumatology clinicians when specific criteria were met (e.g. a risk factor was unmeasured, a risk factor was uncontrolled, or risk was sufficient to warrant consideration of statin treatment) (Table 1). These alerts were tied to order sets to facilitate risk factor measurement, and provision of printed patient education materials, and were linked to letter templates to assist rheumatologists in communicating relevant information about CVD prevention in RA to the patients' primary care physicians, as well as specific requests for medical management of risk factors. These decision support tools were implemented between March and July 2015.

Table 1. Computerized Clinical Decision Support Rules for CVD Prevention in RA

Decision Support	Description (supporting guidelines)	Linked Functions
Consider checking lipids	Over age 40, not statin treated, no total and HDL cholesterol measured in past 5 years [7, 13]	Order set to order lipid panel (fasting) or total and HDL cholesterol (non-fasting)
Consider screening for diabetes	No glucose or HbA1c in past 3 years [7, 14]	Order set to order glucose (fasting) or HbA1c (non-fasting)
Consider moderate to high potency statin for primary prevention	Aged 40-75 years, ASCVD risk of ≥5%, not treated with a moderate or high potency statin [7, 13]	Letter template to primary care provider, written patient education, documentation of exceptions
Consider high potency statin for secondary prevention	Aged 40-75 years, diagnosed ASCVD, not treated with a high potency statin [7, 13]	Letter template to primary care provider, written patient education, documentation of exceptions
Consider addressing uncontrolled hypertension	Diagnosed hypertension, blood pressure >140/90 (or >150/90 and age ≥60)[15]	Letter template to primary care provider, written patient education, documentation of exceptions
Consider additional evaluation or treatment for undiagnosed hypertension	No hypertension diagnosis, mean blood pressure >140/90 (or >150/90 and age ≥60)[15]	Letter template to primary care provider, written patient education, documentation of exceptions
Consider counseling or referral for smoking cessation	Current smokers [7] [16]	Letter template to primary care provider, written patient education, documentation of exceptions
Antiplatelet drug for secondary prevention	Diagnosed ASCVD and no antithrombotic drug prescribed[17]	Order set for aspirin ordering, letter template to primary care provider, written patient education, documentation of exceptions

Performance feedback to clinicians: We used queries of electronic health record data to generate feedback reports of electronic clinical quality measures to rheumatology clinicians (Table 2). These reports showed individual rheumatologists their number of RA patients eligible for each measure and the percent who met the measure. The reports also demonstrated how the individual rheumatologist's performance compared to the practice overall, and the clinicians in the top quartile. Measures included in the report were: 1) assessment of major CVD risk factors, 2) moderate or high intensity statin prescribing for patients with at least moderate CVD risk, 3) hypertension control, 4) non-smoking status,

and 5) antithrombotic therapy prescribed for secondary prevention of ischemic vascular disease. We distributed feedback reports to rheumatology clinicians on a quarterly basis starting in August 2015. The supplement shows a sample report. A study investigator (Dr. Majka) reviewed these initially at a Rheumatology Division Meeting and individually when recipients had questions.

Table 2: Electronic Clinical Quality Measures Applied to Eligible RA Patients*

Performance measure	Denominator Criteria	Numerator Criteria
Major CVD risk factors assessed†	Age 40-75 years old	Have had the following measured: Total and HDL cholesterol (5 years) Glucose or HbA1c (3 years) Smoking status Blood pressure
Moderate or high intensity statin treatment for primary prevention†	Age 40-75 years old with ASCVD risk of ≥5%	Moderate or high intensity dose statin on active medication list
Moderate or high intensity statin treatment rate	Age 40-75 years old	Moderate or high intensity dose statin on active medication list
Hypertension diagnosis rate	Age 18-85 years and blood pressure ≥140/90 on the two most recent measurements or hypertension diagnosis code on active problem list or visit diagnosis	Hypertension diagnosis code on active problem list or visit diagnosis
Controlled hypertension	Age 18-85 years and hypertension diagnosis code on active problem list or visit diagnosis	Most recent blood pressure was <140/90
Non-smoking	Current or former smoker recorded in social history	Former smoker recorded in social history
Antithrombotic drug for secondary prevention	ASCVD diagnosis code on active problem list or previous visit diagnosis list	Antithrombotic drug on active medication list

* For all measures denominator criteria included 2 or more office visits in the 18 months preceding measurement date and an active problem list or visit diagnosis of rheumatoid arthritis in that time period.

† Included in performance reports to rheumatologist.

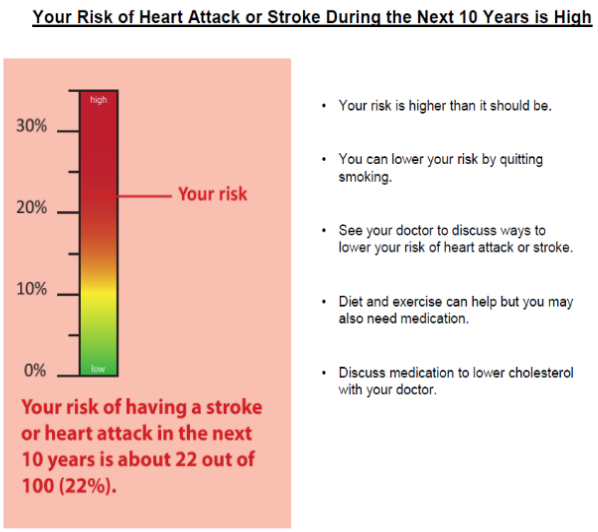
ASCVD: atherosclerotic cardiovascular disease.

Care management: We repeatedly queried EHR data approximately monthly starting in July 2015 to determine which RA patients were eligible for care manager outreach based on criteria that included having apparently unmet risk factor screening or preventive cardiology treatment needs, and having an upcoming rheumatology office visit. A non-clinician care manager sent patients a mailed description of the one or more clinical topics identified and encouraged patient to review these with their rheumatologist. We notified rheumatologists about which of their patients with visits scheduled in the following week had received outreach. Patients who had not had documented lipid testing within the past 5 years or a screening test for diabetes within the past 3 years were encouraged to obtain and bring in labs conducted elsewhere or to obtain the tests from their rheumatology clinician. Patients who were

candidates for statin treatment due to elevated ASCVD risk (using criteria described below) were sent a letter including a graphic representing their risk and a recommendation to discuss medication to lower cholesterol.

Figure 1. Sample Outreach Message

The goal of the care management and outreach was to generate a sense of mutual responsibility whereby the patient would become activated to pursue the recommended healthcare services or behavior changes to address CVD risk and the rheumatologist—by knowing that patients received this outreach—would be activated by the need to meet patient expectations to discuss CVD prevention openly and provide recommended testing and referrals.



Intervention phase 2: In the second phase of the intervention, we used proactive outreach from a care manager to promote primary care follow up for RA patients with preventive cardiology care gaps.

Care managers contacted patients with unaddressed or uncontrolled cardiovascular risk factors on behalf of their rheumatologist when requested to do so by the rheumatologist. Rheumatologists could refer patients for care management using two methods: (1) they could indicate that they wanted a patient to receive care manager-facilitated PCP through the electronic alerts that occurred during rheumatology visits that assessed patients for uncontrolled or unaddressed CVD risk factors. (2) A care manager sent lists of patients identified by electronic queries to the patient's Rheumatologist using email within the Epic electronic health record. The rheumatologists were asked to respond back indicating that it was acceptable to contact the listed patients for care manager-facilitated referral to primary care or to indicate which patients should not be contacted. We collected data from EDW queries and also record data obtained during the care manager-facilitated referral to primary care process. The care manager attempted to contact patients by phone and would ask if the patient completed a visit with his/her PCP to address the identified clinical condition(s). The care manager provided patients information about their identified clinical conditions and reviewed the reasons for referral back to the PCP. The care manager encouraged patients to schedule prompt primary care follow up. The care manager also sent information to the patient's PCP about the identified CVD risk factor(s). The care manager documented care discussions in Epic EHR telephone encounters and sent this to the rheumatologist and, if the PCP was within the health system, to the PCP. For PCPs external to the health system, the care manager contacted them by fax or mail. The care manager sent patients mailings that included information about the CVD risk factors and recommendations for discussion with the PCP. In addition to a manual review of the patient's EHR chart, the care manager would follow up with patients

by phone to determine: the care that was received, which relevant steps were taken, and when actions were not taken to identify reasons why not.

Statistical Analysis: For analysis of Phase 1, we calculated each of the seven quality measures for patients who met the measure eligibility criteria on the first of each month from April, 2014 through December, 2016. For each measure, the primary comparison was between the time period before any intervention took place (April 1 to October 1 2014) and the period of time the interventions were implemented and maintained (October 2014 to December 2016), referred to as the intervention period. This yielded two time series for each measure. A linear model was fit to each series using time as a continuous predictor, intervention period as a dichotomous indicator variable, and a term for the interaction between time and intervention. Subsequently, we determined the autoregressive order of the model residuals by minimizing Akaike's information criterion.[18] Finally, we fitted a linear regression model with autoregressive errors (using the appropriate number of autoregressive parameters, if any were necessary) to each series. These fitted models were used to test statistical significance. To ensure model validity, we examined several residual diagnostics, the Jarque-Bera and the Shapiro-Wilk tests for normality of residuals, and normal Q-Q and autocorrelation plots.[19-20] Secondary analyses compared the slopes of the baseline period to the time during which intervention components were implemented (October 1, 2014 to September 1, 2015), the early maintenance of the interventions (September 1, 2015 to March 1, 2016), and the later maintenance period (March 1 to December 1, 2016). Analyses used SAS version 9.4 (SAS Institute Inc, Cary, NC) and R version 3.3.2 (R Foundation for Statistical Computing, Vienna, Austria).

To further examine the time course of the effects of these interventions when the overall comparison was significantly different from baseline, we examined the slopes of the performance measures during three time periods (implementation—10/1/14 to 9/1/15, early maintenance—9/1/15 to 3/1/16, and late maintenance—3/1/16 to 12/1/16) and compared each of these slopes to the baseline period using the same interrupted time series analysis methods.

For Phase 2, we calculated outcomes for each of 6 measures for the first of the month from June 2016 through November 2016 to establish new baseline rates. We then followed these outcomes for an additional 7 months following the implementation of the Phase 2 changes to the clinical decision support and care management approaches. Measures were applied similarly in Phase 2 as in Phase 1 except we used a measure of statin prescribing for primary prevention where the denominator included all RA patients age 40 to 75 years old, whose LDL was ≥70 mg/dL, and who did not have an ASCVD diagnosis. The numerator was any statin on the active medication list on measurement date or reported to the care manager prior to the measurement date.

Rheumatology Clinician Survey: In December 2015, we invited the 18 clinicians (including attending rheumatologists, rheumatology fellows, advanced practice nurses, or physician assistants) to take a brief online survey after providing written informed consent. Non-respondents were contacted up to 3 times. The survey (included in the supplement) addressed clinician attitudes and practices towards cardiovascular disease prevention in RA patients and also elicited opinions about the intervention components.

5. Results

Phase 1: Initial intervention, Oct 2014 to Dec 2016

There were 1267 patients in the overall adult RA population who had two or more visits in the 18-month period prior to January 1, 2015. Mean age was 57.1 (SD 14.3) and a majority (83.8%) were female. The prevalence of current smoking, hypertension diagnosis, diabetes mellitus and ASCVD were 5.8%, 21.4%, 7.0% and 5.8% respectively.

Table 3. Percentage of Eligible Patients Meeting Quality Measures and Modeled Rates of Change in Performance Before and During the Intervention

	Pre-implementation rate 10/1/14 (%)	End of follow up rate 12/1/16 (%)	Slope in baseline period† (% per month)	Slope in implementation and maintenance period‡ (% per month)	Difference in slope before and during the intervention (% per month)	P
Major CVD risk factors assessed	53.0	72.2	0.03 (-0.36, 0.43)	0.77 (0.19, 1.36)	0.74 (0.28, 1.19)	0.0016
Moderate or high intensity statin treatment for primary prevention	46.3	38.5	-0.32 (-0.73, 0.10)	-0.35 (-0.94, 0.24)	-0.04 (-0.47, 0.40)	0.56
Moderate or high intensity statin treatment rate*	21.6	28.2	0.17 (0.02, 0.31)	0.25 (0.05, 0.45)	0.08 (-0.06, 0.23)	0.13
Hypertension diagnosis rate	80.2	66.3	-0.13 (-1.06, 0.80)	-0.55 (-1.77, 0.67)	-0.42 (-1.48, 0.64)	0.78
Controlled hypertension	73.4	58.0	-0.39 (-1.53, 0.75)	-0.64 (-1.99, 0.72)	-0.25 (-1.51, 1.02)	0.65
Non-smoking	86.0	85.6	0.04 (-0.22, 0.30)	0.01 (-0.38, 0.39)	-0.03 (-0.32, 0.26)	0.58
Antithrom-botic drug for secondary prevention	87.3	78.7	0.27 (-0.38, 0.92)	-0.37 (-1.27, 0.53)	-0.64 (-1.35, 0.06)	0.96

* Many individuals included in this group would not be in a group expected to be prescribed a statin.

†Baseline period, time period before any intervention took place (April 1 to October 1 2014)

‡Implementation and maintenance period (October 2014 to December 2016).

Rates of each measure prior to implementing the improvement activities and at the end of the follow up period are shown in Table 3 and Figure 2. The percentage of patients with all major CVD risk factors assessed was 53.0% at the beginning of the implementation activities and rose to 72.2% by the end of the follow up period. The rate of increase for this measure was significantly greater during the intervention period compared to baseline, a difference of 0.74% increase per month (95% CI 0.28 to 1.19; P=0.0016). By the end of the study, more patients aged 40-75 years received a moderate or high intensity statin (21.6% to 28.2%) but the rate of change in the intervention period was not significantly different from baseline (P=0.13). No other measure increased during the intervention period. The two measures related to hypertension declined, but this appeared to follow the introduction of automated blood pressure machines into the clinic in December, 2015.

Compared to the baseline period, the measure "major CVD risk factors assessed" increased more rapidly in the intervention period, the early maintenance period, and the late maintenance period. The rate of increase was most rapid in the early maintenance period (the time period immediately following the date when all the intervention components had been put in place) and was 1.4% per month (95% CI 1.2 to 1.6) during this time.

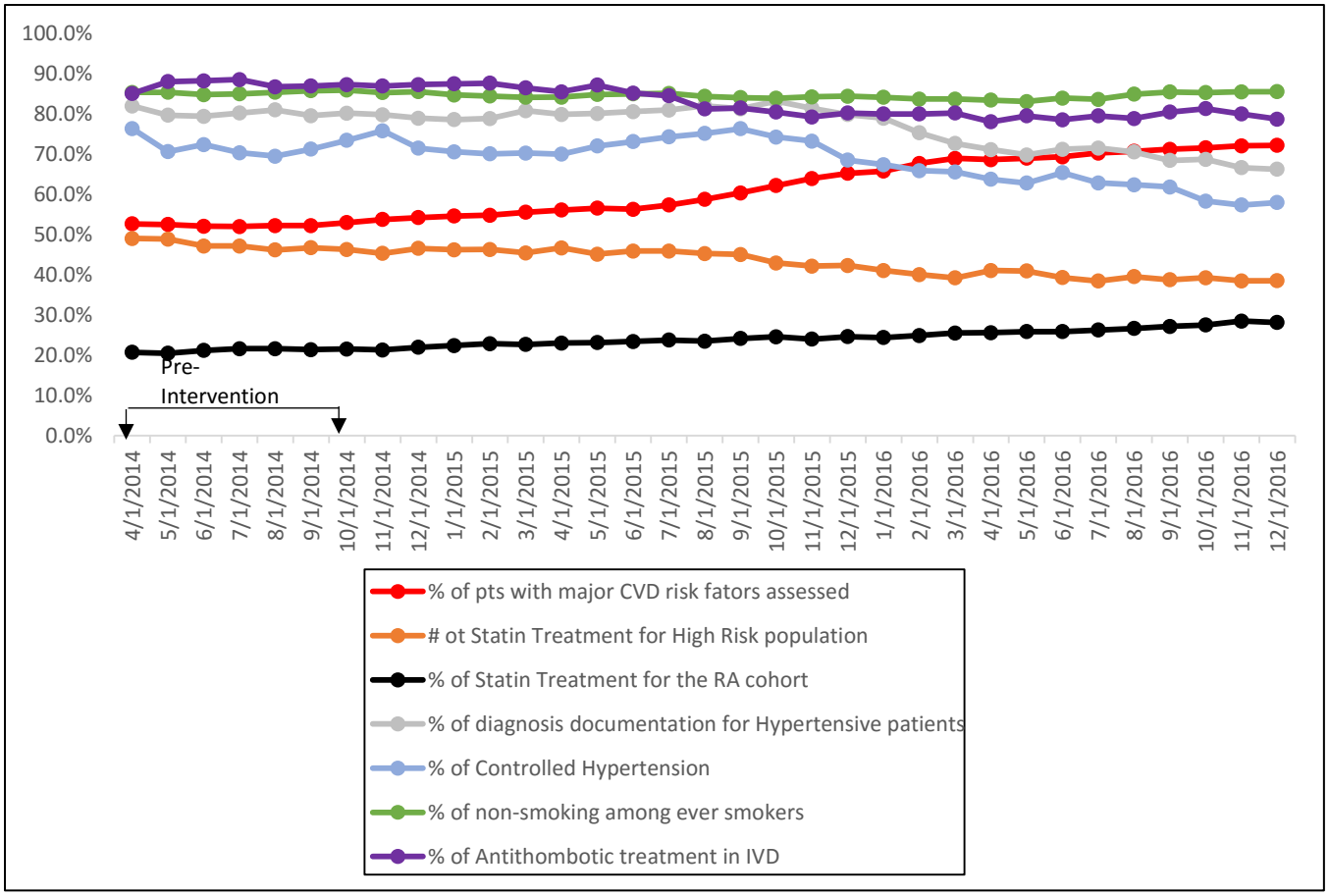
Rheumatology Clinician Survey

Twelve of the eighteen rheumatology clinicians surveyed responded (67%). Of these respondents, 67% were female and 50% were attending physicians. The rheumatology providers expressed approval of the EHR tools used to improve risk factor measurement and referral to primary care providers. While most rheumatology clinicians felt responsible for discussing CVD prevention with their patients with RA, they indicated they were not interested in prescribing medications for CVD prevention themselves. They were supportive of referral to generalists for medical management in patients with CVD risk factors (Table 4).

Table 4. Rheumatology Clinician Survey to Assess Engagement and Optimize Delivery System

Statement	**Percentage who agreed or strongly agreed**
I feel responsible for discussing CVD prevention	83%
The EHR tools used in this intervention improved quality of care	
Audit and feedback	75%
Clinical decision support	83%
Streamlined electronic order-sets	100%
I would like more patients with uncontrolled CVD risk factors to receive personalized risk reports	83%
My patients were not bothered by the CVD risk reports	75%
I do not prescribe a statin medication for CVD prevention myself	100%
Referral to the primary care provider is the best way to address CVD risk factors	67%
I rely on my patients seeing primary care providers for CVD risk treatment	92%
I support automatic direct referral (by a rheumatology care manager) to internal medicine on my behalf for patients with uncontrolled CVD risk factors	92%

Figure 2: Changes in CVD Prevention Measures in RA Patients Over Time-Initial Intervention (Phase 1)



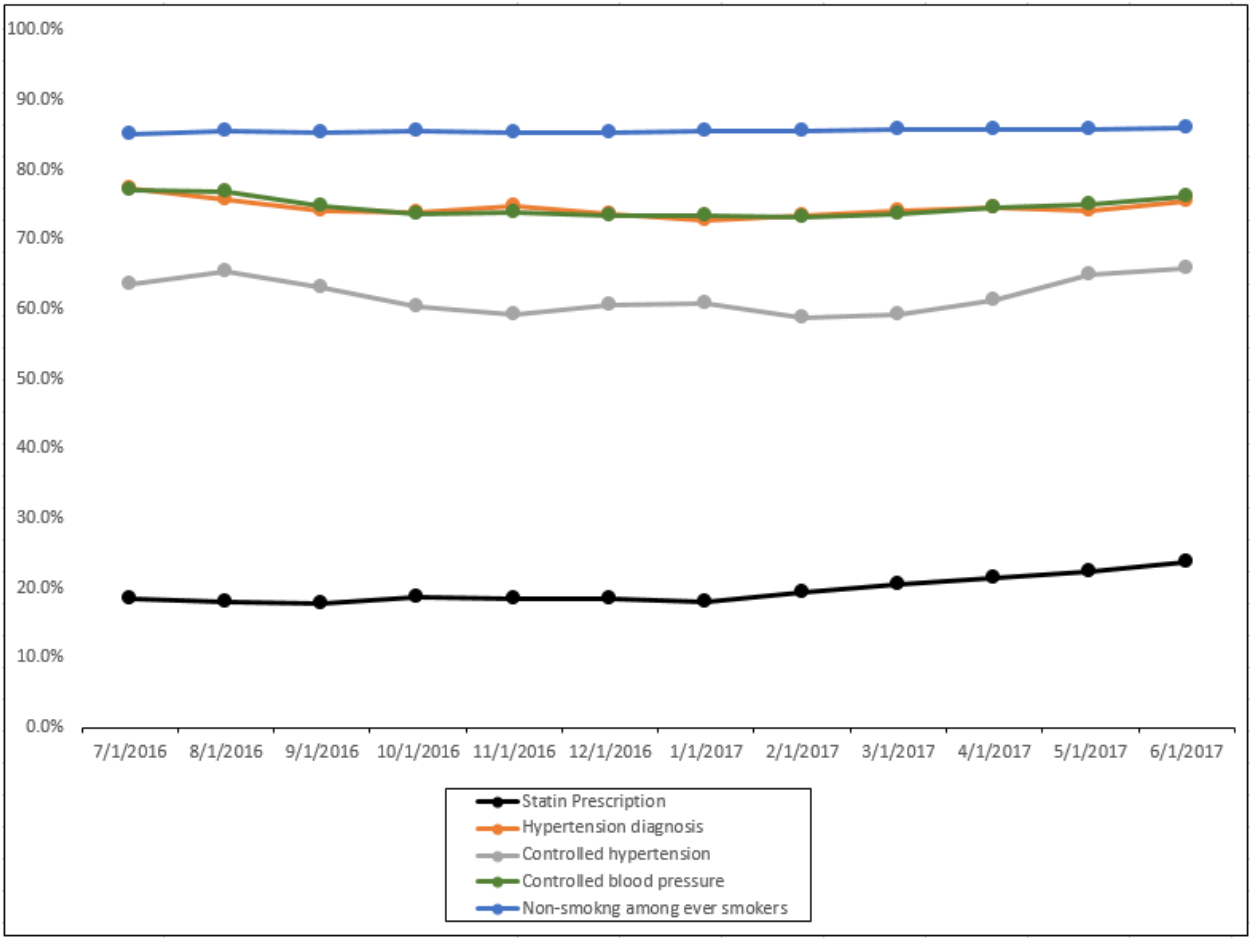
Intervention Phase 2: Following the start of the second phase of this study, the proportion of RA patients prescribed a statin for primary prevention rose from 18.4% to 23.8%, and the rate of increase was significantly greater during this time period (1.06 percent per month greater than the prior period, P<0.001) (Table 5 and Figure 3). During the intervention Phase 1, we observed a decline in the proportion of patients with elevated blood pressure who had hypertension diagnosed, and in the proportion of patients with controlled hypertension which we believe may have been due to the introduction of automated blood pressure machines into the rheumatology clinic in December, 2015. During Intervention Phase 2, rates of increase in hypertension diagnosis and control improved more rapidly compared to the preceding time period (P<0.001 for each) (Table 5 and Figure 3) and reversed preceding negative trends. Figure 3 shows measure changes before and during Intervention Phase 2.

Table 5. Data for CVD Prevention Measures Over Time-Phase 2

	Statin Prescription for Primary Prevention		Hypertension Diagnosis		Controlled Hypertension		Controlled Blood Pressure		Non-smoking among Ever Smokers	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Time	0.045	<0.001	-0.598	0.99	-0.931	<0.001	-0.817	<0.001	0.026	0.22
Time X Intervention*	1.060	<0.001	1.051	<0.001	2.085	<0.001	1.375	<0.001	0.018	0.35

*Time by intervention indicates the difference in slope comparing baseline to intervention.

Figure 3: Changes in CVD Prevention Measures in RA Patients Over Time, Phase 2 (12/2016-6/2017)



Limitations: There are several limitations that should be noted. Since some members of the cohort had external primary care clinicians, some data about risk factor measurements or medications may be missing. We attempted to capture some clinical actions that took place outside of this health system during calls by the care manager but we expect that not all data was captured. Because this was an uncontrolled study, other temporal factors could have affected our results. We did see stable values (rates of increase that were not significantly different from zero) in the measures we used during the initial baseline time period before the implementation of the Phase 1 interventions, with the exception of a slowly increasing overall statin treatment rate before the intervention began, which might reflect changes in CV risk management due to the ACC/AHA recommendations published in 2014.[13] The method of blood pressure measurement in this rheumatology clinic changed during the study period when automated blood pressure machines were introduced. Since there was a documented increase in average blood pressure in the cohort at that time point, it is quite possible that this clinical practice change limited our ability to detect favorable effects of the intervention on the blood pressure measures we examined. Finally, these data were collected at a single academic rheumatology practice, limiting

their generalizability, although the clinical decision support prompts could potentially be implemented in any practice with a comprehensive EHR.

Implications: We used the EHR to identify patients with elevated CVD risk and modifiable targets for CVD prevention, as well as patients whose CVD risk factors were unmeasured. With the implementation of interventions that included clinician education, point-of-care clinical decision support, performance feedback to clinicians and care management, we observed significant improvement in risk factor measurement compared to the pre-intervention period. Overall statin use increased over the course of the intervention but the difference was not statistically significant and the rate of statin use for primary prevention in patients with ASCVD risk of ≥5% did not increase. Additionally, the study intervention did not improve blood pressure control, hypertension diagnosis, or smoking cessation during the initial intervention period. These findings are not surprising given that most studies demonstrated lower levels of identification and management of cardiovascular risk factors in RA patients indicating that there are likely to be barriers to appropriate management in RA patients.[2,6-9, 21]

Through a survey of rheumatology clinicians in this practice, we determined that rheumatologists overwhelmingly felt that it was their responsibility to discuss CVD risk with their patients. However, the rheumatology clinicians indicated that CVD risk factor treatment was best overseen by primary care providers. Nearly all rheumatology respondents favored a care manager automatically referring their patients with uncontrolled risk factors to generalists without their involvement. These findings are in line with previous work showing that while rheumatologists are aware of CVD risk in RA, they prefer not to manage treatment of CVD risk factors given perceived role boundaries.[22] The results of our survey indicate that risk factor management could potentially be addressed through improved coordination of care with the primary care physician. These combined findings led us to adopt a more active care management strategy as our Phase 2 intervention. Through this more proactive approach to getting RA patients to address uncontrolled ASCVD risk with their PCPs, we did observe meaningful increases in statin prescribing and some suggestion of an impact on hypertension measures.

6. List of Publications

Journal articles

Majka DS, Lee JY, Peprah YA, Lipiszko D, Friesema E, Ruderman EM, Persell SD. Changes in Care after Implementing a Multifaceted Intervention to Improve Preventive Cardiology Practice in Rheumatoid Arthritis. *Under review*

Majka DS, Lee JY, Peprah YA, Lipiszko D, Ruderman EM, Persell SD. Changes in Preventive Cardiology Care Through Implementing Care Management in Rheumatoid Arthritis. *In preparation*

Persell SD, Lee JY, Peprah YA, Lipiszko D, Ruderman EM, Majka DS. Effects of Changing to Automated Blood Pressure Measurement in Clinical Practice: Implications for Clinical Care and Measured Quality. *In preparation*

Abstracts

Majka DS, Ruderman EM, Lee JY, Friesema E, Persell SD. Prevalence of Unassessed and Uncontrolled Cardiovascular Disease Risk Factors Among Rheumatoid Arthritis Patients in an Academic Rheumatology Practice. Arthritis & Rheumatology 2015;67:1888-1889.

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