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Quality Improvement Initiatives in Rheumatology: An Integrative Review of the Last Five Years

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Abstract

Purpose of review: We reviewed recent quality improvement (QI) initiatives in the field of rheumatology to identify common strategies and themes leading to measurable change.

Recent findings: Efforts to improve quality of care in rheumatology have accelerated in the last five years. Most studies in this area have focused on interventions to improve process measures such as increasing the collection of patient reported outcomes (PRO) and vaccination rates, but some studies have examined interventions to improve health outcomes. Increasingly, researchers are studying electronic health record (EHR)-based interventions, such as standardized templates, flowsheets, best practice alerts (BPAs), and order sets. EHR-based interventions were most successful when reinforced with provider education, reminders, and performance feedback. Most studies also redesigned workflows, distributing tasks among clinical staff. Given the common challenges and solutions facing rheumatology clinics under new value-based payment models, there are important opportunities to accelerate QI by building on the successful efforts to date. Structured QI models such as the Learning Collaborative may help to disseminate successful initiatives across practices.

Summary: Review of recent QI initiatives in rheumatology demonstrated common solutions, particularly involving leveraging health IT and workflow redesign.

Keywords

Quality improvement; process improvement; quality measure; learning collaborative

Introduction

The publication of the Institute of Medicine's (IOM) report *Crossing the Quality Chasm: A New Health System for the 21st Century* in 2001 shed light on the widening gap between ideal and actual practice in American medicine(1). The report highlighted the need to restructure the healthcare system to provide higher quality, safer care. Based on the IOM's recommendations, there has been increasing attention on incorporating quality improvement (QI) into medical practice. Systems-based practice is now an integral part of medical

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Conflicts of interest
None

training, as mandated by the Accreditation Council for Graduate Medical Education (ACGME), the American Board of Internal Medicine (ABIM), and the American Board of Medical Specialties (ABMS). Quality measures are also increasingly tied to payment models as evident by Merit-Based Incentive Payment System (MIPS) and Advanced Alternative Payment Models (APMs).

The increasing focus on QI is especially timely in the field of rheumatology as we face critical workforce shortages and unequal geographic coverage, making it more important than ever to coordinate care, improve communication and develop innovative models to increase rheumatology's reach(2). Given escalating medical costs in the United States and limited resources for QI, efforts should be concentrated on evidence-based interventions. To our knowledge, there has not been a comprehensive review to examine the effectiveness of QI interventions in rheumatology.

To fill this gap, we summarize recent QI efforts in rheumatology from 2013 to 2018, identifying effective interventions to improve performance on quality measures and disseminate best practices. We also discuss the challenges facing current QI initiatives and develop an agenda for improving rheumatologic care moving forward.

Methods

We performed a literature search using Pubmed, EMBASE, and Web of Science databases from 2013 to 2018 using search terms listed in the Appendix. We identified a total of 264 unique entries which were reviewed independently by two reviewers (LHL, SC), with any discrepancy resolved after discussion. Studies were included if the selected quality measure and the QI interventions were clearly described. QI performed in pediatric rheumatology practices was also included. We excluded review articles, position statements, and studies that did not have clear interventions described or were done in primary care or orthopedic clinics. A total of 28 studies were included and summarized in Tables 1 and 2.

Selected Quality Measures in Rheumatology

In Donabedian's Model of Quality, measures can be categorized as structural, process, or outcome measures(3). Structural measures quantify the resources of a practice setting, such as the number of rheumatologists in a clinic. Process measures describe whether patients have received recommended care. The majority of quality measures in rheumatology are process measures, such as measuring rheumatoid arthritis (RA) disease activity using a standardized instrument, screening for serious infections like tuberculosis prior to biologic drug initiation, or the prescription of particular pharmacotherapies(4). Outcome measures have been more challenging to develop, although work is underway to develop such measures for RA(5). Intermediate outcome measures, such as treating individuals with gout to a target serum urate level, are currently in use(6). Patient activation, defined as patient's engagement in their own health, is also becoming a crucial focus of QI as healthcare systems become more patient-centered.

Among the 28 studies examined in our review, the majority selected a process measure as their primary target for improvement. About a third describe interventions to increase the

collection of standardized outcome measures in RA patients, including disease activity (Simple Disease Activity Index, Clinical Disease Activity Index, Routine Assessment of Patient Index Data 3, Disease Activity Score, Patient Activity Scale), and functional status (versions of the Health Assessment Questionnaire and Patient-Reported Outcome Measurement System)(7-15). Given that many individuals seen in rheumatology practice require immunosuppression, process measures targeting infection prevention strategies, such as immunization rates for pneumococcal disease, have also been a major area of interest(14,16-21). Other interventions have targeted contraception counseling(22,23), routine screening for cardiovascular risk factors in rheumatology patients(24-26), disease monitoring(20,27,28), routine laboratory screening prior to administration of high risk medications(29,30), prescription of calcium and vitamin D in patients on chronic glucocorticoid(31), and patient activation(32,33) (Table 1 and 2).

Very few studies examined actual impact on patient outcomes. Of the 28 studies, only three assessed both process and outcome measures. Sheth et al's study used physician education and electronic best practice alerts to increase the rate of herpes zoster vaccination. This combination of interventions increased vaccination from 10% to 52%, and demonstrated a decrease in herpes zoster infection rate: the intended patient outcome(17). Similarly, Sadun et al's study went beyond measuring contraception counseling and documentation, taking the step to measure unintended pregnancy(22).

The most notable QI initiative focusing on outcome measures is Pediatric Rheumatology Care and Outcomes Improvement Network's (PR-COIN's) effort to increase disease remission in juvenile idiopathic arthritis. Through engagement with stakeholders and multiple iterations of change, PR-COIN developed a Population Management Tool to identify high-risk patients in the patient registry as well as streamlining pre-visit planning. As a result, participating sites were able to increase the percentage of patients in clinical remission from 37.2% to 48.4%(12). Though the improvement percentages are less drastic compared to more focused quality measures such as vaccination rate, the study is novel in improving a meaningful disease outcome.

Notably missing from almost all studies is the demonstration that QI interventions can lead to cost-effective care, a key aspect of QI effort in other fields. Newman et al's study on the use of Rheum-PACER, an EHR tool displaying aggregated patient data, is the only study that evaluated cost(33). They were able to show that Rheum-PACER increased physician productivity as measured by relative value units (RVU's). While cost-effectiveness is not required for a QI initiative to be considered successful, quantifying cost can help garner more support for QI from an administrative leadership and health policy perspective. QI measures in other specialties such as hospital medicine(34), primary care(35), and post-operative care(36) have shown impressive increases in cost-effectiveness, and it will be important for rheumatology to consider and develop methods to evaluate such endpoints in the future.

Common QI Interventions

Although the quality measures examined varied between studies, common themes emerged from the evaluated interventions. Almost all studies included physician and staff education, but education was always integrated with changes to practical processes, including clinical workflow. The strategies used in these multi-modal initiatives corroborate the results of a systematic review demonstrating that continuing medical education alone resulted in only a modest change in physician practice, especially for more complex behavior changes(37). Only one of the studies we reviewed implemented provider education and verbal reminders without other major changes to clinical workflow(27), resulting in relatively limited quality improvement gains. Across studies, the most common workflow intervention was optimizing the EHR to facilitate rheumatology chronic care. Only two studies implemented patient-focused tools aimed at improving patient activation. The interventions were implemented throughout the entire course of a patient encounter, as summarized in Figure 1.

Documentation Capacity Within the EHR.

A structured data field is a data element in an EHR that is implemented to accept simple data formatted in a standardized way. This data can then be more easily retrieved for data analysis(38). One example is a structured data field documenting Clinical Disease Activity Index (CDAI) that only accepts numerical inputs between 0 to 76. Two of the studies built similar data fields in the form of an EHR flowsheet, which documented and displayed trends in disease activity measures over time(11,20). Implementing structured data fields was critical in allowing rapid data collection and analysis in these studies.

When building a structured data field is not possible, studies have used EHR templates to help standardize documentation. EHR templates can serve as a reminder to physicians to document critical data during their patient encounter. In our review, two studies used standardized EHR template to increase RAPID3 documentation in more than 90% of RA visits(9,10). Other subspecialties have shown that standardized EHR templates can improve adherence to evidence-based guidelines and improve quality of care(39-41). EHR templates are also easier to modify compared to built-in structured data fields, making it possible to adapt rapidly to new guidelines.

Best Practice Alerts

Electronic Best Practice Alerts (BPA) can be especially helpful as reminders for infrequent actions, such as pneumococcal vaccination, which only needs to be administered once or twice in a patient's lifetime. The Sheth et al study on improving herpes zoster vaccination used BPAs thoughtfully, preemptively disabling the alert if a patient discusses vaccination with the medical assistants and receives it prior to seeing the physician(17). This strategy reduces alert fatigue, where frequent alerts lead to desensitization and eventually complete disregard for the alert.

Order Sets

Order sets bundle appropriate care and streamline repetitive tasks, demonstrably improving adherence to best practices in rheumatology. Hayward et al used this approach to increase

pregnancy screening prior to cyclophosphamide administration. By bundling cyclophosphamide and urine pregnancy test, Hayward et al achieved 100% screening rate¹⁹. Order sets can also facilitate the ordering of appropriate labs and vaccinations(18,24), or encourage prescription of related medications, such as the prescription of calcium and vitamin D for patients on long-term glucocorticoids(31).

Integration of EHR-based Tools in Clinic Workflow

While EHR-based tools can seem like a quick fix for teams with access to technical resources, they may not be sufficient to change practice patterns. The most successful QI interventions make significant modifications to the broader clinic workflow in addition to EHR-based tools. By having medical assistants help screen and pend orders during the intake process, tasks are more likely to be completed and improvement efforts are more likely to be sustained(19). If clinic workflow is fundamentally problematic, even a well-designed, comprehensive EHR based decision support tool may not lead to significant improvements(26).

Patient-Focused Interventions

Gossec et al designed an interactive website allowing RA patients to monitor their disease activity, but only had small improvement in patient-physician interaction(32). Similarly, Rheum-PACER helps patients track display disease activity over time, but did not increase patient activation(33). Increasing patient participation in the design of patient-focused tools may be helpful in improving patient activation.

National Efforts to Measure and Improve Quality

The Medicare Access and CHIP Reauthorization Act (MACRA) of 2015 signals Medicare's transition from fee-for-service to a pay-for-performance model. Under MACRA, the Merit-Based Incentive Payment System (MIPS) provides incentive payments for physicians who provide high quality care. The submission of quality data can be done through an EHR or a Qualified Clinical Data Registry (QCDR); QCDRs are national registries approved by the Centers for Medicare & Medicaid Services (CMS) to collect, analyze, and report quality measures for MIPS physicians.(42) QCDRs not only measure quality on a national basis, but also provides performance feedback for individual physicians or practices. The frequent measurement of quality metrics can be a challenging part of a QI initiative, especially if there are no local resources dedicated to data extraction, but QCDRs can help support QI initiatives by streamlining the data collection process.

The Rheumatology Informatics System for Effectiveness (RISE) Registry is a QCDR that passively extracts and uploads patient data to a centralized database, where it is aggregated and analyzed(43). Participating practices can access a dashboard displaying performance on MIPS quality measures(44), which can then be used to assess the effects of the QI initiative. Thoughtful application of RISE data may eliminate the need for chart review, EHR query generation, and data analysis, accelerating QI cycles with more rapid feedback. In fact, practices using RISE to report measures to the MIPS program all met MACRA's "Exceptional Performance" threshold(45). In Sweden, the national healthcare quality

registry is becoming an integral part of local QI initiatives (46). The Danish national registry for rheumatologic diseases, DANBIO, initiated a national QI effort by providing alerts to rheumatologists for RA patients with high disease activity, prompting them to intensify disease treatment(47). When used appropriately, national healthcare quality registries can powerfully inform local QI efforts.

Novel Approach to QI: Learning collaborative

The Learning Collaborative (LC) is a new QI model developed specifically to accelerate QI efforts and disseminate best practices. Based on the Institute for Healthcare Improvement (IHI)'s Breakthrough Series, the LC encourages separate organizations to work closely together under the guidance of faculty experts to develop shared solutions to QI issues(48). LC's in other subspecialties have successfully reduced the rate of C-sections and hospital-acquired infections, improved post-operative outcomes and care of chronic diseases, among other important health care outcomes(49).

Pediatric rheumatology has had extensive experience with the LC model through PR-COIN. Established in 2011, PR-COIN uniquely brings together a network of stakeholders, including pediatric rheumatologists, nurses, physical therapists, and parent representatives across multiple institutions to improve care in pediatric patients with juvenile idiopathic arthritis. Through extensive, iterative collaboration, PR-COIN develops and implements new assessment tools and treatment algorithms involving pre-visit planning, population management, self-management, shared decision-making, and patient/parent engagement. For example, the Barrier Assessment Tool (BAT) was developed to assess medication adherence(50). A centralized patient registry allows rapid feedback of quality measure performance for each site(51). This organization illustrates the advantages of a LC model, where collective efforts can have more far-reaching impact than individual initiatives.

Solomon et al's TRACTION study (Treat-to-target in RA: Collaboration To Improve adOption and adhereNce) was the first to apply the LC model to adult rheumatology(13,52). The primary endpoint in the study was a composite score that included the components of treat-to-target (TTT): the documentation of RA disease activity, disease activity goal, applying disease activity to treatment decision, and shared-decision making. Study sites underwent quarterly structured learning sessions and monthly webinars, where they learned improvement strategies from faculty experts and other successful sites. Solomon et al were able to demonstrate an impressive 46% increase in TTT documentation in a 9-month period. While TRACTION was not designed to be a sustained effort, it demonstrated that a LC model can be an effective strategy in adult rheumatology for dissemination of best practices.

Future Directions

Data collection in QI studies continues to be challenging, especially for unstructured and complex data. While structured data fields can be built for individual quality measures, this often increases health care team's documentation burden. Advanced technologies already in use in the tech industry such as natural language processing (NLP) offer promise in their ability to extract clinical data from narrative notes(53,54), possibly amplifying the scale and

potential of EHR-based quality measurement. However, rheumatologists will need to share knowledge and increase collaboration with computer scientists and the tech industry in order for technologies like NLP to undergo adequate development for clinical use.

Conclusion

We found a growing literature on QI initiatives in rheumatology over the last 5 years. While most initiatives addressed process measures, several studies sought to demonstrate improvement in patient outcomes. QI interventions are increasingly implementing EHR-based tools, but those that were most successful coupled EHR modifications with clinical workflow redesign and interprofessional team engagement. Despite institutional differences in resources, systems, and culture, our review found that common solutions have been developed for the same quality problems. Dissemination of these solutions to rheumatology practices remains a challenge, although new QI models such as the Learning Collaborative have had significant success in allowing teams to share common solutions and to improve quality. Building on the success of LCs such as PR-COIN and TRACTION, development of a LC in adult rheumatology is underway. Future work should engage rheumatologists in collective QI initiatives using models such as the LC, and carefully study the impact of participation on patient outcomes.

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Appendix

Search strings used in each database are listed below.

Pubmed

(rheumatology OR rheumatic OR rheumatoid OR lupus OR arthritis OR gout OR osteoporosis OR osteopenia) AND (quality improvement OR patient safety) AND (electronic health record OR electronic medical record OR text mining OR natural language processing OR collaborat*)

Embase

((rheumatology OR rheumatic OR rheumatoid OR lupus OR arthritis OR gout) AND (quality improvement OR patient safety) AND (electronic health record OR electronic medical record OR text mining OR natural language processing OR collaborat*))

Web of Science

((rheumatology OR rheumatic OR rheumatoid OR lupus OR gout OR arthritis) AND quality improvement AND (electronic health record OR electronic medical record OR text mining OR natural language processing OR collaborat*))

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Key Points

- Quality improvement should be an integral part of any rheumatology practice.
- Common targets for quality improvement in rheumatology include improving vaccination rates, collection of patient-reported outcomes, cardiovascular risk assessments, contraception counseling and use, disease monitoring, and baseline screening prior to administering high risk medications.
- Successful quality improvement initiatives integrate electronic health record-based tools with clinic workflow modifications.
- The Learning Collaborative is a new model that has potential to spread successful QI initiatives across rheumatology practices nationally.

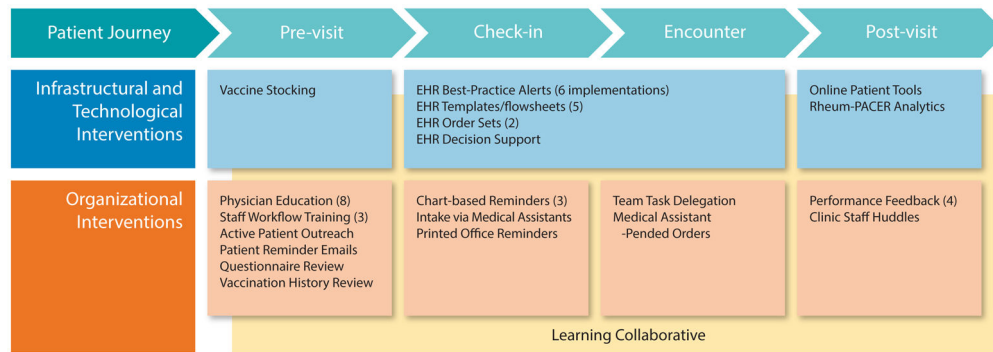


Figure 1. QI Interventions Targeting Different Stages of Patient Encounter. This diagram depicts QI interventions in relations to a patient encounter, and the number of studies that employed these interventions. Infrastructural and Technological Interventions are resource-intensive, whereas Organizational Interventions require redistribution of existing resources. A Learning Collaborative may include QI interventions at all stages of a patient encounter.

Table 1. Summary of QI Interventions and Outcomes in Adult Rheumatology Published Between 2013 and 2018

Author	Outcome Measure	Type of Measure	Domain	Intervention	Findings
Majka 2018	Cardiovascular disease risk factor assessment and management	Process	Population/public health	- Clinician Education - EHR best practice alerts and linked order sets - Provider performance feedback - Previsit planning	- Increase in CVD assessment from 53% to 72% - No change in risk factor management and control
Sadun 2018	- Documentation of contraception use - Documentation of contraception counseling - Provider action after counseling - Unintentional pregnancy	Process Outcome	Patient Safety	- Provider education - EHR template modification - Provider reminders - Patient screening questionnaire	- Documentation of contraception use increased from 46% to 64% - Documentation of counseling increased from 30% to 45% - Interventions after counseling increased from 33% to 46%
Solomon 2017, 2016	Treat-to-target (TTT) implementation score	Process	Clinical process/effectiveness	Learning Collaborative model	Improvement in TTT implementation score from 11% to 57%
Aguire 2017	- PCV 13 vaccination - CDAI measures in RA patients	Process	Population/public health	Nurse-led chart reminders	- Increase in PCV13 vaccination from 0.6% to 85% - Increase in CDAI documentation from 45% to 91%
Akenoye 2017	Improving cardiovascular screening in RA patients	Process	Population/public health	EHR-based reminder and decision support tool displaying CVD risk assessment	No impact on CVD screening
Gossec 2017	Patient reported Perceived Efficacy in Patient-Physician Interactions (PEPPI-5) questionnaire in RA patients	Process	Patient/family engagement	Use of online self- assessment and monitoring tool	No clinically significant difference in patient satisfaction
Jayasundara 2017	Documentation of RAPID3 (Routine Assessment of Patient Index Data 3)	Process	Clinical process/effectiveness	- Provider education - EHR template modification - Reminder emails to providers	- Increase in RAPID3 documentation in 93% of RA visits - Slight increase in remission/low disease activity patients from 27% to 34%
Liu 2017	Collection of Patient-Reported Outcomes Measurement Information System (PROMIS) Physical Function-10a score in RA patients	Process	Clinical process/effectiveness	-Clinic workflow modification	Increase PROMIS PF10a collection from 13% to 36%
Sheth 2017	- Herpes zoster vaccination rates in RA patients on immunosuppressive therapy - Zoster infection rate	Process Outcome	Population/public health	- Physician education - Electronic best practice alert	- Improvement in vaccination rate from 10% to 52% - Decrease in herpes zoster infection rate
Baker 2016	Vaccination rate for RA patients on immunosuppressive therapy (influenza, pneumococcus, zoster)	Process	Population/public health	- Electronic reminders - Order sets - Provider performance feedback - Patient outreach	- Improvement in pneumococcal vaccination rate from 29% to 46% - Improvement in zoster vaccination from 2.5% to 4.5% - No change in influenza vaccination (already high)
Bays 2016	PCV 13 vaccination	Process	Population/public health	- Provider education - Clinic workflow modification	Increase in PCV13 vaccination from 12 to 52%

Author	Outcome Measure	Type of Measure	Domain	Intervention	Findings
Bays 2016	Collection of disease activity measure for RA patients	Process	Clinical process/effectiveness	<ul style="list-style-type: none"> - Identification of RA patients prior to visit - Medical assistants hand out forms - Design of patient and physician forms 	Increase in disease activity measures from 24% to 85% in 27 weeks
Ichijui 2016	Hepatitis B screening and prophylaxis prior to immunosuppression	Process	Patient safety	<ul style="list-style-type: none"> - Developed screening and prophylaxis resources - EHR alert 	No post-intervention results reported
Wells 2016	Documentation of RAPID3 in RA patients	Process	Clinical process/effectiveness	<ul style="list-style-type: none"> - EHR template modification - Provider education 	- Increase in RAPID3 documentation from 65% to 90%
Bhalla 2016	Percentage of female patients on teratogenic medications using effective birth control	Process	Patient safety	<ul style="list-style-type: none"> - Standardizing documentation tools and EHR templates - Alerts - Nurse-led education 	No outcomes reported
Newman 2015	<ul style="list-style-type: none"> - Productivity - Patient satisfaction 	Process	Patient/family engagement	<ul style="list-style-type: none"> - Rheum-PACER program displaying disease activity, patient-reported outcome, and social history - User training 	<ul style="list-style-type: none"> - Increase physician productivity measured by RVU (relative value units) per RA visit - No impact on patient satisfaction, patient activation, or adherence
Pennant 2015	Pneumococcal vaccination in subspecialty clinics	Process	Population/public health	<ul style="list-style-type: none"> - Review and documenting vaccination history by ancillary staff 	<ul style="list-style-type: none"> - Improvement in pneumococcal vaccination rate from 50% to 87% - Patient letters - Provider reminders - Monthly emails to division leadership - Quarterly presentations to ancillary staff to review and reinforce process improvement
Chernitskiy 2014	CDAI documentation	Process	Clinical process/effectiveness	<ul style="list-style-type: none"> - EHR flowsheet documenting CDAI and DAS28-ESR components - Provider performance feedback 	<ul style="list-style-type: none"> - Improvement in CDAI documentation from 57% to 81% - Improvement in DAS28-ESR documentation from 22% to 40%
Komarfa 2014	Hyperlipidemia screening in RA patients	Process	Clinical process/effectiveness	<ul style="list-style-type: none"> - Online survey assessing physician attitudes towards lipid screening - Provider reminders 	- Improvement of lipid screening from 50% to 70%
Mustafa 2014	Antiphospholipid antibody screening in SLE patients	Process	Clinical process/effectiveness	<ul style="list-style-type: none"> - Provider education - Verbal reminders 	Improvement of APL antibody screening from 64% to 77%
Kohler 2013	Increasing prescription of calcium/vitamin D supplements in patients on long-term glucocorticoid	Process	Clinical process/effectiveness	<ul style="list-style-type: none"> - Order set linking calcium/vitamin D to glucocorticoid prescription at least 2 weeks 	<ul style="list-style-type: none"> - Increase in number of calcium prescriptions from 37% to 49% - Increase in number of vitamin D prescriptions from 38% to 53%

Summary of QI Interventions and Outcomes in Pediatric Rheumatology Published Between 2013 and 2018

Table 2.

Author	Outcome Measure	Type of Measure	Domain	Intervention	Findings
Favier 2018	Percent of pediatric JIA patients who completed Barrier Assessment Tool (BAT)	Process	Patient/family engagement	- Learning Collaborative model	Favier 2018
Wojcicki 2016	- Improving vaccination - Annual eye exam for patients with childhood SLE - Documenting patient education in these areas	Process	Population/public health	- EHR flowsheet documenting quality measures for cSLE patients - Provider reminders	Improvement in immunization rate and eye exam
Harris 2015	Improving rate of PCV 13 and 23 vaccination	Process	Population/public health	- Provider education - Stocking of vaccines at the clinic - Weekly previsit planning and review of vaccine history by ancillary staff - Weekly reminder emails to providers - Reminders on clinic encounter forms	- Improvement in PCV13 rate from 7% to 48% - Improvement in PCV23 rate from 9% to 28%
Hayward 2016	Urine pregnancy test prior to initiation of IV cyclophosphamide	Process	Patient safety	- Provider education - Electronic order set linking cyclophosphamide order to urine pregnancy test - Provider education	100% screening rate post-intervention
DeWitt 2014	Rate of remission in JIA patients	Outcome	Clinical process/effectiveness	- Learning Collaborative Model	Improvement in clinical remission from 37% to 48%
Oliver 2013	Rate of uveitis screening in JIA patients	Process	Clinical process/effectiveness	- Learning Collaborative Model - Uveitis screening tool	- Improvement in documentation of uveitis screening from 27% to 46% - No improvement in patient self-report of compliance