

Improving outpatient care in adult inflammatory bowel disease: effect of implementation of a reminder checklist in the electronic health records (IBD-ERS)—a pilot study

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ABSTRACT

Studies have shown that patients with inflammatory bowel disease (IBD) do not receive age appropriate preventive care services at the same rate as the general population. Providers extract information on preventive measures compliance by chart review, discussion with patients or deferment to primary care providers to ensure and document compliance. The aim of this pilot study was to evaluate the effectiveness of our standardised template which was incorporated in the electronic health records in order to provide the highest quality of clinical care and improve efficiency. We compared the outcomes before and after implementation of the template. In our preimplementation phase, we performed retrospective single-centre chart review of all patients diagnosed with IBD and treated with an immune modulator therapy between years January 2015–December 2016 and December 2019–July 2020. Preventive care measures included influenza and pneumonia, smoking cessation, checking thiopurine methyltransferase (TPMT) enzyme activity prior to starting thiopurines, screening for hepatitis B status, and tuberculosis (TB) testing prior to starting anti-TNF therapy. A total of 200 patients were included. Prior to the template implementation, manual extraction of data showed about 43% and 31% of the patients with IBD received influenza vaccination in 2015 and 2016, respectively. There were 40.9% who received pneumococcal vaccination, 57.5% with TPMT activity prior to thiopurine use, 60% had hepatitis B testing and only 12.5% had documented TB test. Post intervention, there was a significant increase in vaccination rates with 93.1% and 87.6% received influenza and pneumococcal vaccination, respectively ($p<0.0005$). About 94.7% had TPMT activity, 96.8% had hepatitis B and 98.9% had TB test completed ($p<0.0005$). The average time (minutes) to obtain information for each patient decreased from 12.27 to 4.62. Our study demonstrated a significant improvement in documented immunisation rates and quality of preventive care after implementation of standardised template.

INTRODUCTION

Inflammatory bowel diseases (IBD) are a spectrum of immune mediated, chronic

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Although guidelines and quality measures for inflammatory bowel disease (IBD) care highlight the importance of preventive care, their uptake remains variable with majority of the patients with IBD not receiving optimal preventive care services.

WHAT THIS STUDY ADDS

⇒ Implementation of a simple electronic reminder checklist of IBD quality measures improved provider efficiency and preventive care of the adult patients with IBD in the outpatient setting.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study emphasises the integration of quality measures through utilisation of electronic health records for improving care in patients with IBD.

inflammatory conditions primarily affecting the gastrointestinal tract. Goals of treatment include induction and maintenance of remission, mitigation of potential treatment related adverse effects, and appropriate preventive care. Previous data suggest that patients with IBD do not receive preventive services at the same rate as the general population.¹ The American Gastroenterological Association (AGA) developed accountability measures that are now part of the Medicare and Medicaid Services pay-for-performance program.² The Crohn's & Colitis Foundation (CCF) also recommends guidelines and outcome measurements for adult patients with IBD. These recommendations include vaccinations, therapy-related testing, and other preventative measures that aim to reduce variations of care, encourage standardised outcome measurements and to provide the highest quality of care for patients with IBD.³

We hypothesised that using an electronic checklist version of the IBD quality measures, integrated into the workflow of an existing electronic health records (EHR) system, will improve the quality of care of the adult patient with IBD by providing a real-time reminder of practice guidelines at the time of the clinic visit. We evaluated the impact of this intervention by comparing outcomes of selected guidelines, before and after incorporation of the checklist into the EHR.

METHODS

We conducted a retrospective cohort study at a single tertiary care IBD centre. Data on quality of healthcare measures in adult patients with IBD were extracted from the EHR. All adult patients (age>18 years) with a diagnosis of IBD, treated with immunosuppressive therapy (biologics, thiopurine analogues, and/or small molecules), were included. Only patients who followed with an IBD provider were randomly selected for our study. A newly designed checklist based on selected guidelines, the Inflammatory Bowel Disease Electronic Reminder System (IBD-ERS), was incorporated into the institutional EHR (Cerner). Providers were given detailed step-by-step email instructions on how to access and use the checklist. The IBD-ERS checklist appears automatically for every patient encounter and could only be accessed by gastroenterology providers during the pilot study (online supplemental figure 1). Data were collected at baseline (5 January 2015–30 December 2016). To evaluate the impact of the IBD-EHR, we analysed a snapshot of data after implementation (10 December 2019–30 July 2020) on randomly selected patients seen in the IBD centre during those time periods. We opted for this approach because we wanted to assess the overall impact on the patients with IBD instead of limiting to a group of select patients in a study setting. Patient characteristics and clinical data were extracted from the EHR. In addition to demographic data on age and ethnicity, data were collected on the following:

1. vaccination status and recommendations for influenza and pneumonia vaccines,
2. thiopurine methyltransferase (TPMT) enzyme activity status prior to thiopurine use,
3. hepatitis B and tuberculosis (TB) screenings prior to initiating anti-TNF therapy and other biologics/small molecules,
4. recommendation for smoking cessation,
5. bone health screening in high-risk individuals (including assessment of serum vitamin D level and recommendation for a DEXA scan to assess bone mineral density) and
6. Surveillance colonoscopies for colon cancer.

The primary objective of this study was to improve the care of the adult patient with IBD by using the EHR as a tool to enhance the delivery of the recommended outpatient adult IBD quality measures. A secondary objective was to improve provider efficiency, by comparing the mean time

it took to obtain this documented information from the EHR before and after the template implementation.

Descriptive statistics, χ^2 analysis, and Wilcoxon rank sum tests were performed for statistical comparisons as appropriate using SPSS Software V.27. A p value of <0.05 was determined to be statistically significant unless stated otherwise below.

RESULTS

Demographic and clinical characteristics

A total of 200 patients were included in the study, 100 each in the preimplementation and postimplementation cohorts. The mean age, age at disease (IBD) onset, body mass index, vitamin D levels, gender, other medical comorbidities such as chronic heart disease, chronic kidney disease, diabetes mellitus, chronic liver disease, and chronic alcoholic use were similar between the two groups. The cohorts were also similar in their use of anti-TNF alpha therapy and anti-integrin receptor treatment but a higher proportion of interleukin-12/23 antagonist use was present in the postintervention group (table 1). A majority (95%) of the patients were Caucasian, and there was a higher percentage (75%) of patients with Crohn's disease in the preintervention group.

Assessment of provider adherence to guidelines and outcomes

There were statistically significant differences among several quality measures between the two groups (table 1). Prior to template implementation, and using manual extraction of data, 30.9% and 40.9% of the patients with IBD received influenza and pneumococcal vaccinations, respectively. TPMT enzyme activity prior to thiopurine use was checked in 56% of patients, 60% had hepatitis B screening and only 12.5% had documented TB screening (table 1). Post intervention, there was a significant increase in documented parameters-vaccination rates (68% for influenza and 67% for pneumococcal vaccinations, respectively), TPMT activity assessment (94.7%), hepatitis B screening (96.8%), completion of vitamin D serum levels and DEXA scans (96%–77%), smoking cessation counselling (100%) and TB screens (98.9%) (figure 1).

There was no statistically significant change in the preintervention and postintervention data for colon cancer screening ($p<0.73$). In addition, the median time to extract information for each patient decreased from 12 to 5 min ($p<0.00001$).

DISCUSSION

IBD-ERS is a simple electronic checklist developed from the recommended outpatient adult IBD guidelines, from the AGA and CCF, and incorporated into our EHR system in conjunction with our information technology team at the Penn State Hershey Medical Center (online supplemental figure 1). Our study demonstrated that the utilisation of a simple checklist, IBD-ERS, within the workflow of the

Table 1 Comparison of patient demographics and preventive healthcare outcomes before and after implementation of the standardised template

Variables	Preintervention n=100	Postintervention (after 6 months use) n=100	P value
Demographics and comorbidities			
Mean age±SD	40.64±13.93	39.92±15.04	0.71
Mean age of onset±SD	26.10±12.23	27.66±13.60	0.38
Female, n	55 (55%)	54 (54%)	0.88
Race, n*			
Caucasian	95 (95%)	83 (83%)	0.006
Other (Asian, African-American)	5 (5%)	17 (17%)	
Body mass index (BMI), kg/m ² mean±SD	28.22±6.62	28.98±7.42	0.45
Family history of IBD, n	39 (39%)	35 (35%)	0.55
Surgery (total or partial colectomy), n	41 (41%)	33 (33%)	0.24
Steroid use, n	22 (22%)	17 (17%)	0.37
Comorbid conditions, n			
Chronic heart disease	8 (8%)	2 (2%)	0.05
Chronic kidney disease	4 (4%)	1 (1%)	0.17
Diabetes mellitus	3 (3%)	4 (4%)	0.70
Chronic liver disease	2 (2%)	3 (3%)	0.65
Chronic lung disease*	0	6 (6%)	0.01
Chronic alcohol abuse	3 (3%)	0	0.08
Type of immunotherapy			
Oral 5-aminosalicylic acid, n	29	12	
Immunomodulators, n	33	19	
Anti-TNF alpha therapy, n	55	53	
Integrin receptor antagonists, n	20	25	
Interleukin-12 and interleukin-23 antagonist n (%)	1	17	
Quality measures outcomes			
Positive smoking history*	14 (14%)	21 (21%)	0.02
Smoking cessation recommendation*	11 (76%)	21 (100%)	
Influenza vaccination received*	No: 3 (3%) Unknown: 66 (66%) Yes: 31 (31%)	No: 27 (27%) Unknown: 5 (5%) Yes: 68 (68%)	<0.00005
Influenza vaccination recommendation	Yes: 90 (90%) No: 10 (10%)	Yes: 95 (95%) No: 5 (5%)	0.17
PPSV 23 vaccination received*	No: 2 (2.4%) Yes: 34 (41%) Unknown: 47 (57%) n/a: 17	No: 24 (25%) Yes: 64 (67%) Unknown: 8 (8.3%) n/a: 4	<0.00005
PCV 13 vaccination received*	No: 2 (2.4%) Yes: 34 (41%) Unknown: 47 (57%) n/a: 17	No: 23 (24%) Yes: 64 (67%) Unknown: 9 (9.4%) n/a: 4	<0.00005
Pneumonia vaccine recommendation	Yes: 72 (87%) No: 11 (13.3%) n/a: 17	Yes: 86 (90%) No: 10 (10.4%) n/a: 4	0.55
TPMT enzyme activity*	Yes: 19 (56%) Unknown: 14 (42.4) n/a: 67	Yes: 18 (95%) Unknown: 1 (5.3%) n/a: 81	0.004
Hepatitis B screening*	Yes: 48 (60%) Unknown: 32 (40%) n/a: 20	Yes: 91 (97%) No: 3 (3.2%) n/a: 6	<0.00005
TB testing*	Yes: 10 (12.5%) Unknown: 70 (87.5%) n/a: 20	Yes: 93 (99%) No: 1 (1%) n/a: 6	<0.00005

Continued

Table 1 Continued

Variables	Preintervention n=100	Postintervention (after 6 months use) n=100	P value
DEXA scan recommendation	Yes: 34 (49%) Unknown: 36 (51.4%) n/a: 30	Yes: 50 (77%) No: 13 (20%) n/a: 35 Unknown: 2 (3%)	<0.00001
Colon cancer screening	No: 2 (2%) Yes: 97 (98%) n/a: 1	No: 1 (1.3%) Yes: 74 (98.7%) n/a: 25	0.73
Vitamin D documentation*	Yes: 83 (83%) No: 17 (17%)	Yes: 96 (96%) No: 4 (4%)	0.002

*P<0.05 signifies statistical difference.

IBD, inflammatory bowel diseases; PCV 13, Pneumococcal Vaccine 13; PPSV 23, Pneumococcal Polysaccharide Vaccine 23; TNF, tumour necrosis factor; TPMT, thiopurine methyltransferase.

EHR system, improved the documented care in the adult IBD population. For example, vaccination rates for influenza and pneumonia were significantly increased and to a higher degree than reported in previous studies.⁴ Screening for TB and hepatitis B also significantly improved. Prior to the checklist implementation, it took an average of 12 min, during a scheduled clinic visit, to manually extract/confirm documentation of the required guidelines from each patient

chart. Post checklist implementation, the average time it took to obtain information from each clinic visit decreased to under than 5 min. The use of IBD-ERS improved provider efficiency by centralising the information and provided a real-time checklist reminder within the workflow of the clinic visit.

Our study had some limitations. It is a retrospective chart review from a single academic centre and our results may not be generalisable. Some of our variables had unknown documentation status where the patients might have received it prior to the visit which can introduce recall bias. In addition, it is difficult to determine how much the preimplementation low rates of preventative care were in part due to difficulty extracting data from the HER or provider failure to document in the correct section in the EHR.

Despite the limitations, our study demonstrated that the integration of a quality measures checklist into our EHR system significantly improved several elements of care in our patients with IBD. Larger multicentre studies are needed to validate our findings.

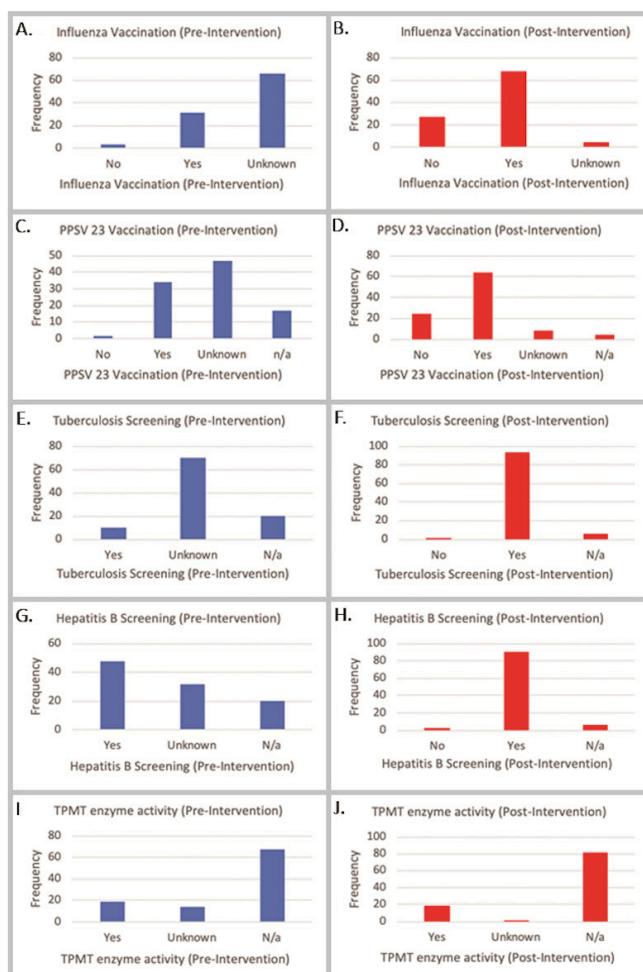


Figure 1 Comparison of Pre and post Intervention Preventive Measures.

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Contributors NB: initiation of concept, study design, manuscript writing, review, and editing. NV: data collection, analysis, interpretation of the data and writing of the manuscript. MC: data collection, review and editing of the manuscript. SD: review, editing and statistical review. EW: Data collection, review and editing of the manuscript. KC: study design, interpretation of the data, writing and reviewing the manuscript. KC is guarantor.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This is a retrospective study with chart extraction. This study was approved by the Penn State College of Medicine Institutional Review Board under protocol number 00013788.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information.

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A.

Allergies: Cipro, Flagyl, morphine, Remicade, ... Weight: (NONE) Med Dose Weight: (NONE in 31 Days) PORTAL: Invite Expired CommonWell: Not Enrolled

Menu ViewPoint Ambulatory View ED View Ambulatory Workflow Quick Orders - Gastroenter... + 0 No Severity Full screen Print 0 minutes ago

IBD Quality Measures

Add IBD Quality Measures

Annual Flu Vaccine	Pneumonia	Smoking Cessation	Vitamin D Measurement	Assessment of Bone	Steroid Sparing Therapy	Colon Cancer Screening	TPMT Enzyme Activity	TB Screening	Hepatitis B Screening
X	X	X	X	X	X	X	X	X	X

Consolidated Problems

All Visits Classification: All Add new as: Diagnoses

Home Medications (12) +

All Visits Medication Reconciliation Hc: acetaminophen (Tylenol 500 mg oral tablet)

Documents (1) +

All Visits: Last 18 months My Documents Note Type Author Date/Time

B.

IBD Quality Measures

Date of Next Colon Cancer Screening

- Reviewed and Complete
- Reviewed and Not Complete
- Not Applicable

Thiopurines

TPMT Enzyme Activity Request Order Placed

None Documented

TPMT enzyme activity checked prior to starting thiopurines

- Reviewed and Complete
- Reviewed and Not Complete
- Not Applicable

Biologics / Small Molecules / Other

T Spot Tuberculosis Test Request Order Placed

None Documented

TB Screening

- Reviewed and Complete
- Reviewed and Not Complete
- Not Applicable

Hepatitis B screening prior to initiating

- Reviewed and Complete
- Reviewed and Not Complete
- Not Applicable

Hepatitis B Results

02/06/2013 12:01	HBcAb	NONREACTIVE
02/06/2013 12:01	HBsAb	REACTIVE
02/06/2013 12:01	HBsAg	NONREACTIVE

C.

Allergies: NKA, No Known Medication Allergies Weight: (NONE) Med Dose Weight: (NONE in 31 Days) PORTAL: Yes HIE: (2) New

Menu ViewPoint Ambulatory View ED View Ambulatory Workflow Quick Orders - Gastroenter... + 0 No Severity Full screen Print 1 minutes ago

IBD Quality Measures

Add IBD Quality Measures

Annual Flu Vaccine	Pneumonia	Smoking Cessation	Vitamin D Measurement	Assessment of Bone	Steroid Sparing Therapy	Colon Cancer Screening	TPMT Enzyme Activity	TB Screening	Hepatitis B Screening
✓	⚠	⚠	✓	✓	✓	✓	✓	X	✓

Consolidated Problems

All Visits Classification: All Add new as: Diagnoses

Home Medications (15) +

All Visits Medication Reconciliation Hb: acetaminophen (Tylenol Arthritis Caplet)

Documents (12) +

All Visits: Last 18 months My Documents Note Type Author Date/Time

Supplementary Material- Figure Legend

Supplementary Figure 1. Inflammatory Bowel Disease Electronic Reminder System (IBD-ERS)

A. Patient profile page showing incomplete IBD Quality Measures; B. IBD Quality Measures documentation page: **Note:** Our template pre-populates existing data (hepatitis B results) if it is completed already; If a lab is not completed, it would be blank. C. Completed IBD Quality Measures on patient profile page.