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Review Article

# Preventative Healthcare Maintenance in IBD: Addressing Clinical Practice Gaps in the United States

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## Abstract

Inflammatory bowel diseases (IBD) are chronic immune mediated inflammatory diseases that require long-term monitoring. Preventive care, including vaccinations and healthcare screenings, is critical. Comprehensive preventive care should include cancer screenings, mental health evaluation, bone health assessment, smoking cessation and monitoring for nutritional deficiencies.

Gastroenterologists due to their frequent interactions with IBD patients are uniquely positioned to oversee aspects of preventive care. However, healthcare maintenance in this population is suboptimal due to a variety of systemic and individual components. Factors include uncertainty among primary care providers regarding immunosuppression management and a gastroenterologist's focus on IBD management. To address these gaps, the implementation of structured care models such as designating a healthcare maintenance champion or creating an IBD-centered medical home is essential.

This article emphasizes the pivotal role gastroenterologists play in ensuring comprehensive healthcare maintenance for IBD patients.

**Keywords:** Inflammatory Bowel Disease; Healthcare; Vaccines; Preventative Care; Primary Care

## Introduction

Inflammatory bowel diseases (IBD) including Crohn's Disease (CD) and Ulcerative Colitis (UC) are chronic diseases that can affect patients of all ages, requiring lifelong medical care. Management of IBD has significantly evolved with treatments including mesalamines, immunomodulators and advanced therapy aimed to achieve remission and prevent disease complications [1]. While these therapies may improve outcomes, immune modifying therapies are associated with an increased risk of serious and opportunistic infections. Malnutrition can also increase risk of opportunistic infections as it may be linked to disease severity [2]. Many serious infections are, however, preventable with vaccinations [1,3]. Close monitoring of possible side effects and extra intestinal manifestations may also lead to detection of unrelated medical conditions. Therefore, gastroenterologists are in a unique position where IBD patients may view their gastroenterologist as their primary care provider (PCP) [4]. However, studies have shown rates of preventive care for IBD patients are lower than the general population [5]. There may be multiple factors that contribute to decreased rates of preventive care. IBD can develop in younger adults in the second and third decade of life where typically in non-IBD patients preventive care is minimal. Primary care physicians may not be familiar with differing healthcare maintenance recommendations or may feel uncomfortable about administering immunizations in the setting of IBD and immunosuppression. Patients might not be aware of the importance of preventive care. In contrast, the gastroenterologist may be aware of IBD healthcare recommendations but they may be more focused on the GI tract due to the variable and progressive

nature of IBD [6-8].

To improve preventive care for IBD patients, potential solutions include appointing an individual to champion health care maintenance or creating a multidisciplinary healthcare model to provide comprehensive care [9]. Healthcare maintenance in an IBD patient is vast as it encompasses more than vaccinations. IBD patients are at increased risk for certain cancers and it is necessary to be knowledgeable on the types of cancer screenings that are recommended. The complexities of healthcare maintenance also include evaluation of depression and anxiety as well as bone health, smoking and vitamin deficiencies. This article aims to summarize key healthcare maintenance practices for within the United States, highlight current guideline recommendations with preventive screening, vaccination strategies, malignancy surveillance, and multidisciplinary care models, and provide gastroenterologists and primary care providers with practical strategies to improve care amongst patients with IBD.

## Screening

Although tuberculosis (TB) in the United States remains relatively low compared to the world, cases have increased in recent years, with approximately 10,000 new cases reported annually. A significant portion of TB cases occur in people born outside the country, highlighting the importance of considering patient origin and travel history when evaluating individuals with IBD [10]. The global rise in TB can pose additional challenges in managing IBD patients. Sometimes considering the origin of new IBD patients is key with an increased risk of TB and TB/HIV-co-infections among refugees [11]. Anti-TNF therapy used in IBD has been associated with an increased risk of TB reactivation, particularly those with latent TB infection. Screening for TB should be considered at the time of IBD diagnosis based on local prevalence and epidemiological risk factors. International guidelines recommend TB screening should always be performed prior to anti-TNF therapy. Screening may consist of chest X-ray, tuberculin skin test (TST) and interferon-gamma release assays (IGRA) based on regional preferences and availability of testing. In the setting of previous Bacillus Calmette-Guerin (BCG) vaccination, IGRA testing may be preferred [12-13].

While Hepatitis B remains a global health problem, it continues to be an important public health concern in the United States, particularly among those born in or with exposure to hepatitis B endemic regions [14]. Screening for hepatitis B should be preferably performed at time of diagnosis for all IBD patients due to the risk of reactivation with immunosuppressive therapy [1,15] Initial serologic testing should include hepatitis B surface antigen (HBsAg), hepatitis B core antibody (anti-HBc) and hepatitis B surface antibody (anti-HBs) [1]. Based on these results, hepatitis B status can be determined and managed appropriately (Figure 1).

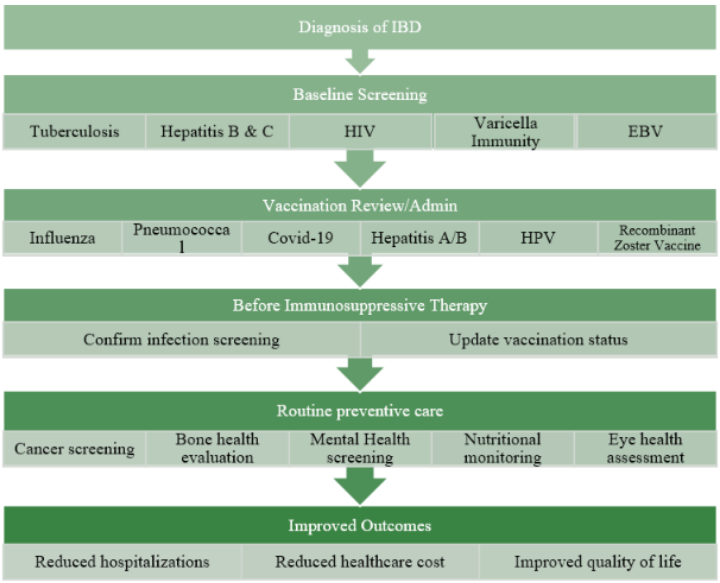


**Figure 1:** Preventative Healthcare algorithm for patients with IBD.

The American Gastroenterological Association (AGA) guidelines advise additional serologic screening at time of IBD diagnosis. In addition to TB and hepatitis B evaluation, human acquired immunodeficiency virus (HIV), hepatitis A, C, Epstein-Barr virus (EBV) and cytomegalovirus (CMV) serologic screening is recommended for all IBD patients at time of diagnosis. In the absence of documented prior infection or vaccination, serologic screening for varicella zoster virus and measles should be evaluated. Testing should be done prior to initiation of immunosuppressive therapy and continued routinely [2].

**Vaccinations**

Vaccination status should be reviewed following IBD diagnosis and appropriate immunizations should be given as soon as possible rather than waiting for immunomodulator or advanced therapy initiation. Immunosuppressants can put patients at risk for infections resulting in increased hospitalizations, costs, and mortality [16-17]. The risk of pneumonia is increased 1.5 to 2-fold in IBD patients compared with non-IBD controls. The risk is higher in IBD patients older than 60 years old and those on immunosuppressive therapy particularly with corticosteroids [18]. The risk of influenza among IBD patients is 1.5 times that of non-IBD individuals and corticosteroids is independently associated with 1.2 fold increase in risk of influenza [19]. Of note, topical therapy and oral mesalamines do not have a higher risk of infection [20]. Vaccines prevent and reduce risk of infectious illness. However, vaccination rates among IBD patients are low as confirmed by several studies [20-21]. While studies generally show that vaccination is safe and well-tolerated in IBD patients, there have been several case reports of IBD flares following COVID-19 vaccination [22]. All patients should ideally be vaccinated prior to initiation of medical therapy [24-27]. However, necessary IBD treatment should never be delayed to administer vaccines.

Non-live vaccinations (inactivated) vaccines can be administered to all patients regardless of their immunocompromised status. There is a diminished immune response to parental vaccines in patients on anti-TNFs in combination with or solely with immunomodulators but not with Vedolizumab or Ustekinumab [24-31]. Family members should be up to date with age-appropriate vaccines as herd immunity is a form of indirect protection. Those patients that are not on immunosuppressive therapy have no specific contraindications for inactivated or live vaccines [27].

The recent AGA Clinical Practice Update [32]. And ECCO [1]. guidelines allow for useful resources for physicians to reference vaccination recommendations. The U.S. Advisory Committee on Immunization Practices (ACIP) provides standard vaccination recommendations for the population within the United States for general healthcare maintenance. While U.S. ACIP does not provide specific recommendations for IBD, it recommends vaccine decisions based on patient's immunocompromised status due to therapy. (Table 1) was formulated to depict current vaccine guidance based on ACIP and AGA guidelines.

| Vaccine | U.S. ACIP/AGA Recommendation |
|---|---|
| COVID-19 | Annual |
| Influenza | Annual<br>SD:<br>All adults 18-64 years of age<br>HD:<br>Adults > 65<br>Adults on anti-TNF therapy |

| | |
|---|---|
| Pneumococcal | Vaccine naïve: PCV 20 or PCV 21<br><br>Previous vaccination with PCV 13 AND PPSV 23:<br><br>PCV 20 or PCV 21 five years after last pneumococcal vaccine<br><br>Incomplete vaccination with PCV 13 OR PPSV 23: PCV 20 or PCV 21at least 1 year after pneumococcal vaccine |
| Recombinant herpes zoster | 2 dose series<br>Adults > 19 years of age<br>Not on immune modifying therapy: doses are 8-12 wk apart<br><br>On immune modifying therapy: doses are 4-8 wk apart |
| Human papillomavirus | 3 dose series (0,1-2, 6 mo.)<br><br>Adults 18-26 years of age<br><br>Adults 27 – 45 years of age who are likely to have a new sexual partner |
| Respiratory syncytial virus (RSV) | Single dose<br><br>Adults >75 y of age<br><br>Adults 60-74 years of age<br><br>Pregnant during 32-36 weeks gestation (**seasonal**: Sept 1 to Jan 31)** |

| | |
|---|---|
| Hepatitis B | Heplisav-B: Two dose series at 0, 1 mo<br><br>Engerix-B or Recombivax HB: three dose series (0,1, and 6 mo)<br><br>Adults (19-59y) starting immune modifying therapy and > 60 with risk factors<br><br>Previous vaccination*** |
| Tetanus, Diphtheria, and Acellular Pertussis (TDAP) | One dose every 10 years<br><br>All adults<br><br>Tdap each pregnancy (27-36 wks) |
| Hepatitis A | 2 dose series at 0 and 6 mo<br><br>All adults |

**Table 1:** Vaccination recommendations for IBD patients based on **U.S. ACIP/AGA** recommendations [2,32-33].

Abbreviations: SD (standard dose), HD (High dose)

*Additional booster according to national guidelines

**Pregnant persons should only receive Abrysvo

*** Previous HBV vaccination

- Anti-HBs < 10 mIU/mL needs single challenge dose with retest in 4-8 weeks.

- Anti-HBs > 10 mIU/mL Amnestic response: no further doses needed

- Anti-HBs < 10 mIU/ML No amnestic response: complete full series

Live vaccines are contraindicated in patients on immune modifying agents. History of vaccination to MMR and Varicella should lead to immunity. Patients with a history of varicella [chickenpox] or documented vaccination should be considered protected [2]. Commercially available serologic tests may inadequately measure vaccine induced antibody concentrations and therefore, serology should not be relied upon due to the potential false negative per Advisory Committee on Immunization Practices (ACIP) [34]. Serologic testing should only be performed if the patient does not have documented vaccination to varicella or exposure to varicella [2]. In case of seronegativity, vaccination of VZV should be administered. In case of seropositivity, vaccination against Herpes zoster is recommended [35-36].

If live vaccines are given, they should be administered at least 1 month prior to starting immunosuppressants (IS). If the patient is already on IS and needs a live vaccine then the patient and provider should have an in depth risk versus benefit discussion that takes into account the current disease state including endoscopic remission. If a live vaccine is given, immunosuppressants should be paused to give the complete vaccine series, and then immunosuppressants should be resumed [32]. ECCO provides suggested time frames for discontinuing immunosuppressive therapy prior to administration of live vaccines, which can vary depending on the specific treatment [2]. (Table 2) has suggested time frames for discontinuing and resuming medical therapy for a live vaccine based on ACIP and ECCO available guidance [2,31].

| Drug | Stopping before live vaccine | Restart after live vaccine |
|---|---|---|
| Prednisone<br>Dose: >20 mg/day<br>Duration: > 2 weeks | 1 month | 1 month |
| Anti-TNF therapy (adalimumab, certolizumab, infliximab, golimumab) | 3 months | 1 month |
| Tofacitinib | 1 month | 1 month |
| Mesalazine, Sulfasalazine, Balsalazide | No time lag needed | ---- |
| Vedolizumab | No time lag needed | ---- |
| Thiopurine | 3 months | 1 month |
| Methotrexate | 1-3 months | 1 month |

**Table 2:** Suggested time frame for discontinuing and resuming medical therapy for live vaccine [2,31].

## Cancer Screening

### Colon Cancer

Chronic intestinal inflammation is a primary risk factor for the development of gastrointestinal malignancy. All IBD patients with disease affecting the colon or rectum should have a colonoscopy 8-10 years after disease onset (symptoms) to evaluate for disease extension and to determine timing of future colon cancer surveillance [37-40 ]. Colon cancer surveillance intervals will vary based on risk factors. Risk factors for colorectal cancer includes disease duration, extent of disease, active disease, primary sclerosing cholangitis (PSC), family history of colorectal cancer, and pseudopolyposis [41-42]. For IBD patients with concurrent PSC, colon cancer screening should be started at diagnosis and annually there after [37, 40] If a patient has isolated ileal Crohn's disease, then they are at similar risk of colorectal cancer to the general population [43]. Of note, small bowel Crohn's disease does carry an increased risk of small bowel adenocarcinoma in areas of high inflammation, but routine surveillance is not recommended for small bowel cancer [44-45]. Colonoscopy is the only recommended modality for CRC surveillance. Patients should ideally have quiescent disease as inflammation can obscure precancerous findings. Lavage and careful inspection are key. Dye spray chromoendoscopy (DCE) versus virtual chromoendoscopy (VCE) can be used. A metanalysis of 11 RCTs found that VCE was comparable to DCE and HD-WLE for dysplasia detection [43]. Universal nomenclature, updated terminology of polyp classification and scoring systems should be used on colonoscopy reports. The AGA Clinical Practice Update on Colorectal Neoplasia and recent BSG guidelines on colorectal surveillance in inflammatory bowel disease gives guidance on the management of visible and invisible dysplasia [40,43].

### Anal Cancer

Although the absolute risk of anal cancer is low, it is higher than the general population [46]. The majority of anal cancers are due to squamous cell carcinoma. IBD patients with perianal disease, anal stricture, smoking, HPV infection, cervical dysplasia, HIV or ano-receptive intercourse are at an increased risk of anal cancer. Fistula-related adenocarcinoma develops in patients with long-standing perianal disease and may present with non-specific symptoms.

It is therefore imperative to ask about bleeding, pain, itching and potential lesions near the anal canal [47] Even though there are no recommended surveillance strategies, the anal canal should be inspected closely during colonoscopy, during digital rectal exam, upon retroflexion and withdrawal of the endoscope [45,48]. If an anal stricture is detected, this should be biopsied either on endoscopy or during exam under anesthesia with colorectal surgery. Internal openings of fistulas should be biopsied [47].

### Skin Cancer

All patients with IBD have an increased risk of nonmelanoma skin cancers and therefore primary prevention with avoidance of excessive sun exposure and use of sunscreen is emphasized [32]. Patients on immunomodulators, anti-tumor necrosis factor inhibitors and small molecules should be referred to a dermatologist if available or to a primary care physician to have yearly total body skin exams due to increase risk in skin cancers (both melanoma

and non-melanoma skin cancer) [49]. Thiopurine use, even after discontinuation, increases the skin's photosensitivity to UVA light [50]. Therefore, any patient that has been on Thiopurines should have a yearly total body skin exam by dermatology despite discontinuation [49-50]. This risk appears to be dose and duration dependent; further studies are needed to evaluate the effects of short-term Thiopurine use.

### Cervical Cancer

There is conflicting data regarding increased risk of cervical dysplasia in women with IBD. There are select studies that suggest increased risk associated with immunosuppressive therapy [51]. However, data is insufficient to determine whether individuals receiving combined immunosuppression or thiopurines require more frequent screening. There is an increased risk of dysplasia with cigarette smoking. The AGA Best Practice Advisory follows USPSTF general population recommendations for ages 21 to 29 to be screened every 3 years with cervical cytology and ages 30 to 65 with cervical cytology every 3 years, HPV testing every 5 years or co-testing every 5 years [32,52]. These guidelines do not apply to those women with history of cervical dysplasia. Ultimately, shared decision making and individual risk stratification should be encouraged.

### Psychologic Impact

Depression and anxiety rates are higher in individuals with IBD compared with their age-matched counterparts [53-54]. Depression and anxiety were strongly associated with surgical history, disease complications including extraintestinal manifestations, smoking and female gender. IBD patients with mental health conditions incurred significantly greater costs compared with IBD patients without mental health conditions signaling an importance of identifying and treating these conditions [55-57]. Mental health screening should be implemented early in the care of IBD patients. PHQ2 and GAD7 scales can be used for depression and anxiety screening, respectively. Although implementing a psychiatrist and psychologist in your practice can be helpful; there are resources globally as listed but not limited to this list (Table 3).

| Organization | Mental Health Services Offered |
|---|---|
| Crohn's and Colitis Foundation | Mental and emotional health education, IBD help center referrals, support groups, peer mentoring |
| IBD Support Foundation | Psychosocial education, emotional support programs |
| Center for Chronic Illness | Therapist led virtual support groups for chronic illnesses |
| Bezzy IBD | Moderated online peer support |
| Trellus | Combines medical care, behavioral health support, and coaching to manage chronic GO conditions |

**Table 3:** List of Mental Health Resources Available in the US.

### Bone Health

The prevalence of osteoporosis in IBD patients is as high as 42%. Patients with low BMI, steroid use, cigarette smoking, postmenopausal women, men > 65 years old, patients with chronic inflammation, vitamin D deficiency, or those with malabsorption should undergo bone density screening. It is imperative to screen for bone loss as supplementation and treatment can reverse osteopenia and osteoporosis and prevent factures [32,58]. If DEXA is normal, then it should be repeated in 5 years or in 2-3 years in the setting of increased risk factors. If the patient has osteopenia, supplemental calcium (1000 mg/day) and Vitamin D (800 IU/day) along with weight bearing exercises to improve bone mineral density should be advised. Monitoring with DEXA should be done in 2-3 years [59]. If osteoporosis is present, then referral to endocrinology or primary care is recommended for further management.

### Eye Health

Approximately 10-43% of IBD patients develop eye problems. Ophthalmologic issues among IBD patients include uveitis, episcleritis or keratopathy [60]. Additionally, patients can have glucocorticoid induced cataracts or glaucoma [61]. Malabsorption and Vitamin A deficiency can increase ocular surface disease or lead to keratoconjunctivitis sicca [62]. It is recommended that patients undergo ophthalmologic evaluation annually [60]. The immediate cost-effectiveness of routine ophthalmologic exams require further research although screening can prevent potential severe complications [62]. Annual exams could be tailored to those individuals that are at high risk for ophthalmologic conditions including those who have malabsorption or have been on long-term steroids.

### Malnutrition and Vitamin Deficiencies

Malnutrition in IBD can arise from a range of underlying factors, including anorexia, trigger avoidance, medication effects, drug-nutrient interaction, malabsorption, inadequate intake, reduced caloric intake, active inflammation, altered anatomy due to prior surgery or short bowel syndrome [63-64]. Without adequate nutrition the immune system may not have the components needed to create an effective immune response resulting in suboptimal responses to vaccinations and an increase risk of infections [64].

Obesity has increased among IBD patients with epidemiologic studies suggesting that 15-40% of IBD patients are obese [65-70]. Obesity can impact medical therapy by decreasing drug-half life and trough levels as well as surgical management by increasing operative time and affecting perioperative complications [68,71]. Glucagon-like peptide-1 receptor agonists (GLP-1 RAs) have emerged as a fundamental component in the management of diabetes and obesity; however their potential therapeutic role in IBD remains under investigation [72].

Vitamin and mineral deficiencies are prevalent in patients with IBD regardless of their body weight. Deficiencies can lead to clinically significant conditions such as anemia, osteoporosis and poor wound healing. A case series, found 56% of IBD patients reported complete avoidance of fruits and vegetables [73]. It is suggested that those with active disease and in clinical remission should be routinely assessed for vitamin and mineral deficiencies.[74] There haven't been formal guidelines to assess micronutrient deficiencies in the setting of IBD until the recent AGA clinical practice update and ECCO consensus on dietary management of IBD, both of which advise all patients with IBD to be monitored for Vitamin D, zinc and iron deficiency. Those with a prior ileal surgery or who follow a vegan diet, should be monitored for Vitamin B12 [75-76]. Vitamin C, known as the forgotten micronutrient, can also be decreased in IBD.[77] Screening for malnutrition and obesity and assessing dietary intake is critical.

**Women's Health**

For women with IBD, it is important to provide education and implement screening plans for cervical cancer and bone health. The HPV vaccine is paramount in preventing cervical neoplasia in these at risk patients. The vaccine is approved for individuals between the ages 9 and 45 and can be provided by their internist or gynecologist [32].

Screening for bone health is pertinent to all IBD patients, but especially women with IBD. These individuals have an increased risk in developing osteoporosis due to post menopause estrogen changes, lower BMI, low vitamin D absorption, and possibly prior steroid use [78].

It is important to recognize that patients with IBD are not at a disadvantage compared to the general population in terms of fertility and opportunity to get pregnant if the patient is in disease remission. There are a couple of factors that may contribute to pregnancy complications such as active disease, prior surgical procedures to the abdomen such as a J pouch, or nutritional concerns that can lead to preterm labor, low birth weight, or miscarriage [79].

Conversations about planned pregnancies should be integrated into the visits for all women of childbearing age, especially before required changes to the treatment are made. This will allow ample time to adjust treatment, as well as update required vaccinations and assess vitamin deficiencies [80].

**Advanced Age Population**

The prevalence of IBD is rising in those older than 65, with a range of differential diagnoses masking as IBD that should be considered carefully during the diagnostic process [81]. Despite this rise, older IBD patients are under-represented in clinical trials for immunosuppressive therapies [82]. The management of older IBD patients remains variable, largely due to a lack of evidence-based guidelines tailored to this population, which in turn leads to a greater reliance on corticosteroids for long periods rather than escalating to advanced therapies [83-85]. However, prolonged use of corticosteroids in the elderly has been associated with a higher risk of serious adverse events [81, 86]. Treatment goals should be adjusted to the patients' biological age with transmural healing taking a step back and allowing symptom control to be the most important aspect to consider.

Healthcare maintenance is important in this "older than traditional IBD patient population" as this group is vulnerable due to co-morbidities and potential cognitive decline from aging [87]. Gastroenterologists and primary care physicians need to be vigilant in preventive screening for osteoporosis, ocular disease, depression and adverse events related to polypharmacy. When considering cancer screening guidelines, life expectancy, functional performance status, comorbidities, finances and the patients desires need to be at the forefront [88-89].

Mental health should be assessed if time allows with the gastroenterologist or with a primary care provider as anxiety and depression rates are higher in the older IBD population. Isolation, adequate housing, transportation and food insecurity due to potential fixed income should be a routine discussion with a primary care physician, geriatrician or social worker [90-91].

Elderly individuals with IBD are at a high risk for bone loss and osteoporosis due to factors like chronic inflammation, nutritional deficiencies and medications. Old age was associated with the highest risk for fracture-related hospitalizations in IBD patients. Other risk factors for osteoporosis in IBD include low body mass index, immobilization or sedentary lifestyle, previous fragility fracture, smoking, excess alcohol consumption, malnutrition, malabsorption, calcium and Vitamin D deficiency. Patients should be monitored for decreased bone mineral density [92].

**Implementing Healthcare Maintenance**

Understanding the complexities of healthcare maintenance is

important but implementing preventive care is imperative to achieve improved patient outcomes within the U.S. Healthcare system. Despite the availability of established guidelines, preventive health measures remain underutilized in patients with IBD, with gaps in vaccination delivery, cancer screening, infection screening, and bone health assessment, which often contribute to a greater burden of disease to the patient, provider and healthcare system. One barrier is the disconnect between gastroenterologists and the primary care physician (PCP), as there can be an uncertainty regarding the responsibility for preventive health maintenance. The first step in addressing these gaps is to actively promote collaboration between gastroenterologists and PCP with patient engagement [93]. Studies have shown that involving patients in their care leads to improved health outcomes [94]. Prasad et al proposes IBD educator roles, similar to a diabetes educator, to improve knowledge and access of preventive care among patients to empower them to understand their health and bridge gaps [95]. A similar concept proposed by Singh et al, looks at the development of IBD counsellors to bridge the gap between doctors and patients. This is particularly important in the U.S. as this can allow for psychosocial support, lifestyle and dietary guidance while being culturally aware to sociocultural norms, improving overall health [96].

Dissemination of current U.S. based preventive care recommendations, including those from ACIP, USPSTF, AGA, with direct referrals to primary care, gynecology, ophthalmology and dermatology can improve communication and quality of IBD care. Evidence from a multicenter quality improvement initiative conducted across 27 U.S gastroenterology practices showed that having standardized care with preventive care strategies and monitoring improved provider communication, significantly reducing emergency department visits and hospitalizations among IBD patients [16].

The IBD medical home is a concept that encompasses a team of physicians, social workers, dieticians and nurses to monitor IBD patients for psychosocial issues and flare symptoms [97]. The medical home can also be used to reinforce preventive care guidelines by administering vaccines [98]. One study found the implementation of vaccines in the gastroenterology clinic resulted in an increased vaccination rate among IBD patients [99]. Vaccines can be administered during periods of remission at routine visits, nurse visits or even by sending the vaccine to the patient's preferred pharmacy. In the U.S., this approach can be further expanded to collaborate with primary care and gastroenterology practices, and through local pharmacies.

Brunt et al furthered the idea of an IBD specialty home by proposing an IBD primary care physician; a condition-focused internist to treat comorbid conditions in the setting of IBD which not only can improve outcomes but reduce costs. The IBD primary care physician can function as a primary care provider in addition to one that understands the complexities of IBD and can manage the other issues that may arise including extra-intestinal manifestations and chronic fatigue [100]. This role is especially important within the U.S Healthcare system where there is an increase in disease complexity with PCP shortage. These providers can tackle healthcare maintenance by delivering vaccinations in a timely manner, evaluating bone density, collaborating with behavior health and/or psychological services to address mental health and refer to specialists (ophthalmologists, gynecologists, dermatologists) when needed. The "IBD Medical Home" was implemented by University of Pittsburgh Medical Center, which resulted in 47.3% fewer emergency visits, 35.9% hospitalizations resulting in $2,500 savings per patient per year [101]. This multidisciplinary care model, as demonstrated in Figure 1, highlights the potential benefits of coordinated preventive care strategies in improving outcomes, while reducing healthcare costs for patients with IBD in the United States.

## Conclusion

The progressive and chronic nature of IBD places the gastroenterologist in a unique patient-provider relationship due to the close monitoring and frequency of appointments. The gastroenterologist needs to understand the intricacies of advanced therapy and the vaccine recommendations that are different from non-IBD patients. Healthcare in IBD patients encompasses more than vaccines as discussed in this review. It is imperative that the gastroenterologist stay up to date on these recommendations to provide comprehensive care. There can be challenges to ensure all aspects of the patient's health are addressed. Referral pathways, implementation of an IBD medical home or IBD counsellors may be a future option to provide integrated care.

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