

Knowledge and attitudes of primary healthcare physicians toward the diagnosis and management of inflammatory bowel disease following an educational intervention: A comparative analysis

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Abstract

Background/Aims: Inflammatory bowel disease (IBD) is a chronic inflammatory condition that requires early diagnosis and proper management. Patients with early symptoms of IBD are typically evaluated first by primary healthcare (PHC) physicians, who in turn refer patients with suspected IBD to specialists. Therefore, we aimed to assess the knowledge and attitude of PHC physicians toward IBD.

Materials and Methods: We conducted a comparative cross-sectional survey of PHC physicians practicing at the Ministry of Health PHC centers in Jeddah, KSA. Demographics and data on the knowledge and practices of physicians were collected through a predefined and tested questionnaire that included three domains (Eaden, Leong, and Sign/Symptom Awareness). A subgroup of the cohort was educated about IBD referral criteria (group A, $n = 65$) prior to study initiation and their responses were compared with those from the remaining group (group B, $n = 135$). Regression analysis was used to test associations with the significance threshold set at 5%.

Results: A total of 211 PHC physicians were surveyed with a response rate of 95%. Female physicians comprised 66.5% of the cohort and the mean age was 32.26 ± 6.6 years. About 91% of physicians were Saudi nationals, and 75.5% were MBBS degree holders. The majority of the respondents (93%) reported seeing zero to five patients with IBD per month, and almost half of the physicians preferred to always refer patients to specialists (49.5%). Most of the respondents were uncomfortable (3.27 ± 1.4 to 4.35 ± 1.2) with initiating or managing specific medical therapies (maintenance therapy, therapy for acute flare, corticosteroids, immunomodulators, and biologics) for patients with IBD. With regard to knowledge, group A had higher scores in all three domains especially in the Sign/Symptom Awareness domain (mean score 6.17 ± 1.1 vs. 3.5 ± 1.01 , $P < 0.001$). According to multivariate analyses, both groups' knowledge showed no significant relationship with any of the medical therapies, except for the Sign/Symptom Awareness domain which was shown to be significantly affecting the comfort of doctors in managing maintenance therapy among patients with IBD [odds ratio (OR) = 1.61, $P = 0.008$]. Gender, nationality, and qualifications were found to have a significant influence on the comfort in initiating specific medical therapies. Group A was identified

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as a significant factor in predicting comfort with managing corticosteroids (OR = 8.25, $P = 0.006$) and immunomodulators (OR = 6.03, $P = 0.02$) on patients with IBD.

Conclusion: The knowledge and comfort of PHC physicians with IBD medication prescription appears to be higher when education is provided. This observation is important, since PHC physicians are responsible for early identification and referral of patients suspected of having IBD, to specialists.

Keywords: Education, inflammatory bowel disease, primary healthcare, referral

INTRODUCTION

Inflammatory bowel disease (IBD) is a chronic inflammatory condition that primarily affects the digestive tract of genetically predisposed individuals. Crohn's disease (CD) and ulcerative colitis (UC) are the two major subtypes of this category of digestive disorders.^[1] In the early stages of IBD, patients go through an asymptomatic preclinical period, which is followed by a clinically apparent period during which patients experience clinical symptoms such as diarrhea and abdominal pain. Other common diseases such as irritable bowel syndrome (IBS), food intolerance, or infections can result in similar nonspecific symptoms and often result in diagnostic delay.^[2] In 2012, a cross-sectional study was conducted in the United States to determine the prevalence of IBD among an insured population. The study reported that there was an observed increase in the prevalence of both CD and UC in the adult population; they estimated that approximately 1,171,000 Americans suffered from IBD.^[3] As such, IBD is no longer considered a rare disorder in several parts of the world, including areas where the disease prevalence was previously considered to be low, such as in Middle Eastern countries.^[4,5] A study conducted in Bahrain in 2017 by Abdulla *et al.* estimated the incidence and prevalence of CD and UC among patients attending a particular primary healthcare (PHC) center. The authors demonstrated that IBD incident cases had increased four-fold from an average of 3 per 10⁵ cases during the period 1984–2001 to 12 per 10⁵ cases during 2002–2014.^[6] In Saudi Arabia, Almofleh *et al.* performed a retrospective cohort study that involved 693 patients with confirmed IBD over a period of 17 years (1993–2009). The study concluded that the annual number of patients diagnosed with CD at one large medical center increased from 1.2 in the first 11 years to 73.7 in the last 6 years.^[7]

The time to diagnosis of IBD varies from one country to another and depends on many factors such as access to specialized care and societal awareness of the disease prevalence. The time to diagnosis typically includes a period during which patients are misdiagnosed as IBS or recurrent gastrointestinal (GI) infections, especially in the PHC setting.^[2] A cohort study conducted in Canada

that aimed to estimate the period of symptoms that preceded the diagnosis of IBD demonstrated that 14% of 396 patients with IBD were initially misdiagnosed with IBS.^[8] Furthermore, a Saudi cross-sectional study done by Mosli *et al.* evaluated 255 patients with a clinical diagnosis of IBS who had not undergone endoscopic evaluation for possible CD. The authors reported that according to the red flag score (RFS), a clinical tool that is highly accurate for detecting CD, more than half of the patients (51.4%) they screened were at high risk for CD and were therefore eligible for ileo-colonoscopy evaluation.^[9] This accumulating literature supports the importance of establishing diagnostic and early referral pathways for patients suspected of having IBD. PHC physicians are the first line of defense when it comes to diagnosing and managing patients who complain of nonspecific GI symptoms. They are usually responsible for the initial diagnosis of IBD and subsequently refer patients to specialists.

Thus, it is crucial that the knowledge and attitude of PHC toward IBD, especially in communities where the disease is becoming increasingly prevalent, were evaluated.^[10] This study aimed to assess the knowledge and attitude of Saudi PHC physicians toward IBD.

MATERIALS AND METHODS

Study design

We performed a cross-sectional study involving all physicians practicing in PHC centers under the umbrella of the Ministry of Health (MOH) in Jeddah, Saudi Arabia. There are 47 PHC centers distributed throughout the five health sectors of Jeddah, namely, the Northeast, Central, Western, Southwest, and Southeast sectors. Each sector consists of 11–13 PHC centers. Using a stratified sampling technique, physicians were randomly selected and recruited from each stratum regardless of their age, nationality, or educational level (general physician, resident, specialist, or consultant). Physicians were asked before they completed the study questionnaire whether they attended the IBD referral education program that included an introduction to the IBD RFS criteria action plan. Those who answered

“yes” were consecutively assigned to group A, whereas those who answered “no” were assigned to group B.

Research instrument and data collection

A previously published and validated self-administered questionnaire was used in the study.^[11,12] The first part of the questionnaire consisted of questions about the sociodemographics of the participants such as age, gender, nationality, year of graduation, qualifications (MBBS, board certification, PHD of family medicine, diploma, or master's degree of family medicine), and place of work. The following two parts included questions that assessed knowledge and attitude of physicians toward IBD. The third part of the questionnaire focused on determining the likelihood of physicians to refer a patient with a potential diagnosis of IBD.

Three knowledge domains were included (Eaden Knowledge, Leong Knowledge, Sign/Symptom Awareness). Based on Eaden *et al.*,^[11] the Eaden Knowledge domain had 11 questions; based on Leong *et al.*,^[12] the Leong domain contained 12 questions, and finally, the Sign/Symptom Awareness domain had 7 questions. These questions were converted into incorrect (0) and correct (1) answers, and an additive method was used to generate the total score of each domain.

Attitude scores were based on the comfort of physicians with delivering specific therapies to patients with IBD and were calculated using a rating scale that ranged from 1 to 5, with 1 being “extremely comfortable” and 5 being “extremely uncomfortable.” To identify the relationship between comfort with medical therapies and IBD-specific knowledge, the rating scales were divided into “positive comfort” (scores 1 and 2) and “not positive comfort” (scores 3–5). The questionnaire was distributed to physicians during working hours hand-to-hand and recollected in the same manner within 24 h.

Prior to initiating the study, a pilot study that involved 10% of the sample (20 physicians) was conducted in PHC centers that were not included in the final study sample. The data from this pilot phase were used to test the questionnaires' applicability and are not included in the final analysis.

Intervention: The IBD referral education program

The IBD regional referral education program we refer to commenced on January 1st 2017. The program involved a scheduled weekly meeting that took place in PHCs that were affiliated with the following hospitals: King Fahd General Hospital, East Jeddah Hospital, King Abdulaziz Hospital and Oncology center, and Al-thagher Hospital.

Only PHCs identified as centers with a high number of patients seen per year were selected to participate. Centers were segmented into three categories: A, B, and C, where category A included centers with high flow of patients (>45,750 patients per year), category B included a medium flow of patients (36,500– 45,750 per year), and category C included centers with a low flow of patients (<36,500 per year). Physicians working at 180 category A HCPs were selected to attend this activity. The duration of each meeting was 30 min per week (except for the month of Ramadan when it was reduced to 30 min per month) for 1 year. Education was delivered to physicians in the form of a seminar that was prepared by a medical science liaison and presented by specialized physicians. The points that were covered during these seminars included clinical differences between IBD and IBS, that is, symptomatology, pathology, epidemiology, and the burden of IBD in the local community. An approach to the diagnosis and management of IBD was also discussed with a focus on how to utilize the IBD RFS criteria in practice [Figure 1]. A variety of case scenarios were also presented after each seminar to demonstrate how to interpret the IBD RFS criteria. A printed form of the IBD RFS criteria was then distributed to all HCPs who attended this meeting.

Outcomes

The main primary outcome of the study was to assess the knowledge of MOH PHC physicians of IBD and evaluate their attitude toward the diagnosis and management of IBD.

Sample size calculation and statistical analysis

Using the Raosoft calculator, the study sample size was calculated according to the following criteria: confidence level (CI) of 95%, an expected proportion of the population with adequate knowledge of 50%, and an error of 1%–10% (5%). A total sample size of 192 physicians was estimated. The sample size was increased by 10% to a total of 211 physicians to account for non response.

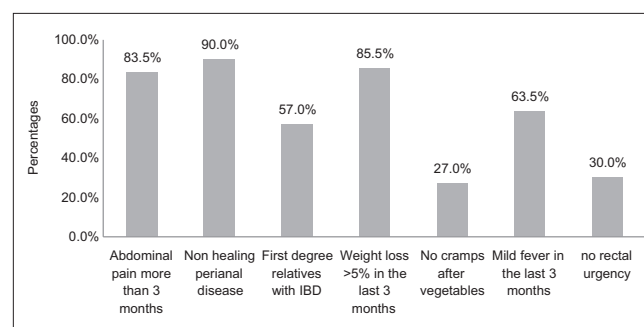


Figure 1: IBD red flag criteria

The data were analyzed using IBM SPSS version 23. Simple descriptive statistics were used to define the characteristics of the study variables in the form of counts and percentages for categorical and nominal variables, while continuous variables were presented as means and standard deviations. Chi-square testing was used to establish a relationship between categorical variables. Standard Student's *t*-test and one-way analysis of variance, with least significant difference (LSD) as a *post hoc* test, were used to compare two group means and more than two group means, respectively. These tests were performed with normal distribution assumptions. Alternatively, Welch's *t*-test and Games–Howell tests were used to compare two-group LSD of non-normally distributed continuous variables and LSD in multiple groups, respectively.

Multivariable logistic regression was used to identify factors that were independently associated with overall comfort of physicians with IBD while controlling for the prespecified covariates of age, gender, nationality, and qualification. A multinomial logistic regression was also used to classify subjects based on values of a set of predictor variables of any given dependent study variable. Odds ratios (OR) with 95% CIs were generated. Finally, the condition for rejecting the null hypothesis was a conventional *P* value of <0.05.

Ethical considerations

Approval from the ethical committee from the Joint Program of Family Medicine in Jeddah and from the director of PHC in Jeddah was obtained. All collected data were kept confidential and access was restricted to this scientific research. Ethical considerations were followed throughout the study.

RESULTS

Baseline characteristics

A total of 200 PHC physicians participated in the study, of which 65 were educated on the IBD referral criteria (group A) and the remaining 135 respondents were not (group B). Table 1 outlines the demographic profile of the sample population. The majority of the respondents were females (66.5%), Saudi nationals (91.0%), MBBS degree holders (75.5%), and had an average age of 32.3 ± 6.6 years. The majority of the participants reported that they encounter less than five patients with IBD per month (93.5%) and almost half of them (49.5%) always referred patients suspected of having IBD to specialists.

Knowledge and attitude of physicians toward IBD

In terms of knowledge, group A participants had higher mean scores than that of group B in the Eaden

Table 1: Demographic profile of the study participants (n=200)

	Overall	Group A	Group B	<i>P</i>
Total	200	65	135	-
Gender				
Male	67 (33.5)	24 (36.9)	43 (31.9)	0.477
Female	133 (66.5)	41 (63.1)	92 (68.1)	
Age, mean (SD)	32.26 (6.6)	34.45 (8.1)	31.21 (5.5)	0.001 ^b
Nationality				
Saudi	182 (91.0)	56 (86.2)	126 (93.3)	0.097
Non-Saudi	18 (9.0)	9 (13.8)	9 (6.7)	
Medical qualification				
MBBS	151 (75.5)	44 (67.7)	107 (77.8)	0.315
Board or PhD	37 (18.5)	15 (23.1)	22 (16.3)	
Diploma or master's	10 (5.0)	5 (7.7)	5 (3.7)	
Others	2 (1)	1 (1.5)	1 (2.2)	
No. of patients seen per month				
<1	142 (71.0)	44 (67.7)	98 (72.6)	0.204
1-5	45 (22.5)	16 (24.6)	29 (21.5)	
5-10	7 (3.5)	1 (1.5)	6 (4.4)	
>10	6 (3)	4 (6.2)	2 (1.5)	
Referral to specialist				
Never	8 (4.0)	3 (4.6)	5 (3.7)	0.074
Sometimes	60 (30.0)	16 (24.6)	44 (32.6)	
Often	33 (16.5)	6 (9.2)	27 (20.0)	
Always	99 (49.5)	40 (61.5)	59 (43.7)	

SD=Standard deviation. ^aSignificant using independent *t*-test at <0.05 level ^bSignificant using Welch's *t*-test at <0.05 level

Knowledge (7.2 ± 2.1 vs. 7 ± 1.92 , $P = 0.503$) and Leong Knowledge (6.6 ± 2.5 vs., 5.5 ± 2.1 , $P = 0.002$) domains, respectively. Moreover, in the Sign/Symptom Awareness domain, group A had a relatively higher mean score compared with group B (6.2 ± 1.1 vs. 3.5 ± 1.0 , $P < 0.001$). Based on the comfort scores of both groups, group A exhibited relatively higher levels of discomfort than group B when administering specific medical therapies including all maintenance therapies (3.86 ± 1.5 vs. 3.27 ± 1.4 , $P = 0.008$), immunomodulators (4.35 ± 1.2 vs. 3.90 ± 1.3 , $P = 0.019$), therapy for acute flares (3.98 ± 1.4 vs. 3.60 ± 1.4 , $P = 0.068$), corticosteroids (4.11 ± 1.2 vs. 3.58 ± 1.3 , $P = 0.007$), and biologics (4.34 ± 1.2 vs. 3.85 ± 1.4 , $P = 0.018$) [Table 2].

Predictors of physicians' level of comfort with IBD

Table 3 outlines the associations between physicians' characteristics and degree of comfort with managing patients with IBD. It is notable to mention that knowledge, based on the three domains namely, Eaden (OR = 0.925, $P = 0.458$), Leong (OR = 1.015, $P = 0.87$), and Sign/Symptom Awareness (OR = 0.885, $P = 0.467$), did not significantly affect the comfort levels of the physicians with IBD management. In addition, the education intervention provided to group A did not appear to influence their comfort with IBD management (OR = 1.382, $P = 0.584$). However, physicians who "sometimes" referred patients suspected of having IBD to specialists (OR = 0.168, $P < 0.001$) were found to be more likely to feel comfortable with managing IBD cases.

Table 2: PHC physicians' knowledge and comfort on common medical therapies used in managing IBD

	Total	Group A Mean (SD)	Group B Mean (SD)	P
Eaden Knowledge	7.07 (1.97)	7.2 (2.1)	7 (1.92)	0.503
Leong Knowledge	5.89 (2.28)	6.62 (2.5)	5.53 (2.09)	0.002 ^a
Sign/Symptom Awareness	4.37 (1.62)	6.17 (1.1)	3.5 (1.01)	<0.001 ^a
How comfortable are you in initiating/directly using				
Maintenance therapy	199	3.86 (1.5)	3.27 (1.4)	0.008 ^a
Therapy for an acute flare	199	3.98 (1.4)	3.60 (1.4)	0.068
Steroids	200	4.11 (1.2)	3.58 (1.3)	0.007 ^a
Immunomodulators	200	4.35 (1.2)	3.90 (1.3)	0.019 ^a
Biologics	195	4.34 (1.2)	3.85 (1.4)	0.018 ^b

PHC=Primary healthcare; IBD=Inflammatory bowel disease; SD=Standard deviation. ^aSignificant using independent *t*-test at <0.05 level.

^bSignificant using Welch's *t*-test at <0.05 level

Table 3: Group A vs. Group B's knowledge and characteristics as predictors of comfort in managing IBD cases

IBD comfort ^a	Wald	OR	95% CI for OR		P
			Lower bound	Upper bound	
Age	0.681	1.028	0.963	1.096	0.409
Eaden Knowledge	0.551	0.925	0.753	1.136	0.458
Leong Knowledge	0.026	1.015	0.846	1.218	0.872
Sign/Symptom Awareness	0.508	0.885	0.631	1.24	0.476
Education intervention	0.3	1.382	0.434	4.401	0.584
Gender=male	2.234	0.571	0.274	1.19	0.135
Nationality=Saudi	1.135	1.921	0.578	6.389	0.287
Qualification=MBBS	1.7	7.264	0.369	143.161	0.192
Qualification=board or PhD	1.46	6.563	0.31	138.891	0.227
Qualification=diploma or master's	2.954	21.065	0.652	680.619	0.086
Patients seen per month = <1	0.272	1.658	0.248	11.087	0.602
Patients seen per month=1-5	0.023	0.859	0.118	6.233	0.881
Patients seen per month=5-10	0.003	1.073	0.093	12.405	0.955
Referral to specialist=never	3.081	0.225	0.042	1.19	0.079
Referral to specialist=sometimes	18.304	0.168	0.074	0.381	<0.001
Referral to specialist=often	0.879	0.613	0.22	1.706	0.348

IBD=Inflammatory bowel disease; OR=Odds ratio; CI=Confidence interval. ^aThe reference category is *Comfortable*

IBD-specific knowledge and comfort with specific medical therapies

Table 4 summarizes PHC physicians' knowledge and selected characteristics by their level of comfort with each of the five medical therapies. In terms of maintenance therapy, higher Symptom Awareness scores (4.85 ± 1.7 vs. 3.93 ± 1.4 , $P = 0.001$) and group A physicians (74.1% vs. 56.7%, $P = 0.029$) were more likely to feel uncomfortable with managing IBD. Moreover, female physicians were more likely to feel uncomfortable with managing therapy for an acute flare than males (74.4% vs. 25.6%, $P = 0.007$). As for managing patients with IBD using corticosteroids, lower Leong Knowledge scores (5.56 ± 2.5 vs. 6.45 ± 1.9 , $P = 0.044$) and group A physicians (84.9% vs. 70.6%, $P = 0.049$) were more likely to express discomfort. Physicians in group A (91.2% vs. 78.2%, $P = 0.033$) and Saudi physicians (93.8% vs. 6.2%, $P = 0.017$) were also more likely to feel uncomfortable with managing patients with IBD using immunomodulators. In terms of using biologics, group A physicians were more likely to express discomfort compared with group B (89.8% vs. 75.2%, $P = 0.023$).

Multiple regression analysis

The association between groups A and B's IBD knowledge and their comfort level to each medical therapy was examined through multiple regression analysis while controlling for the prespecified covariates of age, gender, nationality, and qualification [Table 5]. Both groups' knowledge showed no significant relationship with any of the medical therapies, except for the Sign/Symptom Awareness domain which appeared to significantly affect the comfort of doctors with managing maintenance therapies of patients with IBD (OR = 1.610, $P = 0.008$). Gender significantly influenced the comfort of physicians with initiating therapy for acute flares (OR = 0.312, $P = 0.004$) and to prescribe biologics (OR = 4.961, $P = 0.026$). Saudi physicians were more comfortable with prescribing therapy for an acute flare (OR = 3.75, $P = 0.045$) and with prescribing immunomodulators (OR = 4.467, $P = 0.02$) compared with non-Saudi physicians. Moreover, doctors with MBBS (OR = 3.660E + 09, $P < 0.001$) or board or PhD (OR = 3.342E + 09, $P < 0.001$) qualifications were significantly more comfortable with prescribing corticosteroids compared with physicians with other

Table 4: Group A vs. Group B physicians' knowledge and characteristics by comfort level with specific medical therapies

How comfortable are you in initiating/directly/using:	Age	Eaden Know.	Leong Know.	Symptom Awareness	Group		Gender		Nationality		Medical Qualification			
					A	B	Male	Female	Saudi	Non Saudi	MBBS	Board or PhD	Diploma or Master's	Others
Maintenance therapy	32.55 (6.9)	7.22 (2.1)	6.14 (2.5)	4.85 (1.7)	43 (74.1)	55 (56.7)	27 (27.6)	71 (72.4)	91 (92.9)	7 (7.1)	75 (76.5)	16 (16.3)	6 (6.1)	1 (1.0)
Positive comfort	32.16 (5.8)	7.23 (1.8)	5.79 (1.9)	3.93 (1.4)	15 (25.9)	42 (43.3)	16 (28.1)	41 (71.9)	49 (86.0)	8 (14.0)	43 (75.4)	11 (19.3)	2 (3.5)	1 (1.8)
<i>P</i>	0.726	0.991	0.355	0.001 ^a	0.029 ^c	0.945	0.162					0.846		
Therapy for an acute flare	32.13 (6.9)	7.16 (2.0)	5.87 (2.4)	4.40 (1.7)	43 (79.6)	78 (70.3)	31 (25.6)	90 (74.4)	112 (92.6)	9 (7.4)	91 (75.2)	21 (17.4)	8 (6.6)	1 (0.8)
Positive comfort	31.89 (3.9)	7.02 (1.6)	5.59 (2.1)	4.34 (1.4)	11 (20.4)	33 (29.7)	21 (47.7)	23 (52.3)	37 (84.1)	7 (15.9)	35 (79.5)	6 (13.6)	2 (4.5)	1 (2.3)
<i>P</i>	0.823	0.691	0.497	0.823	0.202	0.007 ^c	0.104					0.768		
Steroids	31.51 (6.3)	6.92 (2.1)	5.56 (2.5)	4.52 (1.7)	45 (84.9)	72 (70.6)	35 (29.9)	82 (70.1)	109 (93.2)	8 (6.8)	93 (79.5)	19 (16.2)	5 (4.3)	0 (0.0)
Positive comfort	33.00 (6.1)	7.24 (1.6)	6.45 (1.9)	4.18 (1.4)	8 (15.1)	30 (29.4)	16 (42.1)	22 (57.9)	34 (89.5)	4 (10.5)	27 (71.1)	9 (23.7)	1 (2.6)	1 (2.6)
<i>P</i>	0.207	0.406	0.044b	0.272	0.049c	0.165	0.46					0.219		
Immunomodulators	31.82 (6.4)	7.09 (2.1)	5.90 (2.4)	4.45 (1.6)	52 (91.2)	93 (78.2)	40 (27.6)	105 (72.4)	136 (93.8)	9 (6.2)	108 (74.5)	29 (20.0)	7 (4.8)	1 (0.7)
Positive comfort	32.26 (3.9)	7.58 (1.2)	5.87 (2.0)	4.16 (1.2)	5 (8.8)	26 (21.8)	13 (41.9)	18 (58.1)	25 (80.6)	6 (19.4)	24 (77.4)	5 (16.1)	1 (3.2)	1 (3.2)
<i>P</i>	0.714	0.205	0.955	0.358	0.033 ^c	0.114	0.017 ^c					0.611		
Biologicals	32.20 (6.9)	7.06 (2.1)	5.99 (2.5)	4.55 (1.7)	53 (89.8)	82 (75.2)	38 (28.1)	97 (71.9)	123 (91.1)	12 (8.9)	102 (75.6)	24 (17.8)	8 (5.9)	1 (0.7)
Positive comfort	32.45 (4.1)	7.21 (1.7)	5.88 (1.9)	4.00 (1.5)	6 (10.2)	27 (24.8)	15 (45.5)	18 (54.5)	28 (84.8)	5 (15.2)	25 (75.8)	6 (18.2)	1 (3.0)	1 (3.0)
<i>P</i>	0.841	0.698	0.817	0.092	0.023c	0.055	0.285					0.663		

^aSignificant using Welch's t-test at <0.05 level. ^bSignificant using independent t-test at <0.05 level. ^cSignificant using Chi-square test at <0.05 level

Table 5: Physicians' knowledge as a predictor of comfort with medical therapies after controlling for age, group, gender, nationality, and qualification

How comfortable are you in initiating/directly using		Wald	OR	95% CI for OR		P
				Lower bound	Upper bound	
Maintenance therapy	Age	0.107	1.010	0.949	1.076	0.744
	Eaden Knowledge	0.378	0.935	0.755	1.158	0.538
	Leong Knowledge	0.587	1.076	0.892	1.297	0.444
	Sign/Symptom Awareness	6.965	1.610	1.130	2.294	0.008*
	Group=A	0.301	0.718	0.220	2.344	0.583
	Gender=Male	0.049	0.914	0.410	2.035	0.825
	Nationality=Saudi	3.749	3.385	0.985	11.632	0.053
	Qualification=MBBS	0.064	0.649	0.023	18.560	0.800
	Qualification=board or PhD	0.337	0.359	0.011	11.467	0.562
Therapy for an acute flare	Qualification=diploma or master's	0.000	1.028	0.025	42.934	0.988
	Age	0.540	1.028	0.954	1.108	0.463
	Eaden Knowledge	0.011	1.012	0.808	1.267	0.916
	Leong Knowledge	0.641	1.083	0.891	1.316	0.424
	Sign/Symptom Awareness	1.760	0.774	0.531	1.130	0.185
	Group=A	3.215	3.352	0.893	12.578	0.073
	Gender=male	8.467	0.312	0.142	0.684	0.004*
	Nationality=Saudi	4.027	3.753	1.031	13.659	0.045*
	Qualification=MBBS	1.137	5.065	0.257	99.929	0.286
Steroids	Qualification=board or PhD	1.373	6.370	0.288	141.011	0.241
	Qualification=diploma or master's	1.926	11.050	0.371	328.709	0.165
	Age	1.895	0.955	0.895	1.020	0.169
	Eaden Knowledge	0.007	0.990	0.779	1.258	0.933
	Leong Knowledge	3.381	0.831	0.681	1.012	0.066
	Sign/Symptom Awareness	1.328	0.794	0.537	1.175	0.249
	Group=A	7.461	8.252	1.815	37.513	0.006*
	Gender=male	2.173	0.541	0.239	1.224	0.140
	Nationality=Saudi	0.046	1.187	0.248	5.686	0.831
Immunomodulators	Qualification=MBBS	270.852	3.660E+09	2.658E+08	5.040E+10	<0.001*
	Qualification=board or PhD	250.100	3.342E+09	2.206E+08	5.062E+10	<0.001*
	Age	0.509	0.972	0.899	1.051	0.476
	Eaden Knowledge	1.712	0.830	0.628	1.097	0.191
	Leong Knowledge	0.306	1.064	0.853	1.328	0.580
	Sign/Symptom Awareness	1.082	0.805	0.534	1.212	0.298
	Group=A	5.378	6.031	1.321	27.538	0.020*
	Gender=Male	3.544	0.431	0.180	1.035	0.060
	Nationality=Saudi	5.380	4.467	1.261	15.824	0.020*
Biologics	Qualification=MBBS	1.295	6.505	0.259	163.545	0.255
	Qualification=board or PhD	1.843	10.117	0.358	285.739	0.175
	Qualification=diploma or master's	1.855	16.118	0.295	880.004	0.173
	Age	0.210	0.984	0.917	1.055	0.647
	Eaden Knowledge	0.141	0.956	0.755	1.211	0.707
	Leong Knowledge	0.134	1.039	0.846	1.276	0.714
	Sign/Symptom Awareness	0.026	0.970	0.669	1.407	0.872
	Group=A	3.370	3.807	0.914	15.864	0.066
	Gender=male	4.961	0.387	0.168	0.892	0.026*
	Nationality=Saudi	1.751	2.422	0.653	8.982	0.186
	Qualification=MBBS	1.222	5.545	0.266	115.602	0.269
	Qualification=board or PhD	1.154	5.637	0.240	132.277	0.283
	Qualification=diploma or master's	2.043	16.049	0.357	721.493	0.153
	Qualification=diploma or master's	2.043	16.049	0.357	721.493	0.153

OR: odds ratio; CI: confidence interval *Significant at <0.05 level

qualifications. Finally, physicians in group A were more comfortable with managing corticosteroids (OR = 8.25, $P = 0.006$) and immunomodulators (OR = 6.03, $P = 0.020$) compared with physicians in group B.

DISCUSSION

Despite the increasing prevalence of IBD worldwide,^[13,14] studies evaluating early disease diagnostic tools and

referral pathways are lacking. Such tools are crucial for PHC physicians to be able to deliver appropriate and evidence-based care.^[15] In this study, we divided participating physicians into two groups wherein one received an educational intervention focusing on IBD referral criteria and the other did not. Overall, the knowledge scores of the group that received education was relatively higher than that of the group that did not receive education, especially in the Sign/Symptom Awareness

domain, which may imply that the educational intervention may have influenced their knowledge of IBD. However, it is also notable that the comfort levels that physicians demonstrated toward IBD-specific medical therapies were much lower in the former group. PHC physicians included in this study generally felt uncomfortable with any of the particular forms of medical IBD therapies. The observed low level of comfort of the physicians who received education could be theoretically explained by suggesting that the PHC physicians who were educated became more aware of the potential side effects of certain IBD medications, and this might have reduced their comfort level with prescribing these medications. Also, PHC physicians who received education might have become more aware that they would need to follow up certain investigations once they started the IBD treatments or during follow up, and these investigations are not available at their PHC centers. A past survey by Tan *et al.* that evaluated 409 general practitioners (GPs) practicing in South Australia demonstrated that 30% of physicians felt uncomfortable with managing IBD in general, but 71% and 91% of the cohort were uncomfortable with the use of certain medical therapies, namely, immunomodulators and biologics, respectively.^[16] According to the same study, 70% of the GPs expressed that IBD-focused clinical support tools were appreciated and needed. Moreover, another survey conducted by Sossai *et al.* also reported that 71.8% of 39 GPs working in the Marche region of Central Italy required better instructions when it came to IBD cases.^[17] Theoretically, if PHC physician's knowledge and experience with IBD is insufficient, suboptimal management of IBD would occur, which may lead to misidentification of flares, inappropriate use of corticosteroids, overuse of aminosalicylates, or delay in delivering appropriate interventions.^[15] Since IBD is no longer considered a rare disease, providing IBD-centered education for PHC physicians could aid in avoiding future morbidity of IBD by early referral and management. In particular, education focused on the use of noninvasive biomarkers such as fecal calprotectin to screen for and monitor patients with IBD is crucial.^[18] The opinion of the authors is that the benefits of such an educational program could outweigh its cost. The reduced level of comfort that was observed can be avoided by increasing the confidence level of physicians through providing more knowledge and skills and to foster in the PHC physicians self-directed learning habits as well as their lifelong interests and motivation to continue medical education.

Our analyses has also suggested that knowledge did not seem to influence the comfort level of PHC physicians toward certain medical therapies for IBD following

education about IBD referral criteria. A similar Australian study reported that there was no positive correlation between IBD-specific knowledge and levels of comfort with IBD in general or any specific medical therapy for IBD, and that knowledge did not appear to be associated with the decision to refer. This may indicate that greater IBD-specific education did not improve the physicians' care provision toward patients with IBD.^[16] On the other hand, we observed that knowledge scores of physicians that did not receive education, especially scores from the Sign/symptom Awareness domain, was positively associated with the comfort levels of physicians with specific medical therapies. This, however, could be explained by the notion that gaining certain knowledge such as knowledge of the side effects of certain medications may sometimes reduce the level of comfort of physicians with prescribing these medications. Regardless, this finding suggests that knowledge can influence the attitude of PHC physicians toward the management of patients with IBD.^[19,20]

Recent evidence suggests that disease outcomes greatly depend on the quality of management, particularly during the early years of diagnosis.^[21] Therefore, timely referral to a gastroenterologist for diagnosis and the presence of a structured management plan are fundamental.^[22] Conversely, referral to a specialist does not transfer all the required care of the patient. It is presently acknowledged that shared or multidisciplinary care is the key to achieving optimal healthcare outcomes for patients with IBD. PHC physicians' involvement in the management of patients with IBD extends beyond the time of diagnosis as it is crucial that they are able to identify IBD relapses, detect extra-intestinal manifestations, and contribute to other areas of IBD care that can ultimately help reinforce specialized management.^[15,23] The burden of IBD is continuously increasing, which has a negative impact on the overall health status of people. By knowing that providing education about IBD to PHC physicians could lessen the burden of IBD by aiding early diagnosis and early referral to specialists, the authors believe that the next step should be to emphasize the importance of early diagnosis of IBD to PHC physicians. This could be achieved through systematically organized education and by integrating IBD into the curriculum of family medicine training residency programs.

We acknowledge that our study is limited by several factors including a small sample size, cross-sectional design, and lack of randomization. Future large randomized controlled trials are needed to better characterize the association between PHC physicians' knowledge of IBD and their level of comfort with managing IBD, and to identify

interventions that can improve IBD quality of care on the PHC level.

CONCLUSION

According to our results, an educational intervention can significantly increase PHC physicians' knowledge of IBD. However, this improvement in knowledge does not seem to translate into better levels of comfort toward IBD-specific medical therapies. PHC physicians included in this study generally felt uncomfortable with the prescription of any form of IBD therapy. Further studies focusing on identifying interventions that could improve PHC physicians' knowledge of IBD and physicians' comfort level with IBD-specific medical therapies are needed.

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Conflicts of interest

There are no conflicts of interest.

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