

Patient Perception of Chronic Illness Care in a Large Inflammatory Bowel Disease Cohort

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Background: Improvements in care for inflammatory bowel diseases could use the Chronic Care Model, an evidence-based approach that has improved patient outcomes and reduced costs in other illnesses. Specific aims include (1) to explore patient perception of chronic illness care in a large inflammatory bowel disease cohort and (2) to determine whether demographic factors, medication adherence, quality of life, disease type, and activity were associated with perception of chronic illness care.

Methods: We randomly selected 1000 participants from the Crohn's and Colitis Foundation of America Partners Internet cohort to receive the validated Patient Assessment of Chronic Illness Care (PACIC) instrument, which measures patient experience with specific aspects of care congruent with the Chronic Care Model on a scale of 1 to 5, with 5 being highest perception of care. We used descriptive and bivariate statistics to assess relationships.

Results: Nine hundred and forty-five participants completed the PACIC (576 Crohn's disease, 339 ulcerative colitis, and 30 indeterminate or other; 74% female, mean age 45 [SD = 15.1], mean PACIC 2.4 [SD = 0.93]). Recent gastroenterologist visit, hospitalization, surgery, and current pouch/ostomy were all associated with significantly higher PACIC ($P < 0.05$). PACIC correlated positively with quality of life (Pearson's correlation = 0.12, $P = 0.003$) but not medication adherence or disease activity.

Conclusions: Reports of chronic illness care in this inflammatory bowel disease cohort are in the same range as other illnesses. PACIC is positively associated with quality of life, so efforts to align care with the Chronic Care Model may benefit this population. Subjects who had more subspecialty interactions reported an increased perception of care, indicating the important role of direct patient contact.

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Key Words: inflammatory bowel disease, chronic illness care, Patient Assessment of Chronic Illness Care

Inflammatory bowel diseases (IBDs), including Crohn's disease (CD) and ulcerative colitis (UC), are chronic relapsing illnesses affecting as many as 1.5 million individuals in the United States.¹ IBD can negatively impact quality of life in patients² and carry a considerable cost burden for health care systems.³ Furthermore, there is a persisting gap in quality of care for IBD,⁴ as in many other illnesses. Ideally, improvements in care for IBD would

improve patient outcomes and reduce costs while delivering high-quality care across the United States.

The Chronic Care Model (CCM) is an evidence-based guide to quality improvement that has been studied in hundreds of settings since its development in 2001.⁵ The goal of the CCM is to establish proactive planned care for chronic illnesses built on productive interactions between active patients and proficient health care providers. The model provides specific recommendations for changes in the following 6 areas: health care organization, community resources, self-management support, delivery system design, decision support, and clinical information systems. Implementation of CCM-based care has improved patient outcomes⁶ and reduced costs⁷ in diabetes and many other diseases.

Based on findings in other illnesses, the CCM could be an effective framework for improving care for IBD. Additionally, one group has demonstrated decreased costs and health care utilization with a gastroenterologist-led shared care model for IBD that is congruent with some elements of the CCM⁸. Before large-scale changes in health care delivery for IBD are implemented, however, appropriate tools for measuring CCM-based care need to be established. The Patient Assessment of Chronic Illness Care (PACIC) instrument is a short validated survey that measures patient experience with specific actions and aspects of care

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congruent with the CCM.⁹ To our knowledge, patient assessment of quality of care, as it pertains to the CCM, has not yet been evaluated in a large IBD population. The purpose of this study was (1) to explore patient perception of chronic illness care in a large Internet-based IBD cohort and (2) to determine whether demographic factors, medication adherence, quality of life, disease type, and disease activity were associated with perception of chronic illness care.

METHODS

Study Design

We performed a cross-sectional study of the relationship between PACIC and demographic factors, disease type and activity, medication adherence, and quality of life nested within a large Internet-based cohort study (Crohn's and Colitis Foundation of America [CCFA] Partners). CCFA Partners is an Internet registry of patients with IBD who complete twice-yearly on-line surveys about health history, disease management, and issues facing IBD patients.¹⁰ Inclusion criteria are self-reported IBD, aged 18 years or older, and Internet access. Since launching in 2011, CCFA Partners has over 12,000 participants.

Patient Selection

Between February 4, 2012 and February 25, 2012, 1000 participants were randomly selected to receive the PACIC instrument⁹ in addition to the standard 6-month follow-up survey for the CCFA Partners study.

Instruments

The 6-month follow-up CCFA Partners survey was released to all eligible CCFA Partners participants and included questions on demographics, health care, smoking history, IBD characteristics, medications, family history, disease history, daily activity, quality of life, and health status. Additional modules, including the PACIC, were released to varying numbers of participants. All instruments have been previously validated and are described below. All measures were reported for the time between baseline and follow-up surveys (approximately 6 months) unless otherwise specified by the instrument.

The PACIC instrument consists of 20 questions divided into 5 subscales (Patient Activation, Delivery System Design/Decision Support, Goal Setting, Problem Solving/Contextual Counseling, and Follow-up/Coordination), which overlap all dimensions of the CCM that could be perceived by the patient.⁹ The PACIC measures the patient experience with actions or aspects of care that are consistent with the CCM within the past 6 months. It is scored by averaging the weighted values of all responses for the overall score or questions pertinent to each of the subscales. Results are expressed as a decimal value from 1 to 5, with 1 being the lowest perception of chronic illness care and 5 being the highest. The PACIC has been validated multiple times¹¹ and has been used in a variety of diseases. This instrument is the

most appropriate instrument for measuring the patient experience of receiving integrated chronic care based on its psychometric characteristics, perceived applicability, and relevance.¹²

The short Crohn's Disease Activity Index was shown to be comparable to the original and widely used Crohn's Disease Activity Index¹³ in validity, reliability, and responsiveness.¹⁴ It contains 15 questions, and results are expressed as inactive disease (≤ 150), mild disease (151–199), and moderate-to-severe disease (≥ 200).

The Simple Clinical Colitis Activity Index was validated in a longitudinal cohort study of patients undergoing colonoscopy and was found to have excellent psychometric validity and moderate-to-good performance validity.¹⁵ A score of ≤ 2 is associated with remission¹⁶ and a score of ≥ 5 defines a relapse of UC.¹⁷

The Manitoba IBD Index is a validated single-item indicator of IBD activity over an extended period of time (6 months for this study).¹⁸ Responses were categorized into well or rarely active (a-b), occasionally or sometimes active (c-d), and often or constantly active (e-f).

The short IBD questionnaire is a validated continuous measure of health-related quality of life that has been shown to correlate with disease activity in the IBD population.¹⁹ Scores range from 10 to 70 with 10 associated with low health-related quality of life and 70 being optimum.

The Morisky Medication Adherence Scale consists of 8 questions regarding different aspects of medication adherence for various time periods.²⁰ Each question is worth 1 point, and results are expressed as the sum. Responses are categorized into low,^{1–5} medium,^{6,7} and high⁸ adherence.

Statistical Analysis

All analyses were performed using SAS version 9.3 (Cary, NC). The population was characterized using descriptive statistics, including proportions, means, and standard deviations, for overall IBD and stratified for CD and UC. Outcomes were compared using bivariate statistics, including the Student's *t* test. The associations between PACIC scores and other continuous measures were described by Pearson's correlation. Confidence intervals were 95%, and $P < 0.05$ was considered statistically significant. The Institutional Review Board at the University of North Carolina at Chapel Hill approved the study protocol.

RESULTS

Study Population

Of the 1000 participants selected to receive the PACIC survey, 979 (98%) started the survey and 945 (97% of those who started) completed the instrument (576 CD, 339 UC, 74% female, mean age 45 [SD = 15.1]) (Table 1). Thirty participants reported indeterminate colitis or IBD unspecified and hereafter are included with UC. The majority of the respondents reported white race (94.9%). Nearly all were residents of the United States (96.9%). In general, respondents were well educated, with

TABLE 1. Sample Characteristics, n = 945

Characteristic		Mean (SD) or Percent	
Demographics	Age, years	44.9 (15.2)	
	Female	73.9	
	U.S. resident	96.9	
	Race/ethnicity	White	94.9
		African American	<1
		Asian	1.4
		Native Hawaiian/Pacific Islander	<1
		American Indian/Alaskan Native	<1
		More than one race	2.1
		Other	<1
		Hispanic	1.8
	Education completed	Less than 12th grade	1.1
		12th grade	7.1
		Some college	19.1
		College graduate	40.6
Graduate school		32.2	
Current smoker		5.3	
Disease characteristics	CD	60.9	
	UC	35.9	
	Indeterminate or other	3.2	
	≥1 hospitalizations in the past 6 months	9.0	
	≥1 bowel surgeries in the past 6 months	4.2	
	Current ileal or Koch pouch	4.4	
	Current ostomy	6.4	
	Health care setting	Has PCP (seen at least once in the past 6 months)	82.5
		Has GI specialist (seen at least once in the past 6 months)	85.0
		GI specialist—university/academic setting	16.4
GI specialist—private practice		72.2	
Mean scores	Mean MMAS	6.3 (1.72)	
	Mean SIBDQ	50.5 (11.1)	
	Mean Manitoba (CD)	Occasionally or sometimes active	
	Mean sDAI	52.1	
	Mean Manitoba (UC)	Occasionally or sometimes active	
	Mean SCCAI	3.3	

MMAS, Morisky medication adherence scale; sDAI, short Crohn's Disease Activity Index; SCCAI, Simple Clinical Colitis Activity Index; SIBDQ, short IBD questionnaire.

40.6% having completed a college degree and 32.2% with graduate-level education. A small percentage reported recent hospitalizations (9.0%), surgeries (4.2%), and current pouch (4.4%) or ostomy (6.4%).

Mean medication adherence score was 6.3 (SD = 1.72) or moderate. A total of 213 participants had a low adherence score (36.2%), 199 had medium adherence (33.8%), and 176 had high adherence (29.9%). Mean quality of life as measured by the short IBD questionnaire score was 51 (SD = 11.1), which is consistent with reported means for mild or inactive IBD.^{2,10,21,22} Mean short Crohn's Disease Activity Index was 52.1, indicating inactive disease. The mean Manitoba IBD index for CD was 3.65, indicating occasionally or sometimes active disease. Mean UC disease activity as measured by the Simple Clinical Colitis Activity Index was 3.3 or between relapse and remission. The mean Manitoba index for UC was 3.89, indicating occasionally or sometimes active disease.

PACIC: Overall and Subscale Scores

The mean PACIC score was 2.4 (SD = 0.93), which is within the range reported for other illnesses²³⁻²⁶ (see Fig. 1). The subscale domain of Patient Activation was significantly higher ($P < 0.0001$) and the subscale domain of Follow-up/Coordination was significantly lower when compared across all other domains ($P < 0.0001$).

PACIC: Association with Patient and Provider Characteristics

The following characteristics were associated with a significantly higher PACIC score: 1 or more visit with a gastroenterology (GI) specialist in the past 6 months, 1 or more hospitalization or surgery in the past 6 months, and current pouch or ostomy ($P < 0.05$) (Table 2). The following characteristics were not associated with a significant difference in PACIC score: demographic factors (including gender, age, education level), disease type (CD versus UC) or duration, 1 or more visit with a primary care physician in the past 6 months, and GI health care setting (university/academic versus private practice). Recent GI visit significantly increased the Patient Activation ($P = 0.0003$) and Problem Solving/Contextual

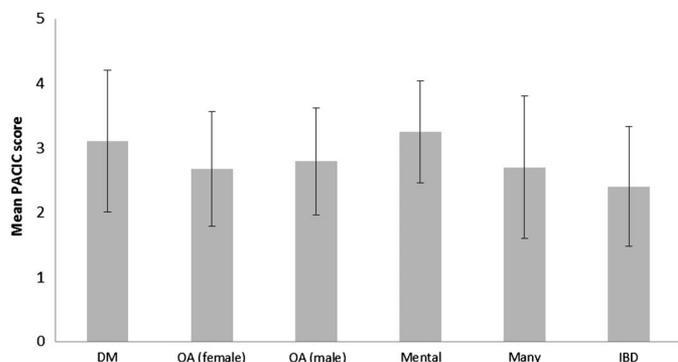


FIGURE 1. Mean PACIC scores reported for chronic illnesses, including diabetes (DM),²⁴ osteoarthritis (OA) stratified by gender,²⁵ mental disorders,²³ and a survey of many chronic illnesses.²⁶

TABLE 2. Mean PACIC Overall Scale and Subscale Scores (SD) by Population Characteristics, n = 945

Characteristic	Patient Activation	Delivery System Design/ Decision Support	Goal Setting	Problem Solving/ Contextual Counseling	Follow-up/ Coordination	Overall	P ^a
Entire study population	3.14 (1.30)	2.68 (1.03)	2.06 (0.98)	2.78 (1.31)	1.84 (0.9)	2.40 (0.93)	n/a
Sex							0.891
Male	3.02 (1.25)	2.78 (0.95)	2.06 (0.94)	2.78 (1.24)	1.87 (0.89)	2.41 (0.89)	
Female	3.19 (1.31)	2.64 (1.06)	2.06 (1.00)	2.77 (1.33)	1.83 (0.90)	2.40 (0.94)	
Age, yr							0.08
18–39	3.21 (1.29)	2.62 (0.97)	2.08 (0.97)	2.85 (1.28)	1.82 (0.89)	2.42 (0.90)	
40–64	3.14 (1.31)	2.69 (1.05)	2.03 (0.97)	2.72 (1.31)	1.82 (0.85)	2.38 (0.92)	
≥65	2.96 (1.25)	2.82 (1.17)	2.15 (1.06)	2.78 (1.37)	2.01 (1.08)	2.46 (1.03)	
Disease type							0.076
CD	3.20 (1.31)	2.72 (1.04)	2.09 (0.98)	2.81 (1.32)	1.89 (0.91)	2.45 (0.94)	
UC	3.06 (1.28)	2.61 (1.02)	2.01 (0.98)	2.71 (1.29)	1.76 (0.87)	2.34 (0.90)	
Disease duration, yr							0.23
0–5	3.11 (1.30)	2.58 (1.02)	2.01 (0.93)	2.68 (1.26)	1.74 (0.83)	2.33 (0.88)	
6–10	3.34 (1.22)	2.73 (1.00)	2.17 (1.00)	2.88 (1.32)	1.89 (0.96)	2.50 (0.91)	
11–20	3.21 (1.32)	2.70 (1.06)	2.06 (0.98)	2.91 (1.30)	1.83 (0.87)	2.44 (0.92)	
>20	3.02 (1.32)	2.73 (1.06)	2.05 (1.01)	2.70 (1.34)	1.90 (0.94)	2.39 (0.97)	
Education level							0.071
High school or less	3.24 (1.32)	2.83 (1.18)	2.29 (1.22)	2.99 (1.39)	2.03 (1.04)	2.59 (1.07)	
Some college or higher	3.14 (1.30)	2.67 (1.02)	2.04 (0.95)	2.76 (1.30)	1.82 (0.87)	2.39 (0.91)	
Recent interactions							0.648
≥1 primary care	3.13 (1.29)	2.69 (1.03)	2.07 (0.98)	2.78 (1.31)	1.87 (0.91)	2.41 (0.92)	
No primary care	3.35 (1.30)	2.73 (1.05)	2.11 (0.97)	2.85 (1.36)	1.77 (0.84)	2.45 (0.92)	
≥1 specialist	3.23 (1.26)	2.72 (1.00)	2.09 (0.97)	2.87 (1.30)	1.89 (0.90)	2.46 (0.91)	0.004
No specialist	2.80 (1.39)	2.59 (1.13)	1.98 (1.04)	2.46 (1.30)	1.67 (0.88)	2.21 (0.97)	
Health care setting							0.060
University or academic	3.33 (1.22)	2.70 (1.08)	2.23 (1.04)	2.97 (1.37)	1.99 (0.95)	2.55 (0.99)	
Private practice	3.14 (1.29)	2.71 (1.01)	2.05 (0.98)	2.77 (1.30)	1.81 (0.99)	2.40 (0.91)	
Health care utilization							0.014
≥1 hospitalization	3.27 (1.31)	2.84 (1.10)	2.31 (1.00)	3.03 (1.33)	2.16 (0.96)	2.64 (0.95)	
None	3.13 (1.30)	2.66 (1.03)	2.04 (0.98)	2.75 (1.30)	1.81 (0.89)	2.38 (0.92)	
≥1 bowel surgeries	3.71 (1.25)	3.04 (0.98)	2.42 (1.08)	3.43 (1.26)	2.51 (1.05)	2.93 (0.93)	<0.001
No surgeries	3.12 (1.30)	2.66 (1.03)	2.04 (0.98)	2.75 (1.30)	1.81 (0.88)	2.40 (0.92)	
Pouch/ostomy status							<0.001
Current pouch	3.67 (1.11)	3.07 (1.10)	2.62 (1.28)	3.40 (1.31)	2.34 (1.13)	2.93 (1.03)	
No pouch	3.12 (1.30)	2.66 (1.03)	2.04 (0.96)	2.75 (1.30)	1.82 (0.88)	2.38 (0.91)	
Current ostomy	3.35 (1.22)	2.99 (1.13)	2.40 (1.10)	3.19 (1.21)	2.23 (1.01)	2.75 (0.99)	0.003
No ostomy	3.13 (1.31)	2.66 (1.02)	2.04 (0.97)	2.75 (1.31)	1.81 (0.89)	2.38 (0.92)	

^aP value for t test comparing overall PACIC scores by population characteristics. Statistically significant values are indicated in bold (P < 0.05).

Counseling (P = 0.0008) subdomains. Recent hospitalization or surgery and current pouch or ostomy increased all subdomains.

PACIC: Association with Disease Activity, Quality of Life, and Medication Adherence

Quality of life, as measured by short IBD questionnaire, was found to have a modest but significant positive association

with PACIC score (Pearson’s correlation = 0.119, P = 0.003). The associations between PACIC and disease activity as measured by a number of instruments were small and inconsistent (Table 3). For CD, PACIC was not associated with current disease activity, as measured by short Crohn’s Disease Activity Index and Manitoba IBD Index. For UC, PACIC was significantly negatively associated with current disease measured by Simple

TABLE 3. Association of Mean PACIC Score and Disease Activity Measured by 3 Indices (sCDAI, SCCAI, and Manitoba)

		Mean PACIC (SD)	<i>P</i>
sCDAI (n = 542)	Inactive, ≤150	2.42 (0.92)	0.159
	Mild disease, 151–199	2.83 (1.08)	
	Moderate-to-severe disease, ≥200	2.63 (0.95)	
SCCAI (n = 369)	Inactive, ≤2	2.46 (0.95)	0.011
	Mild disease, 2.1–4.9	2.33 (0.89)	
	Moderate-to-severe disease, ≥5	2.12 (0.80)	
Manitoba IBD Index—CD (n = 574)	Well or rarely active (a-b)	2.41 (0.95)	0.696
	Occasionally or sometimes active (c-d)	2.42 (0.93)	
	Often or constantly active (e-f)	2.49 (0.92)	
Manitoba IBD Index—UC (n = 369)	Well or rarely active (a-b)	2.20 (0.82)	0.073
	Occasionally or sometimes active (c-d)	2.29 (0.84)	
	Often or constantly active (e-f)	2.46 (0.98)	

sCDAI, short Crohn's Disease Activity Index; SCCAI, Simple Clinical Colitis Activity Index. Statistically significant values are indicated in bold ($P < 0.05$).

Clinical Colitis Activity Index (categorical $P = 0.0107$; continuous Pearson's correlation = -0.144 , $P = 0.005$); however, PACIC was not significantly associated with Manitoba IBD Index for UC ($P = 0.0726$). Medication adherence did not correlate with PACIC score ($P > 0.05$).

DISCUSSION

In this IBD population, overall PACIC scores were within the range reported for other illnesses. The Patient Activation subscale score was significantly higher and the Follow-up/Coordination subscale score was significantly lower than all others ($P < 0.0001$) for the entire study population. Although the value of individual subscale scores is debatable due to high internal consistency,¹¹ these findings suggest that the CCFA Partners Internet-based cohort of individuals with IBD is a highly active, motivated population and deficits may be in the arena of continuity of care. Studies of diabetes,^{24,27} mental illness,²³ osteoarthritis,²⁵ and other chronic illnesses²⁶ also found Follow-up/Coordination to be the lowest subscale score and hence targets for quality improvement work. The significant positive association between PACIC score and quality of life suggests that implementation of quality improvement in care for IBD based on the CCM could benefit this population; however, the correlation was weaker than expected (Pearson's correlation = 0.12).

The association between subspecialty care (such as visit with GI specialist, recent surgery or hospitalization, or current pouch or ostomy) may result from increased opportunities for very sick patients to interface with their health care providers, resulting in increased perception of care. These findings may indicate an important role for direct patient contact in perception of quality of care or could demonstrate a need to adjust for

frequency of health care interactions in future studies using the PACIC instrument.

Associations between PACIC measurements of disease activity were inconsistent and only one was significant; thus, we fail to make any conclusive statements about the relationship between IBD activity and patient perception of care. Similarly, no relationship was found in a study of psychological support and disease activity with patients with CD and UC.²⁸ Disease duration was examined as a potential confounding factor, but no significant association was found between disease duration and PACIC score. Medication adherence was not found to be associated with PACIC, and this finding is consistent with studies in diabetes²⁹ and a study of many illnesses including diabetes, chronic pain, heart failure, asthma, and coronary artery disease.²⁶ Although we found no statistically significant associations between demographic factors and PACIC scores, other reports show mixed associations with demographic factors. No association was found in a study of mental illnesses,²³ and contradicting associations were found in different diabetes studies,^{9,24} indicating that study population characteristics and specific health care settings may play an important role in patient perception of chronic illness care. It may not be possible to directly compare baseline PACIC scores in cross-sectional studies at different sites.

To our knowledge, this is the first reported instance of the PACIC instrument being used in an entirely self-administered web-based setting. The high initiation (98%) and completion (97%) rates suggest no problems with the adaptation to a web-based format, completion of the survey, and overall feasibility of an on-line version of the PACIC.

There are several strengths to this study of perception of chronic illness care in IBD. This study includes a large sample size, allowing for increased statistical power to describe

associations between various clinical factors and perception of chronic illness care. Additionally, the population is quite diverse, as evidenced by the wide variability of demographic factors such as age, geographic location, education, health care setting and disease type, activity, and duration. The limitations of this study include the cross-sectional design, which hinders our ability to draw causal conclusions regarding associations between PACIC and disease outcomes. PACIC scores may be more meaningful when used in a prospective study of PACIC scores at baseline with outcomes collected over time. Other weaknesses of this study include a lack of external generalizability, which is inherent to Internet-mediated research, and the self-report IBD diagnoses within the CCFA Partners cohort.

In conclusion, patient-reported experiences of chronic illness care in this IBD cohort are similar to reports for other illnesses. Perception of chronic illness care is positively, albeit modestly, associated with quality of life. Efforts to align care with the CCM may benefit this population.

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Author contributions: R. L. Randell was involved in all aspects of the study, including study concept and design, analysis and interpretation of data, drafting and critical revision of the manuscript, and obtained funding for this study. M. D. Long was involved with study concept and design, analysis and interpretation of the data, and critical revision of the manuscript. C. F. Martin was involved in study concept and design, analysis and interpretation of data, statistical analysis, and critical revision of the manuscript. R. S. Sandler was involved in study concept, critical revision of the manuscript, and study supervision. W. Chen was involved in data acquisition. K. Anton was involved in study design, data analysis, and critical revision of the manuscript. M. D. Kappelman was involved in all aspects of the study, including study concept and design, analysis and interpretation of data, critical revision of the manuscript, and study supervision.

REFERENCES

- Kappelman MD, Rifas-Shiman SL, Kleinman K, et al. The prevalence and geographic distribution of Crohn's disease and ulcerative colitis in the United States. *Clin Gastroenterol Hepatol*. 2007;5:1424–1429.
- Faust AH, Halpern LF, Danoff-Burg S, et al. Psychosocial factors contributing to inflammatory bowel disease activity and health-related quality of life. *Gastroenterol Hepatol (N Y)*. 2012;8:173–181.
- Bemstein CN, Longobardi T, Finlayson G, et al. Direct medical cost of managing IBD patients: a Canadian population-based study. *Inflamm Bowel Dis*. 2012;18:1498–1508.
- Kappelman MD, Palmer L, Boyle BM, et al. Quality of care in inflammatory bowel disease: a review and discussion. *Inflamm Bowel Dis*. 2010;16:125–133.
- Wagner EH, Austin BT, Davis C, et al. Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)*. 2001;20:64–78.
- Warm EJ. Diabetes and the chronic care model: a review. *Curr Diabetes Rev*. 2007;3:219–225.
- Kuo S, Bryce CL, Zgibor JC, et al. Cost-effectiveness of implementing the chronic care model for diabetes care in a military population. *J Diabetes Sci Technol*. 5:501–513.
- Sack C, Phan VA, Grafton R, et al. A chronic care model significantly decreases costs and healthcare utilisation in patients with inflammatory bowel disease. *J Crohns Colitis*. 6:302–310.
- Glasgow RE, Wagner EH, Schaefer J, et al. Development and validation of the Patient Assessment of Chronic Illness Care (PACIC). *Med Care*. 2005;43:436–444.
- Long MD, Kappelman MD, Martin CF, et al. Development of an internet-based cohort of patients with inflammatory bowel diseases (CCFA Partners): methodology and initial results. *Inflamm Bowel Dis*. 2012;18:2099–2106.
- Gugiu C, Coryn CL, Applegate B. Structure and measurement properties of the Patient Assessment of Chronic Illness Care instrument. *J Eval Clin Pract*. 2010;16:509–516.
- Vrijhoef HJ, Berbee R, Wagner EH, et al. Quality of integrated chronic care measured by patient survey: identification, selection and application of most appropriate instruments. *Health Expect*. 2009;12:417–429.
- Best WR, Beckett JM, Singleton JW, et al. Development of a Crohn's disease activity index. National Cooperative Crohn's Disease Study. *Gastroenterology*. 1976;70:439–444.
- Thia K, Faubion WA Jr, Loftus EV Jr, et al. Short CDAI: development and validation of a shortened and simplified Crohn's disease activity index. *Inflamm Bowel Dis*. 17:105–111.
- Higgins PD, Leung J, Schwartz M, et al. The quantitative validation of non-endoscopic disease activity indices in ulcerative colitis. *Aliment Pharmacol Ther*. 2007;25:333–342.
- Turner D, Seow CH, Greenberg GR, et al. A systematic prospective comparison of noninvasive disease activity indices in ulcerative colitis. *Clin Gastroenterol Hepatol*. 2009;7:1081–1088.
- Jowett SL, Seal CJ, Phillips E, et al. Defining relapse of ulcerative colitis using a symptom-based activity index. *Scand J Gastroenterol*. 2003;38:164–171.
- Clara I, Lix LM, Walker JR, et al. The Manitoba IBD Index: evidence for a new and simple indicator of IBD activity. *Am J Gastroenterol*. 2009;104:1754–1763.
- Irvine EJ. Quality of life in inflammatory bowel disease and other chronic diseases. *Scand J Gastroenterol Suppl*. 1996;221:26–28.
- Morisky DE, Ang A, Krousel-Wood M, et al. Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens (Greenwich)*. 2008;10:348–354.
- Ananthakrishnan AN, Beaulieu DB, Ulitsky A, et al. Does primary sclerosing cholangitis impact quality of life in patients with inflammatory bowel disease? *Inflamm Bowel Dis*. 2010;16:494–500.
- Lam MY, Lee H, Bright R, et al. Validation of interactive voice response system administration of the Short Inflammatory Bowel Disease Questionnaire. *Inflamm Bowel Dis*. 2009;15:599–607.
- Gensichen J, Serras A, Paulitsch MA, et al. The Patient Assessment of Chronic Illness Care questionnaire: evaluation in patients with mental disorders in primary care. *Community Ment Health J*. 47:447–453.
- Jackson GL, Weinberger M, Hamilton NS, et al. Racial/ethnic and educational-level differences in diabetes care experiences in primary care. *Prim Care Diabetes*. 2008;2:39–44.
- Rosemann T, Laux G, Szecsenyi J, et al. The Chronic Care Model: congruency and predictors among primary care patients with osteoarthritis. *Qual Saf Health Care*. 2008;17:442–446.
- Schmittiel J, Mosen DM, Glasgow RE, et al. Patient Assessment of Chronic Illness Care (PACIC) and improved patient-centered outcomes for chronic conditions. *J Gen Intern Med*. 2008;23:77–80.
- Szecsenyi J, Rosemann T, Joos S, et al. German diabetes disease management programs are appropriate for restructuring care according to the chronic care model: an evaluation with the patient assessment of chronic illness care instrument. *Diabetes Care*. 2008;31:1150–1154.
- Engel KL, Helvie K, Adler J, et al. Sa1297 the relationship between perceived psychological support, health-related quality of life, and disease activity in newly diagnosed inflammatory bowel disease patients. *Gastroenterology*. 142:S-266.
- Mackey K, Parchman ML, Leykum LK, et al. Impact of the Chronic Care Model on medication adherence when patients perceive cost as a barrier. *Prim Care Diabetes*. 2012;6:137–142.