Method To Derive A Crohn's Disease Activity Index From Electronic Health Records Data

Anna Swenson, Katherine Womack, Meaghan Quinn, Gary Curhan | OM1, Inc, Boston, MA, USA

Background

The Crohn's Disease Activity Index (CDAI)[1] is currently the gold-standard for measuring disease activity in Crohn's disease (CD) patients. It is the most commonly used outcome measure in clinical trials, however, due to the burden of completion, it is infrequently used in routine care. Real world data, including electronic health records (EHR), are useful for studying longitudinal disease and treatment outcomes in the real world, but most EHR databases do not include CDAI. Building off the methods presented by Rudrapatna et al. 2021[2], we calculated a derived CDAI using data elements available in EHR data.

Objective

To derive longitudinal CDAI scores using data elements routinely reported in EHR data.

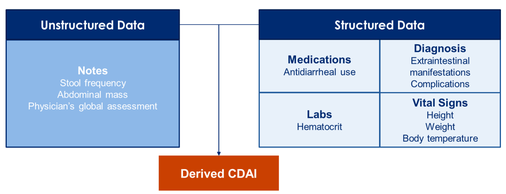
Methods

Data Source
Data were derived from the OM1 PremiOM™ CD Dataset (OM1, Boston, MA), a multisource real-world database with linked healthcare claims and EHR data on US patients with CD (2013-present).

Score Derivation
Weight, body temperature and hematocrit were sourced from structured vital signs and laboratory data. Ideal body weight was calculated from height and sex using the Devine formula. Extraintestinal manifestations/complications were evaluated based on the presence or absence of ICD diagnosis codes for each condition. Abdominal mass was abstracted from clinical notes. Number of stools in the past 7 days, average daily abdominal pain, and general well being were extrapolated from single-day measures extracted from clinical notes rather than based on 7-day diaries. Each component value was multiplied by the weights outlined in Best et al. 1976[1].

Components recorded within 4 months were added to calculate a derived CDAI. Multiple CDAIs could be calculated for each patient over time, but each component was allowed to contribute to only one CDAI score.

Figure 1. Source Data Types for CDAI Derivation.



Results

Among 14,485 CD patients, only 10 had a CDAI recorded in their notes. After applying the algorithm, we were able to calculate a derived CDAI for 1,581 patients. 494 patients had > 1 score derived. **Figure 2** shows the distribution of derived CDAIs (n=2,553 scores). Patients with a derived CDAI were younger and a higher proportion were treated with biologics and corticosteroids than those who could not have a CDAI calculated (**Table 1**). Patients with penetrating disease had higher mean CDAI scores than those with inflammatory or stricturing disease (**Table 2**). Mean CDAI was lower after corticosteroid initiation (**Table 2**).

Conclusions

- A derived CDAI can be calculated from data that may be routinely recorded in EHRs.
- Efforts to standardize the collection of CDAI components in EHRs would further increase the availability of derived CDAIs.
- Further work to validate these derived scores against a gold standard and to replicate the findings in other real-world datasets should be considered. Validation was not feasible in this dataset due to the lack of recorded CDAIs.
- Derived CDAIs could potentially be used to study longitudinal changes in disease status and treatment effectiveness in settings where observed CDAIs are unavailable.

Figure 2. Derived CDAI Distribution (N scores = 2,553).

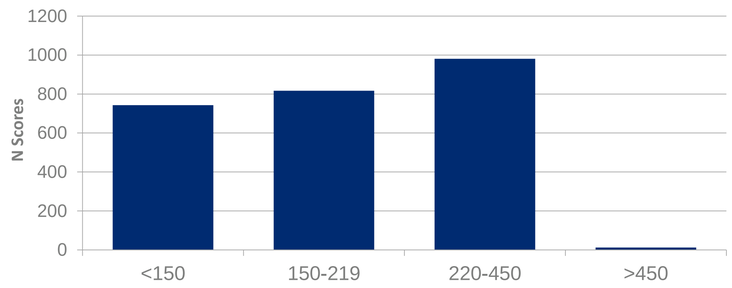


Table 1. Characteristics of Patients With and Without a derived CDAI

	Derived CDAI (N = 1,581)	No CDAI (N = 12,896)
Age, years (mean, SD)	40 (18)	45 (18)
Sex (% female)	848 (53.6%)	7804 (60.5%)
Race		
White	1101 (69.6%)	9031 (70.0%)
Black	116 (7.3%)	986 (7.6%)
Asian	45 (2.8%)	176 (1.4%)
Other	146 (9.2%)	672 (5.2%)
Unknown	173 (10.9%)	2031 (15.7%)
Charlson Comorbidity Index (mean, SD)	3.0 (2.4)	2.8 (2.1)
Treated with biologic (ever)	1,119 (70.8%)	6,215 (48.2%)
Treated with corticosteroids (ever)	1,389 (87.9%)	10,024 (77.7%)
Treated with mesalamine (ever)	439 (27.8%)	3,295 (25.6%)

Table 2. Characteristics of Patients with a derived CDAI

	Derived CDAI (mean, SD)
Fecal calprotectin*	
<250 (n=78)	212 (111)
≥250 (n=87)	224 (70)
CD Behavior	
Inflammatory only (n=156)	195 (80)
Stricturing only (n=247)	177 (87)
Penetrating only (n=46)	218 (107)
Inflammatory, Penetrating & Stricturing (n=149)	243 (99)
CDAI within 30 days before first corticosteroid record (n=105)	257 (93)
CDAI in the 0-180 days after first corticosteroid record (n= 176)	206 (96)
CDAI within 30 days before first biologic record (n= 64)	216 (95)
CDAI in the 0-180 days after first biologic record (n=133)	210 (99)

*within 30 day of CDAI score

Conference
Presented at Crohn's and Colitis Congress. January 19, 2023. Denver, CO, USA

References

1. Best, W.R., et al., *Development of a Crohn's disease activity index. National Cooperative Crohn's Disease Study.* Gastroenterology, 1976. **70**(3): p. 439-44.
2. Rudrapatna, V.A., B.S. Glicksberg, and A.J. Butte, *Utility of routinely collected electronic health records data to support effectiveness evaluations in inflammatory bowel disease: a pilot study of tofacitinib.* BMJ Health Care Inform, 2021. **28**(1).

Disclosures
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