[DRAFT IN PROGRESS] Managing Irritable Bowel Syndrome Through Lightweight, Daily Tracking

Isaac D. Gerg, TODO
The Pennsylvania State Univeristy
Applied Research Laboratory
State College, PA 16804–0030
Email: idg101@arl.psu.edu

***Abstract*—Irttiable bowel syndrome (IBS) is a multifaceted syndrome with generally unknown etiology with few exceptions [pimentel cite]. It primarily manifests itself through one or more symptoms of chronic diarrhea, constipation, and abdominal pain. Generally, it is a diagnosis of exclusion after the patient has had a comprehensive workup. In this paper, we show how the author, the patient, who is a 34 year old male diagnosed with irritable bowel syndrome manifesting through symptoms of abdominal pain and diarrhea, utilizes a smartphone application and spreadhseet to track bowel movements, medication, exercise, and overall functionality to assess treatment efficacy.**

I. Introduction

IBS is a multifacieted syndrom witih generally unknown etiology with the exception of the recent work done by Rao and Pimentel. Generally, patients go through a battery of tests and eventually IBS is diagnosed as moreso an exclusion of other, more life threatening conditions such as chrons diease or ulcerative colitis. Depits TODO of US population diagnosed with IBS, treating it difficult. Doctors and have many approaches to treatment which include anti-spasodmoics, cognitive behaviour therepy (CBT), altered diet [FODMPA citatpion], SSRIs, and TCAs. Anecdotal, doctors and patients generally use a try-and-see approach for symptom managagment akin to contemperorary SSRI managment [TODO stard trial].

In this study, we seek to quantify symptom serverity, bowel habits, and medications in a lightweight manner making daily compliance of record keeping easy and regress on the data to determine what treatments are effective for an N=1 study, i.e. the author. There has been much overlap between eitologies of anxiety and depression with IBS [TODO citation] so there is a strong need to have objective eidence to support a particlarly treatement especially because the placebo effect [TODO cite kirch work] may be large and the side effect profile of many IBS treatments may add to the treatment themselves [TODO cite side effects of nexium and librax.]

II. Tracking Methodology

The patient uses a simple android applicatoin and google spreadsheet for daily tracking. The android applicaoitn used is Bowel Move and requires a handful of clicks to enter a BM. Likewise, google spreadsheets are available on most internet connected platforms and smart phones making it easy to find a suitable computer to enter in daily data. Together, compliance of the record keeping protocol exceeds 99

The patient keeps log of the following items through a Google spreadsheet:

noitemsep

- AM/PM Health Quality Index (HQI)
- Medication intake as dosage
- Time spent performing cardiovascular exercise
- Body weight

HQI is defined on a 1-4 scale describing how the symptoms manifest themselves as a function of the patients ability to complete his daily wishes ans plans (e.g. work, exercise, time with family, etc). HQI has defined levels which are:

1) Symptom severity requires medical urgent medical attention (e.g. ED visit)
2) Symptom severity prevents patient from completly daily wishes (e.g. missed a day of work due to persistant abdominal pain)
3) Symptoms notable but patient is able to cope with symptoms to complete daily wishes (e.g. a stomach ache while at a baseball game which is tolerable and resolves with time)
4) Symptoms are not present.

Medications are recorded as total daily dose. For example, a daily dose of 20mg Nexium bid is entered as 40mg. Time spent performing cardio recorded as total daily time in minutes. For example, a two-hour mountain bike ride is records as 120 minutes. Daily weight is recorded first thing in the morning and entered in pounds.

III. Data Visualization

Bristol Stool Scores (BSS) over the sampling period are shown below.

We are interested in the number of bowel movements outside the 3-5 BSS. We defines these as abnormal movements and wish to minimize their presence. We show their contribution below.

The time between movements we list for completeness below. The plot shows a bimodal distribution and the author believes the left-most peak is characteristic of IBS-D.

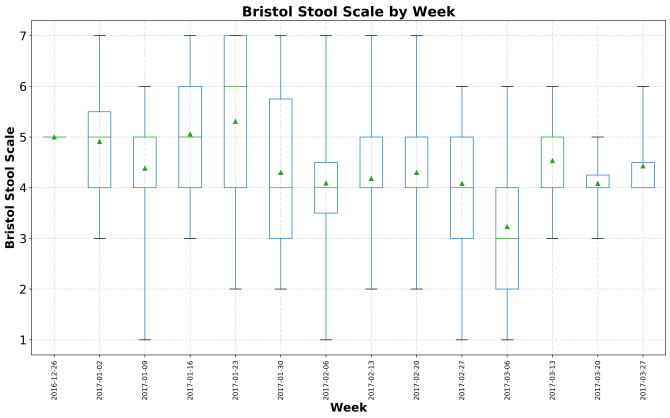

Fig. 1. Bristol Stool Score by Week

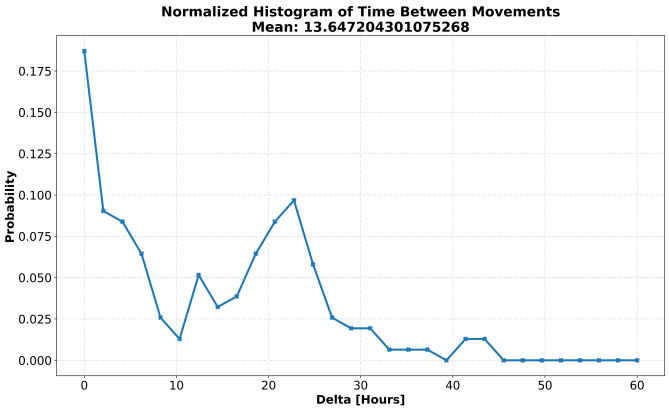

Fig. 3. Distribution of Time Between Bowel Movements

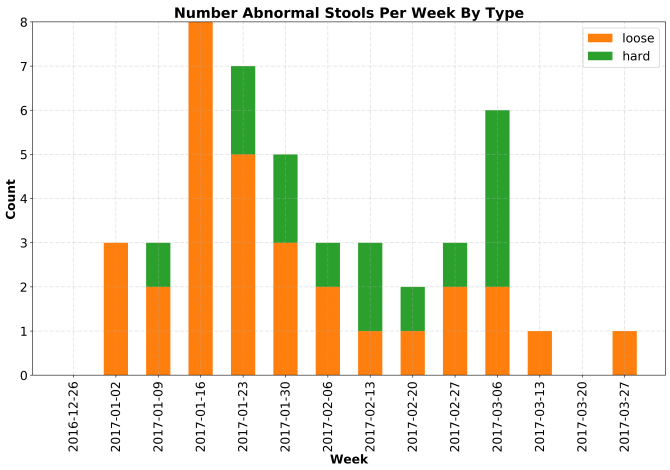

Fig. 2. Abnormal Bowel Movements by Week and Type

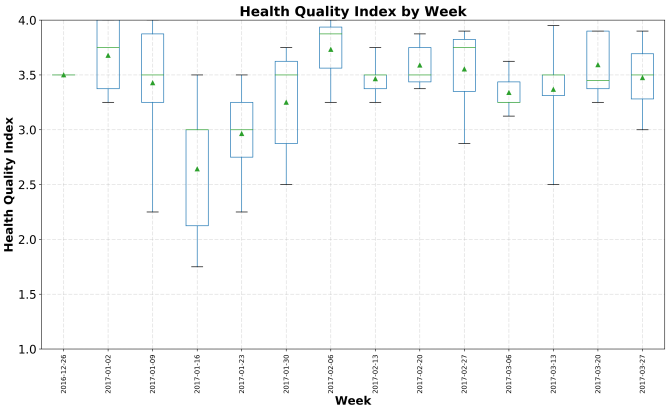

Fig. 4. Health Quality Index by Week

Bristol Stool Score (BSS) [TODO cite] of movement.

Health Quality Index plots by week are presented below.

Mean minutes of cardio per week

Mean dosage of medicines per week

Mena daily weight per week

At date TODO, a full metaboloic panel was conducted with no anomolous results.

IV. Analysis

A total of TODO days of daily recorrds were recorded which resulted in TODO BMs recorded. The recorded time period is January 1, 2017 to TODO. An exploratory analysis of the data follows.

We perform ordinary least squares (OLS) regresion using the data above to assess how medications and cardio affect HQI and BSS means on two different scales, 3 days and 7 days. Two different time scales are assessed allowing a degree of freedom for the treatments to reach therapeutic level when initiated and washout when discontinued.

With width specified:

TODO Verify and notate that all regression had signifiant p-value of f stat.

Regressor: HQI 3-Day Mean				
	coef	std err	t	$P > \|t\|$
Intercept	3.1799	0.081	39.273	0.000
cardio [hrs]	-0.0737	0.046	-1.604	0.113
nexium [20mg]	0.1697	0.053	3.206	*0.002
librax [capsule]	0.0642	0.034	1.896	0.062
clartin-d [capsule]	-0.0975	0.083	-1.178	0.243
vitamin d [5000IU]	-0.0163	0.015	-1.105	0.272
Metamucil [serving]	-0.0518	0.084	-0.615	0.540

Regressor: HQI 7-Day Mean				
	coef	std err	t	$P > \|t\|$
Intercept	3.1799	0.081	39.273	0.000
cardio [hrs]	-0.0737	0.046	-1.604	0.113
nexium [20mg]	0.1697	0.053	3.206	*0.002
librax [capsule]	0.0642	0.034	1.896	0.062
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Metamucil [serving]	-0.0518	0.084	-0.615	0.540

We see from Table TODO and TODO that on 3-day time scales, TODO is statistically signifiant and on week-long time scales, TODO is statistically significant.

We regress on the number of abnormal movements of both

3 day and 7 day in the future.

Regressor: Abnormal Events 3-Day Mean				
	coef	std err	t	$P > \|t\|$
Intercept	3.1799	0.081	39.273	0.000
cardio [hrs]	-0.0737	0.046	-1.604	0.113
nexium [20mg]	0.1697	0.053	3.206	*0.002
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Tables TODO and TODO show statistically signifance for TODO and TODO. Clariten-D has a signifitant effect on TODO day mean abnormal movements. The coeffecient is postive meaning it increase the number of adverse events which is not desireable. Clariten-D is not signifnitamnt in tables TODO and TODO and therefore we conclude is doesn't postively contrinute to HQI but postively contributes to the number of negative events. The administration of Clariten-D was administrated during the period nexium and librax were adminstered. The adverse events during this period prompted the author to contacted several doctors and describeb the problem and request a suggested cure. All doctors suggested the librax was the main contributued and advised to reduce intake. The author reduced the librax resulting in a slight increase in symptoms. The author then discontinued taking clariten-d and the symptoms resolved as predicted by the regression model.

Conclusion

We demonstrate simple, lightweight daily tracking of medications, exercise, Bristol Stool Scores, and a Health Quality Index can be utilized to manage and reduce symptoms in an N=1 setting. We demonstrate how simple staticial analysis can be used to tailor medical treatment for an individual allowing for the identification and resolution of bowel issues for an IBS-D patient.

Acknowledgment

The authors would like to thank TODO for the useful discussions and reviews.