PMD35

# COST-MINIMIZATION FOR A NOVEL IBS DIAGNOSTIC BLOOD PANEL VERSUS STANDARD EXCLUSIONARY DIAGNOSTIC TESTING FOR DIARRHEA PREDOMINANT IRRITABLE BOWEL SYNDROME: A UNITED STATES PERSPECTIVE

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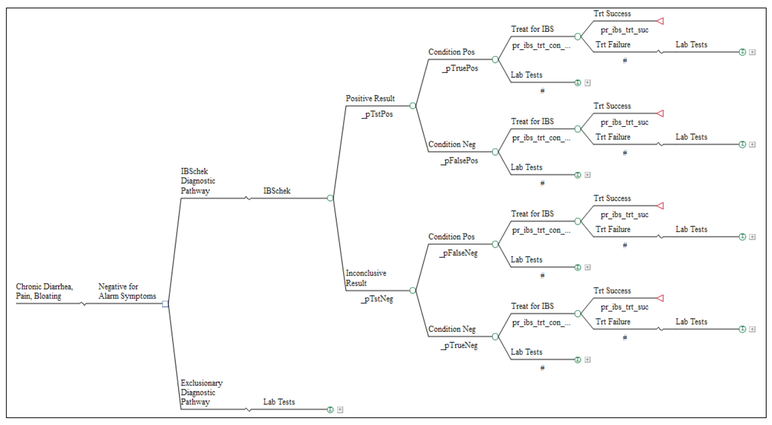
## INTRODUCTION

- Irritable Bowel Syndrome (IBS) is a chronic gastrointestinal disorder characterized by abdominal pain, bloating, discomfort and changes in bowel habit
- A published article (2005) estimated the prevalence of irritable bowel syndrome to be 14.1% (medically diagnosed 3.3%; undiagnosed, but meeting irritable bowel syndrome criteria 10.8%)
- IBS has a significant impact on the sufferer's health and quality of life; also, there are significant social and economic ramifications
- There are three distinct sub-types: diarrhea predominant (IBS-D), constipation predominant (IBS-C) and mixed (IBS-M)
- Diagnosing IBS-D involves a combination of symptom-based criteria (ROME III). However, diagnosing IBS-D involves differentiating this condition from organic diseases such as celiac disease and inflammatory bowel disease
- The anti-transglutaminase test (anti-tTG) is a reliable method to identify patients with celiac disease. Other diagnostic tests commonly used in the process of diagnosing patients who present with IBS-D symptoms include: complete blood count (CBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), thyroid function test (TFT) and liver function test (LFT)
- Also, diagnostic procedures to rule out other organic conditions may include: colonoscopy, endoscopy, ultrasound and abdominal CT scan
- IBS presents a significant health burden to patients and to the healthcare system in the US both in terms of significant direct and indirect (i.e. absenteeism) medical costs
- IBS*chek*™ is a novel diagnostic blood panel (for IBS-D) which involves measuring antibody levels for cytolethal distending toxin B (anti-CdtB) and vinculin (anti-vinculin)
- Animal studies have demonstrated that an IBS-like phenotype can be produced when host antibodies to CdtB cross-react with vinculin
- This biomarker has recently been validated in a large clinical trial (TARGET-3)
- This novel diagnostic blood test may provide significant benefits for patients who present with IBS-D symptoms by avoiding unnecessary testing procedures and a shorter time to diagnosis and treatment

## OBJECTIVES

- The primary aim of this study was to compare the costs associated with two differing diagnostic pathways in gastroenterology practice in the US: (1) The IBS*chek*™ diagnostic pathway vs. (2) the exclusionary diagnostic pathway for patients who present with IBS symptoms
- The secondary objective of this study was to extend the results of the cost-minimization model (CM) to a budget impact analysis for a health plan

### Figure 1: Decision Tree Model (CM1)

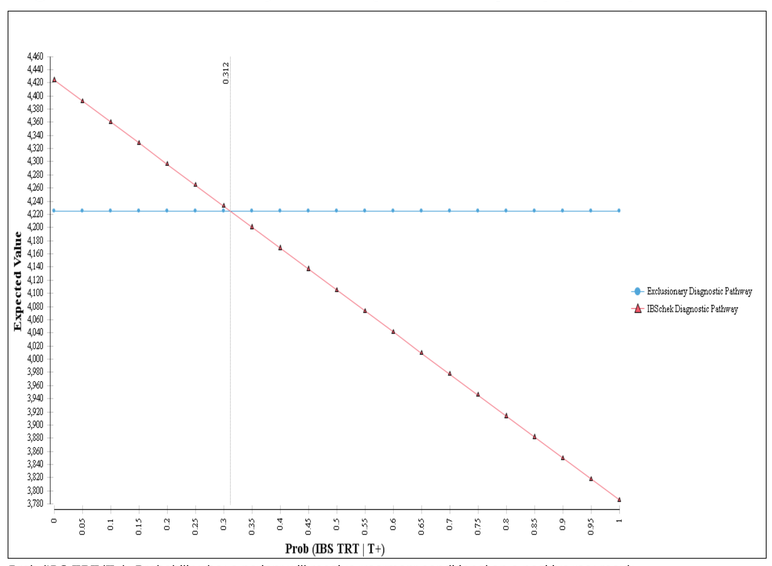



### Table 1: CM Results (CM1)

| Diagnostic Pathway | Setting | Pre-test Prob Dis + | Prob (IBS TRT \| T +) | Prob (IBS TRT \| T -) | Expected Cost | Cost (Savings) |
|---|---|---|---|---|---|---|
| | | | | | | |
| W/ IBS*chek*™ | GI | 0.763 | 0% | 0% | 4424 | 199 |
| Exclusionary | GI | NA | NA | NA | 4225 | |
| | | | | | | |
| W/ IBS*chek*™ | GI | 0.763 | 25% | 0% | 4265 | 40 |
| Exclusionary | GI | NA | NA | NA | 4225 | |
| | | | | | | |
| W/ IBS*chek*™ | GI | 0.763 | 50% | 0% | 4105 | (120) |
| Exclusionary | GI | NA | NA | NA | 4225 | |
| | | | | | | |
| W/ IBS*chek*™ | GI | 0.763 | 75% | 0% | 3945 | (280) |
| Exclusionary | GI | NA | NA | NA | 4225 | |
| | | | | | | |
| W/ IBS*chek*™ | GI | 0.763 | 100% | 0% | 3786 | (439) |
| Exclusionary | GI | NA | NA | NA | 4225 | |

Pre-Test Prob Dis +: Probability of IBS-D in the US in a patient consulting for Diarrhea, Bloating and Pain. Prob (IBS TRT |T+): Probability that a patient will receive treatment conditional on a positive test result. Prob (IBS TRT | T-): Probability that a patient will receive treatment conditional on a negative test result.

### Figure 2: Sensitivity for Pr (IBS TRT | T+) (CM1)




Prob (IBS TRT |T+): Probability that a patient will receive treatment conditional on a positive test result

## STUDY DESIGN & METHODS

- A cost-minimization (CM) decision tree model was constructed to compare the costs associated with two possible diagnostic pathways: (1) diagnostic pathway with novel IBS diagnostic blood panel and (2) exclusionary diagnostic pathway (i.e. standard of care)
- The setting for the model are gastroenterologists within the US
- The model structure (CM Model 1) was based on current literature and guidance from IBS expert clinicians (Figure 1, Table 1)
- New data became available after the abstract submission; therefore the model and the results (cost-minimization and budget impact) (CM Model 2) have been updated accordingly (Figures 3-6; Tables 2,3)
- For both models (CM 1 and CM 2), the probabilities for test utilization were taken from an IBS survey of practicing gastroenterologists
- Country specific costs (US) were used to populate both models
- The probability that patients will proceed to treatment was modeled as a function of the sensitivity, specificity and likelihood ratios of the individual biomarker tests (Tables 3)
- These probabilities are computed as follows:

$$Post-test\ Odds\ (D+) = Pre-test\ Odds(D+) * LR(CDTB) * LR(Vinculin)$$

$$Post-test\ \Pr(D+) = \frac{Post-test\ Odds(D+)}{1 + Post-test\ Odds\ (D+)}$$

- One-way sensitivity analyses were performed for key input variables (Table 2)
- For both models, a sensitivity analysis was performed with respect to the pre-test probability of disease (IBS-D) (Figure 2, Figure 4)
- The budget impact analysis (BIA) extrapolates results of the CM Model 2 to a health plan with 1 million covered lives (Table 3)
- TreeAge Pro 14 was used for cost-minimization modeling; Microsoft Excel 2010 was used for budget impact modeling

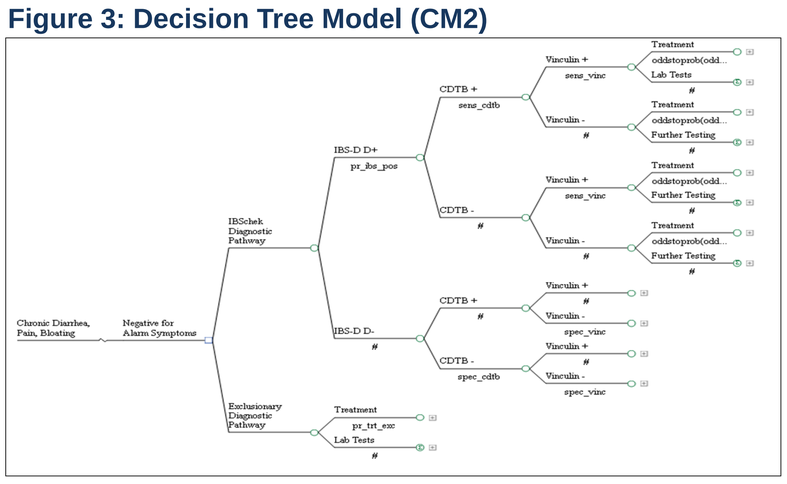
## RESULTS (CM Model 1)

- Colonoscopy, endoscopy, computed tomography and ultrasound were the most common diagnostic procedures reported with estimated utilization rates of 0.625, 0.400, 0.306 and 0.294
- The corresponding charges were $2,727, $1,375, $2,175 and $370.50
- The base case for the pre-test probability of disease (IBS-D) was estimated to be 0.763
- The CM model predicts a base case savings of $280 per patient for the diagnostic pathway that includes the novel IBS diagnostic blood panel
- Sensitivity analyses predict a range of cost savings of $120 to $439
- Budget impact analysis predicts a base case savings of $1,080,232 to the plan or $0.09 on a per member per month basis for the diagnostic pathway with the novel IBS diagnostic blood panel
- The time dependent model indicates that the potential cost savings associated with the novel IBS blood test are attenuated over time

## RESULTS (CM Model 2)

- For the base-case, the CM model predicts a cost savings of $509 for the novel IBS diagnostic blood panel vs the exclusionary diagnostic pathway, due to the avoidance of downstream testing (e.g. colonoscopy, CT scans) (Table 2)
- A sensitivity analysis was performed for a pre-test probability of disease, for a range of values from 0.363 to 0.963; under this scenario, the outcomes range from an additional cost of $142 for the diagnostic blood panel to a cost savings of $840 for the diagnostic blood panel (Table 2)
- The sensitivity analysis for the pre-test probability of disease indicates that the break-even occurs at 0.451 (Figure 4)
- The sensitivity analysis for the probability of IBS treatment in the exclusionary branch of disease indicates that the break-even occurs at 0.652 (Figure 5)
- The sensitivity analysis for the probability of treatment success indicates there is no break-even for this variable (Figure 6)
- For the BIA, as the proportion seeking care is varied from 10% - 100% the cost savings varies from $0.06 to $0.61 PMPM (Table 3)

### Figure 3: Decision Tree Model (CM2)

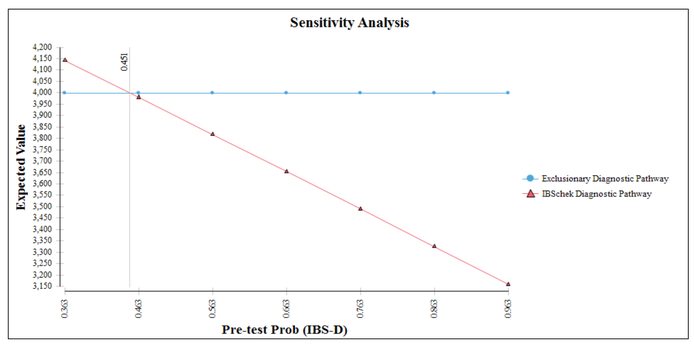



### Table 2: CM Results (Model 2)

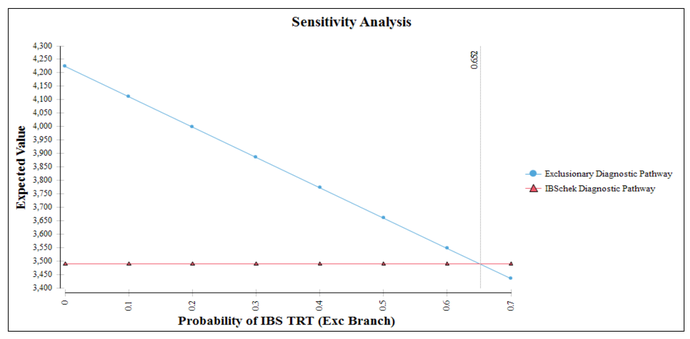
| Diagnostic Pathway | Setting | Pre-test Prob Dis + | Prob (IBS TRT) Exclusionary | Expected Cost | Cost (Savings) |
|---|---|---|---|---|---|
| | | | | | |
| W/ IBS*chek*™ | GI | 0.363 | NA | 4141 | 142 |
| Exclusionary | GI | NA | 20.0 | 3999 | |
| | | | | | |
| W/ IBS*chek*™ | GI | 0.463 | NA | 3980 | (19) |
| Exclusionary | GI | NA | 20.0 | 3999 | |
| | | | | | |
| W/ IBS*chek*™ | GI | 0.563 | NA | 3817 | (182) |
| Exclusionary | GI | NA | 20.0 | 3999 | |
| | | | | | |
| W/ IBS*chek*™ | GI | 0.663 | NA | 3654 | (345) |
| Exclusionary | GI | NA | 20.0 | 3999 | |
| | | | | | |
| W/ IBS*chek*™ | GI | 0.763 | NA | 3490 | (509) [1] |
| Exclusionary | GI | NA | 20.0 | 3999 | |
| | | | | | |
| W/ IBS*chek*™ | GI | 0.863 | NA | 3325 | (674) |
| Exclusionary | GI | NA | 10.0 | 3999 | |
| | | | | | |
| W/ IBS*chek*™ | GI | 0.963 | NA | 3159 | (840) |
| Exclusionary | GI | NA | 0.0 | 3999 | |

1 – Base case

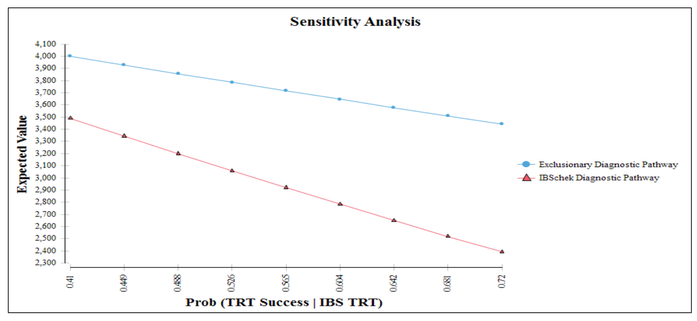
### Figure 4: Sensitivity for Pre-Test Pr(D+) (CM2)




### Figure 5: Sensitivity for Pr(IBS TRT | Exc Br) (CM2)




### Figure 6: Sensitivity for Pr(TRT Success) (CM2)




### Table 3: Budget Impact Analysis (CM2)

| Covered Lives [1-5] | Proportion Seeking Care | Number of Individuals Seeking Care | Net Cost if 100% of Patients Diagnosed with Exclusionary Path | Net Cost if 50% Exclusionary Path, 50% IBS*chek*™ | Cost (Savings) | Cost (Savings) PMPM |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1,000,000 | 10% | 2,856 | $ 11,421,144 | $ 10,694,292 | $ (726,852) | $ (0.06) |
| 1,000,000 | 20% | 5,712 | $ 22,842,288 | $ 21,388,584 | $ (1,453,704) | $ (0.12) |
| 1,000,000 | 30% | 8,567 | $ 34,259,433 | $ 32,079,132 | $ (2,180,302) | $ (0.18) |
| 1,000,000 | 40% | 11,423 | $ 45,680,577 | $ 42,773,424 | $ (2,907,154) | $ (0.24) |
| 1,000,000 | 50% | 14,279 | $ 57,101,721 | $ 53,467,716 | $ (3,634,006) | $ (0.30) |
| 1,000,000 | 60% | 17,135 | $ 68,522,865 | $ 64,162,008 | $ (4,360,858) | $ (0.36) |
| 1,000,000 | 70% | 19,991 | $ 79,944,009 | $ 74,856,300 | $ (5,087,710) | $ (0.42) |
| 1,000,000 | 80% | 22,846 | $ 91,361,154 | $ 85,546,847 | $ (5,814,307) | $ (0.48) |
| 1,000,000 | 90% | 25,702 | $ 102,782,298 | $ 96,241,139 | $ (6,541,159) | $ (0.55) |
| 1,000,000 | 100% | 28,558 | $ 114,203,442 | $ 106,935,431 | $ (7,268,011) | $ (0.61) |

1 – Assumption: HMO with 1 million covered lives.
2 - IBS Prevalence = 14.1% (Hungin AP, Chang L, Locke GR, Dennis EH, Barghout V. Irritable bowel syndrome in the United States: prevalence, symptom patterns and impact. Aliment Pharmacol Ther. 2005 Jun 1;21(11):1365-75.6)
3 – IBS-D Prevalence within IBS =32.2% (IBS Physician Survey (Administered by AHRM Inc. (April – June of 2015))
4 – Proportion of US population within 18-64 age group (62.9%) (http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf)
5 – Pre-test probability of disease estimated to be 0.763 (from cost-minimization model)

## CONCLUSIONS

- Current medical literature suggests that extensive testing to diagnose IBS is often not recommended
- For patients who present with IBS-D symptoms in the US, this evaluation predicts that the inclusion of a novel Diagnostic Blood Panel in the diagnostic process has the potential for significant cost savings due to the avoidance of downstream testing
- Sensitivity analyses indicate that the pre-test probability of disease (IBS-D) has a significant impact on cost outcomes
- Both cost-minimization models predict significant cost savings for the Diagnostic Blood Panel arm

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## DISCLOSURES

This study was sponsored by Commonwealth Laboratories, LLC, Salem, MA, USA. All authors met the ISPOR authorship criteria. Neither honoraria nor payments were made for authorship.

Dr. Mark Pimentel has acted as scientific consultants for Commonwealth Laboratories, LLC and Commonwealth Diagnostics International, Inc.