

BACKGROUND

- Localized colorectal cancer (~80% of cases): resection sole curative treatment.
- Afterwards: patients at risk for complications (e.g., anastomotic leakage and ileus)
- >70% no complications → could benefit from early discharge.

Aim: identification of risk factors of complications to determine risks and optimal timing of patient discharge.

METHODS

Population: 767 elective bowel surgeries at the Medical Spectrum Twente hospital (NL), Mar 2020 - Dec 2023.

Outcome Measures: any or serious complications (Clavien-Dindo classification >II).

- 34 perioperative variables (Table 1).
- Empirical logit plots: univariate associations and two-way interactions.
- Variable selection: filtering using mutual information (MI). To capture interaction effects, the analysis extended to include conditional MI (CMI).
- Datasets: 580 in-sample patients (up to December 2022) and 187 out-of-sample patients (2023) for validation.
- Comparison performance logistic regression, weighted logistic regression and random forests: AUC and Brier scores.

Table 1.

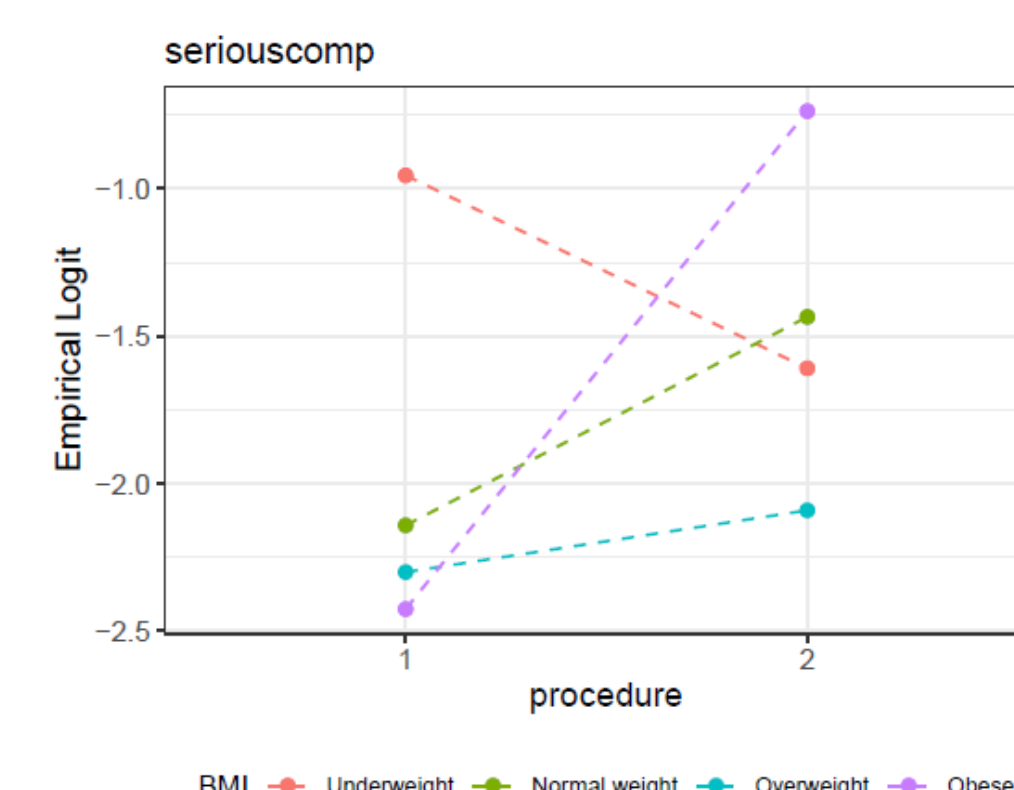
Age
Reported gender
Diabetes
Heart disease
Heart medication
Pulmonary disease
Comorbidities
BMI
Smoking status
Alcohol use
Previous surgeries
Indication for surgery
ASA score
WHO score
Radiotherapy
Preop. nutritional status
Anemia
Stoma counselling
Carbohydrate intake
Oral laxatives
Anesthesia type
Surgical procedure
Subprocedure
Stoma procedure
Open surgery
Converted to open
Other conc. major procedures
Muscle relaxants
Bowel anastomosis
Given crystalloids
Given colloids
Blood loss
Surgery time

RESULTS

Complication rates: In-sample: 34% any, 11% serious; out-of-sample: 39% any, 11% serious complications.

Empirical logit plots: patients with extreme BMI values undergoing rectal procedures → higher risks of serious complications compared to colonic procedures (Figure 1).

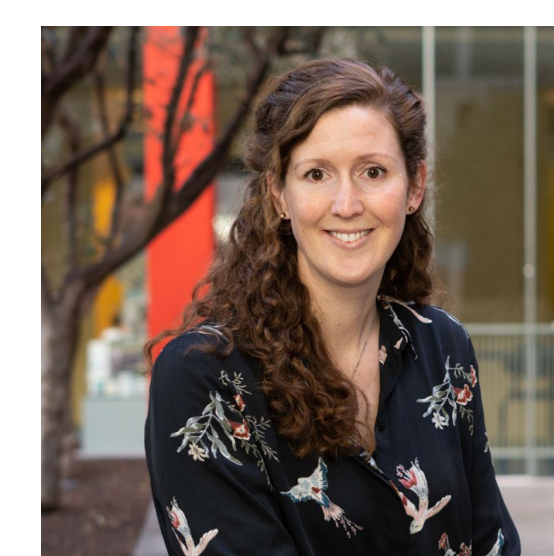
Figure 1.



More information:

Annemieke Witteveen, PhD
Associate Professor

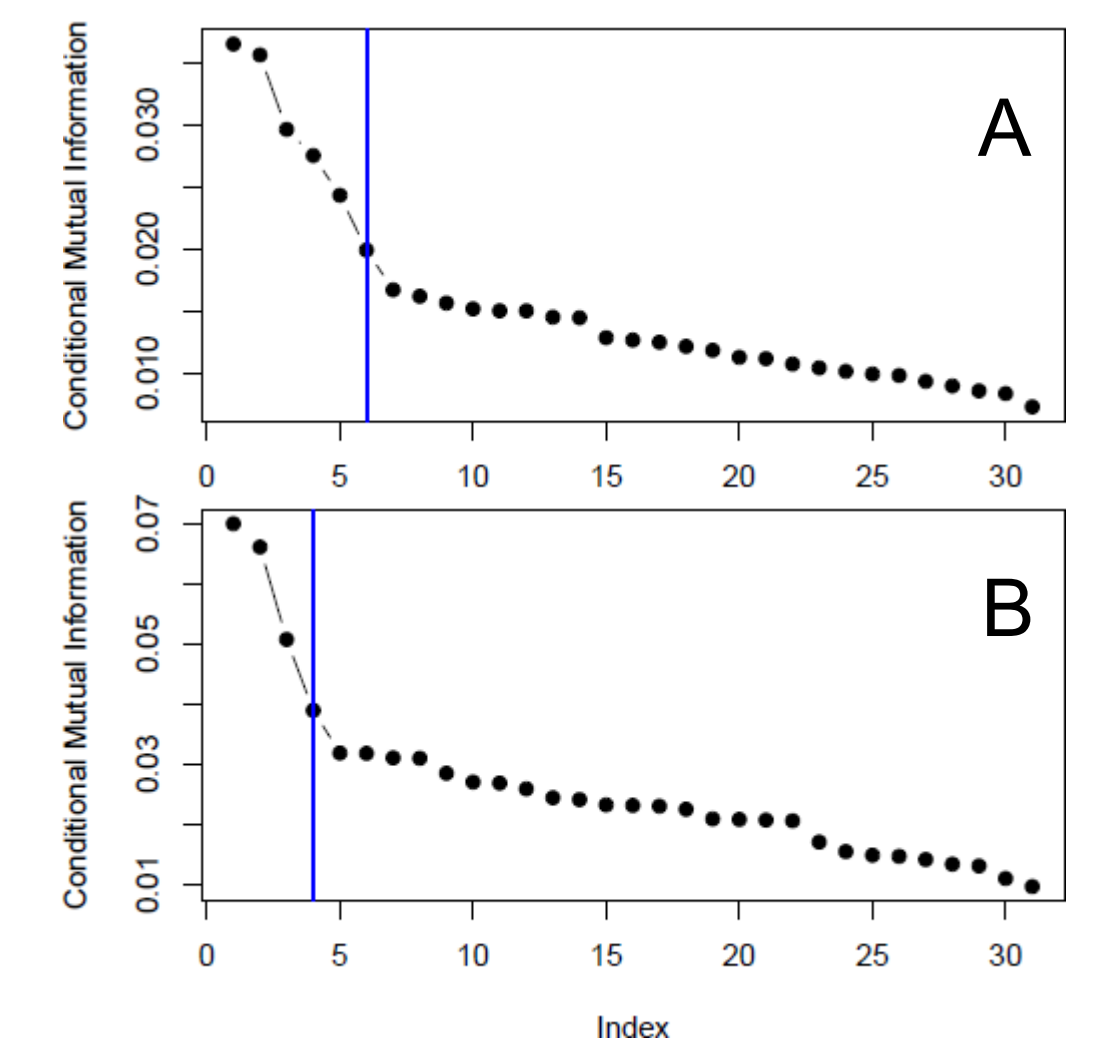
A.Witteveen@utwente.nl



RESULTS continued

Figure 2. Conditional mutual information (CMI) analysis of remaining variables for A) any complications and B) serious complications.

The CMI values for each variable, conditioned on three previously selected variables, to identify additional influential variables are given on the y-axis in Figure 2. The elbow index, indicated by a vertical line, highlights the threshold we used to select significant variables for further analysis, including that index's variable.



MI + CMI: key predictors for complications: age, BMI, duration, multiple major procedures.

Table 2. Performance of the models. Best performances per variable set, measure and sample in bold.

		Outcome: any complication						Outcome: serious complication					
		In-sample			Out-of-sample			In-sample			Out-of-sample		
Method	Variable set	AUC	Brier (no compl.)	Brier (serious compl.)	AUC	Brier (no compl.)	Brier (serious compl.)	AUC	Brier (no compl.)	Brier (serious compl.)	AUC	Brier (no compl.)	Brier (serious compl.)
Logistic regression	All	0.73	0.55	0.36	0.58	0.51	0.46	0.78	0.84	0.60	0.46	0.86	0.81
Weighted log. regression		0.73	0.37	0.21	0.58	0.34	0.30	0.80	0.46	0.18	0.54	0.52	0.47
Random Forest		0.79	0.20	0.17	0.63	0.24	0.24	0.77	0.19	0.22	0.72	0.19	0.24
Logistic regression	Filtering	0.68	0.52	0.39	0.58	0.51	0.47	0.74	0.82	0.68	0.57	0.84	0.79
Weighted log. regression		0.68	0.32	0.23	0.58	0.32	0.28	0.73	0.36	0.22	0.59	0.37	0.32
Random Forest		0.78	0.20	0.18	0.61	0.23	0.28	0.78	0.16	0.23	0.69	0.18	0.28

CONCLUSIONS

Key Takeaways: Factors related to the patient, such as age and BMI, along with intraoperative elements like blood loss, fluid management, and the type of procedure performed significantly influence the risk of complications in bowel surgeries.

Policy Implications: By monitoring these predictors, we can facilitate safe early discharge when people with low risks are identified.

Future Research: Development of prediction model for risks of complications on larger dataset, including timing of complication.

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