On Association between Surgical Hypothermia and Surgical Site Infections

Srimanta Ghosh
M.Sc. in Mathematics with Data Science
Semester III
University Roll No.: E1773U232013
Institute of Mathematics and Applications, Bhubaneswar

(Project Guide)
Dr. Atanu Kumar Ghosh
Assistant Professor, Department of Statistics
Presidency University, Kolkata

Agenda

Agenda

The Problem

- When the body temperature drops below 36°C (96.8°F), we call it "Surgical hypothermia(IPH)".
- Some research suggested that IPH could reduce the effectiveness of drugs, increase surgical bleeding, delay recovery from surgery and increase the risk of surgical site infections(SSIs).
- Hence a new study was conducted to explore whether there is an association between IPH and SSIs in patients who had colorectal surgery.

The Problem

- When the body temperature drops below 36°C (96.8°F), we call it "Surgical hypothermia(IPH)".
- Some research suggested that IPH could reduce the effectiveness of drugs, increase surgical bleeding, delay recovery from surgery and increase the risk of surgical site infections(SSIs).
- Hence a new study was conducted to explore whether there is an association between IPH and SSIs in patients who had colorectal surgery.

The Problem

- When the body temperature drops below 36°C (96.8°F), we call it "Surgical hypothermia(IPH)".
- Some research suggested that IPH could reduce the effectiveness of drugs, increase surgical bleeding, delay recovery from surgery and increase the risk of surgical site infections(SSIs).
- Hence a new study was conducted to explore whether there is an association between IPH and SSIs in patients who had colorectal surgery.

Agenda

Data Source

Walters, Michael J., Marianne Tanios, Onur Koyuncu, Guangmei Mao, Michael A. Valente, and Daniel I. Sessler. "*Intraoperative core temperature and infectious complications after colorectal surgery: A registry analysis*." Journal of clinical anesthesia 63 (2020): 109758.

Agenda

Research Questions

1. What is the effect of Average core temperature of a patient during surgery on Serious Infection the patient has developed with in 30 days of surgery?
   - **To answer this we shall be using Effect Size Logistic Regression[2, 1] Models.**
2. What is the hazard of a patient discharge alive from hospital after surgery and how it is affected by Average core temperature of the patient during surgery?
   - To answer this we shall be using Survival Models[3, 4, 1].

Research Questions

1. What is the effect of Average core temperature of a patient during surgery on Serious Infection the patient has developed with in 30 days of surgery?
   - To answer this we shall be using Effect Size Logistic Regression[2, 1] Models.
2. What is the hazard of a patient discharge alive from hospital after surgery and how it is affected by Average core temperature of the patient during surgery?
   - To answer this we shall be using Survival Models[3, 4, 1].

Research Questions

1. What is the effect of Average core temperature of a patient during surgery on Serious Infection the patient has developed with in 30 days of surgery?
   - **To answer this we shall be using Effect Size Logistic Regression[2, 1] Models.**
2. What is the hazard of a patient discharge alive from hospital after surgery and how it is affected by Average core temperature of the patient during surgery?
   - To answer this we shall be using Survival Models[3, 4, 1].

Research Questions

1. What is the effect of Average core temperature of a patient during surgery on Serious Infection the patient has developed with in 30 days of surgery?
   - **To answer this we shall be using Effect Size Logistic Regression[2, 1] Models.**
2. What is the hazard of a patient discharge alive from hospital after surgery and how it is affected by Average core temperature of the patient during surgery?
   - **To answer this we shall be using Survival Models[3, 4, 1].**

Agenda

The Model

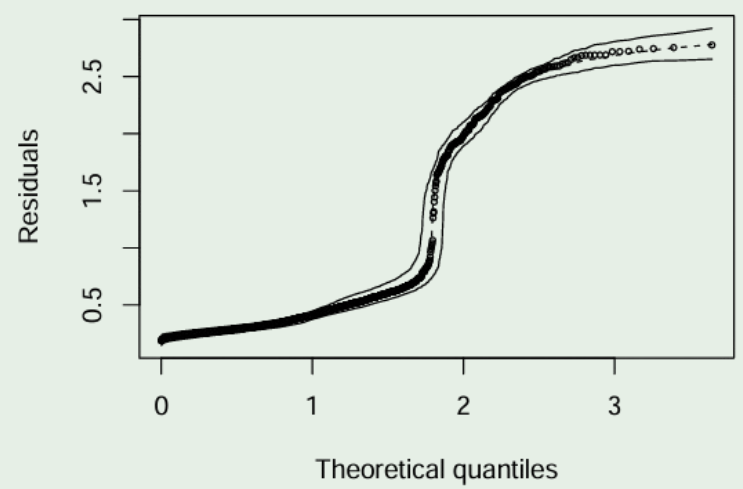
$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 * TWATemp + \sum_{j=2}^{m} \beta_j * Covariate_j$$

$$\beta_1 = log\ odds;\ e^{\beta_1} = Odds\ Ratio$$

Agenda

Results

Coefficients:	Estimate	exp(β)
(Intercept)	12.93385	414462.48
Age	-0.01098	0.99
CHF1	0.65959	1.93
RENFAIL1	0.64706	1.91
WGHTLOSS1	1.01999	2.77
LYTES1	0.43496	1.54
SurgDuration	0.00390	-0.46
TWATemp	-0.46225	0.63



Agenda

The Model

Non-Parametric Model

$$\hat{S}(t_k) = \prod_{j=1}^{K}(1 - \frac{d_j}{r_j})$$

- $t_1 < t_2 < .... < t_K$ are K unique time the event occurred.
- d_k denote the number of event occured at time t_k, For $k = 1, 2, ..., K$
- r_k denote the number of patients are in hospital and in the study just before t_k; these are the at risk patients.

Semi Parametric Model

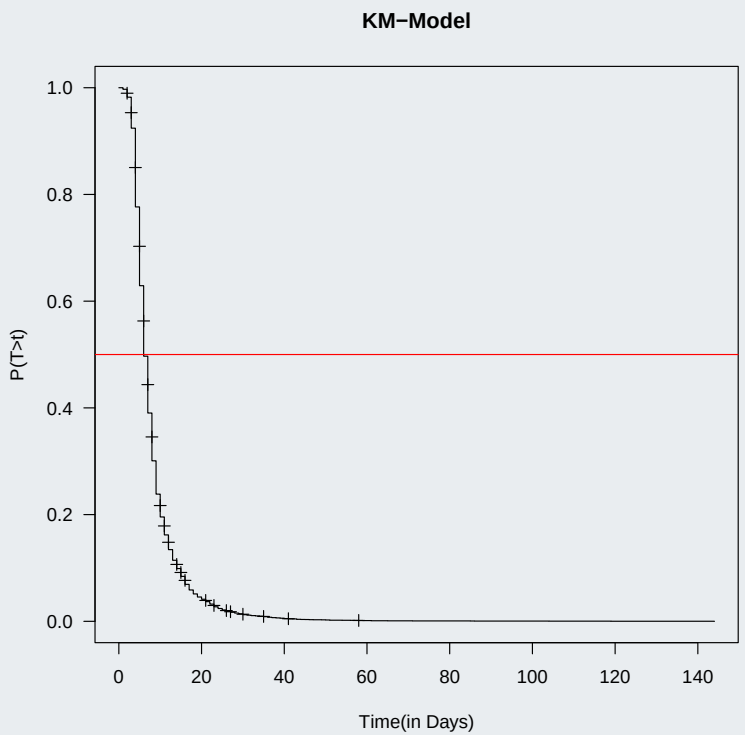
$$HAZ = h_0(t) * e^{\sum_{i=1}^{p} bjXj}$$

- $h_0(t) \geq 0$ is an unspecified function, known as the baseline hazard. It is the hazard function for an individual with features $X_1 = \cdots = X_p = 0$.
- e^{b_j} represents the hazard ratio.

Agenda

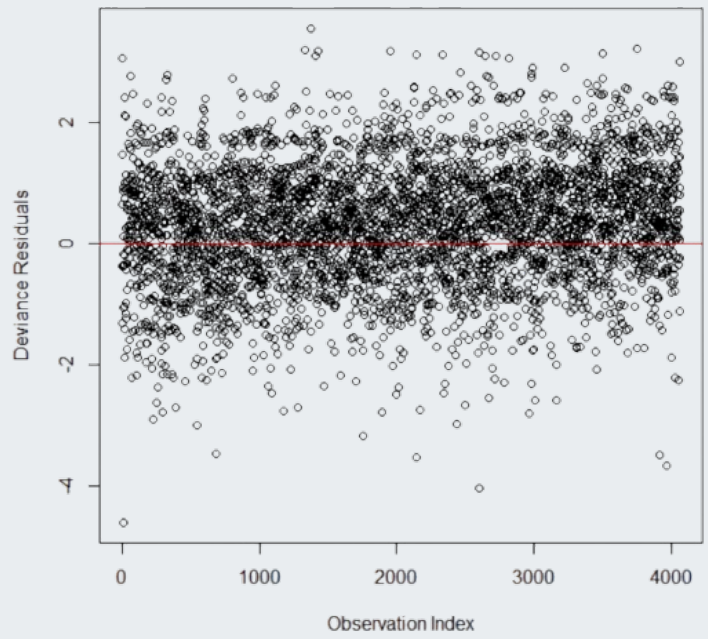
Results

time	n.risk	n.event	survival
1	7908	23	0.997092
2	7885	117	0.982296
3	7762	459	0.924209
4	7302	1166	0.776629
⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮
85	5	1	0.000616
86	4	1	0.000462
104	3	1	0.000308
119	2	1	0.000154
144	1	1	0.000000



Results

Variable	exp(coef)	exp(-coef)
Age	0.9952	1.0048
FEMALE1	1.0606	0.9429
CharlsonScore	0.9596	1.0421
RENFAIL1	1.1351	0.8810
METS1	1.1782	0.8488
COAG1	0.8117	1.2320
WGHTLOSS1	0.4582	2.1827
LYTES1	0.7396	1.3520
DRUG1	0.8275	1.2085
SteroidHx1	1.0888	0.9185
ImmunosuppressantHx1	0.8738	1.1445
SurgDuration	0.9968	1.0032
Open1	0.8549	1.1698
TWATemp	0.9270	1.0788
SeriousInfection1	0.5235	1.9101
SuperficialInfection1	0.7143	1.3999



References


Generalized linear models.
Routledge, 2019.


Frank E Harrell et al.
Regression modeling strategies: with applications to linear models, logistic regression, and survival analysis, volume 608.
Springer, 2001.


David G Kleinbaum and Mitchel Klein.
Survival analysis a self-learning text.
Springer, 1996.


Michael H Kutner, Christopher J Nachtsheim, John Neter, and William Li.
Applied linear statistical models.
McGraw-hill, 2005.