The Himalayan Database

Modeling fatal mountaineering accidents in the Himalayas

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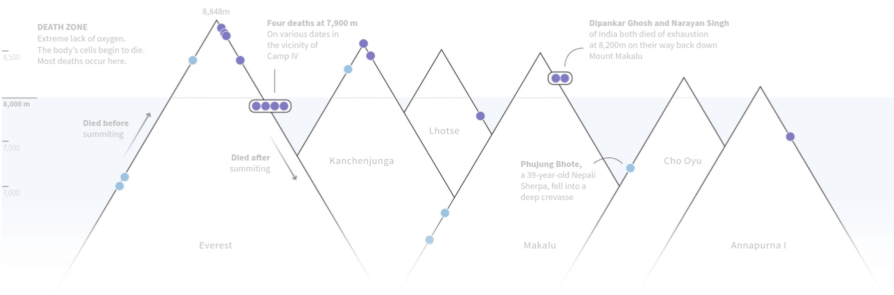
Introduction



Data Selection

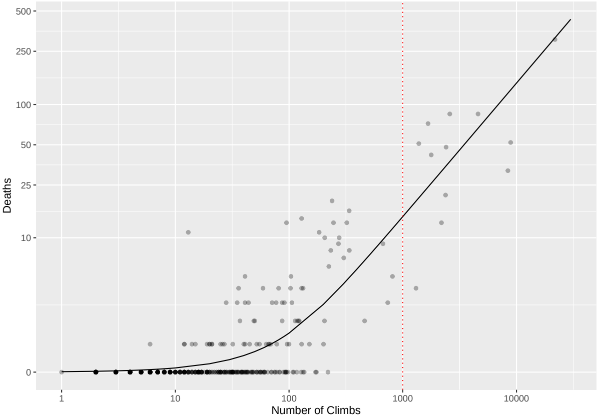


Figure: *Plot of deaths vs number of climbs for each individual peak from 1905 to 2020. The vertical red line is the arbitrary cut-off point of greater than 1000 total climbs.*

Data Selection Continued

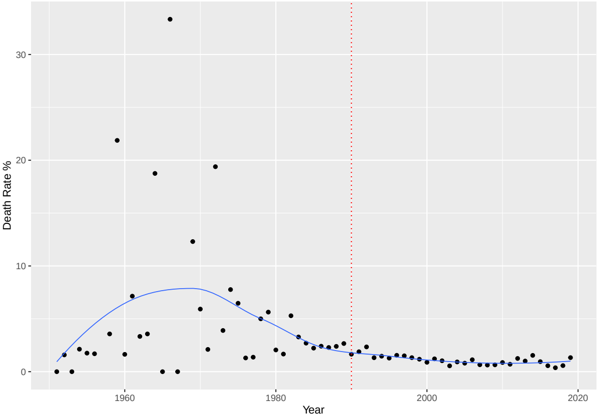


Figure: *Death Rate as a percentage vs year for the subset of peaks as selected from previous slide. Vertical red line is the arbitrary cut-off point.*

Variable Analysis

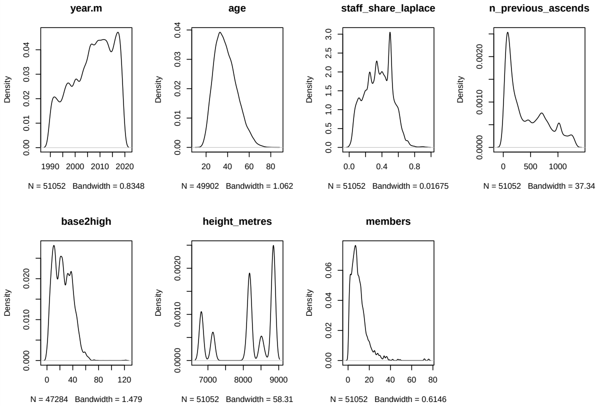


Figure: *Density plots of the different quantitative variables*

Variable Analysis

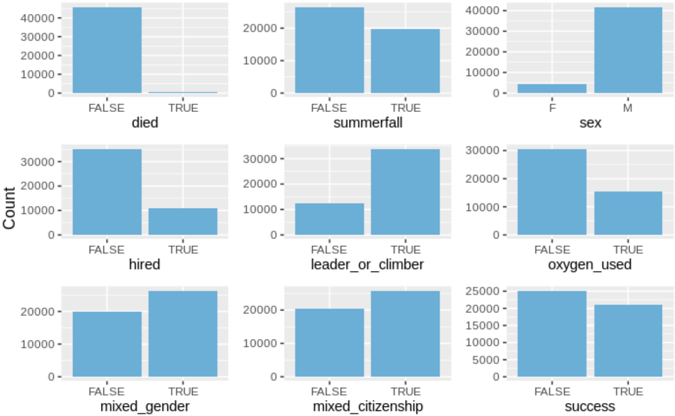


Figure: *Distribution of the qualitative variables*

Observations	46222
Dependent variable	died
Type	Generalized linear model
Family	binomial
Link	logit

$\chi^2(11)$	179.76
Pseudo-R^2 (Cragg-Uhler)	0.04
Pseudo-R^2 (McFadden)	0.04
AIC	4834.51
BIC	4939.41

	Est.	S.E.	z val.	p
(Intercept)	-9.79	0.95	-10.26	0.00
successTRUE	-0.57	0.13	-4.53	0.00
summerfallTRUE	-0.33	0.12	-2.86	0.00
age	0.01	0.00	2.59	0.01
hiredTRUE	0.49	0.13	3.63	0.00
staff__share__laplace	-0.90	0.37	-2.47	0.01
mixed__genderTRUE	-0.30	0.10	-2.96	0.00
mixed__citizenshipTRUE	-0.22	0.10	-2.16	0.03
I(n__previous__ascends/100)	-0.12	0.02	-6.78	0.00
base2high	-0.02	0.00	-4.51	0.00
I(height__metres/100)	0.08	0.01	6.48	0.00
oxygen__usedTRUE	0.30	0.14	2.13	0.03

Standard errors: MLE

Figure: *Stepwise logistic regression with highest AIC*

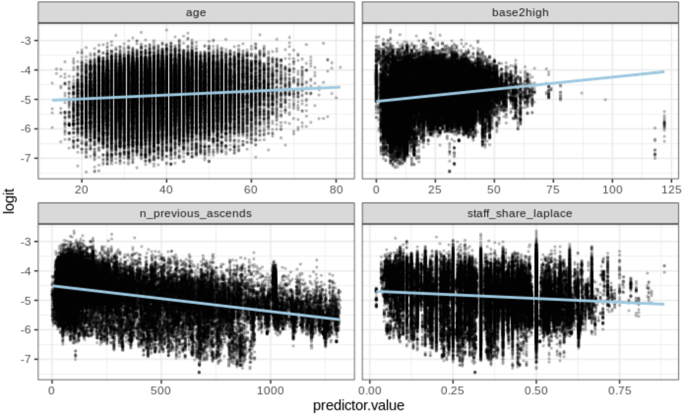


Figure: *Log odds of qualitative variables*

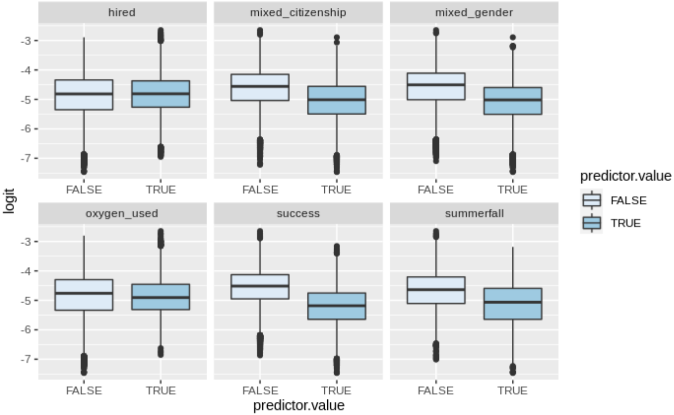


Figure: *Log odds of categorical variables*

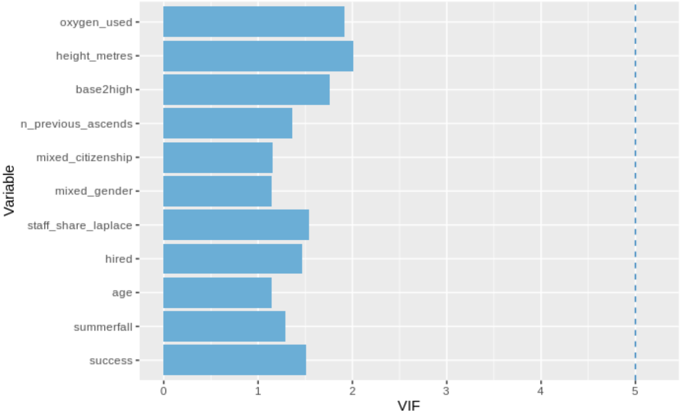


Figure: *Model diagnostics: VIF*

Interpretation

Keeping all other variables constant except x_1:

$$\log\left(\frac{\pi_a}{1-\pi_a}\right) = \beta_0 + \beta_1 x_{1a} + \beta_2 x_2 + \dots \tag{1}$$

$$\log\left(\frac{\pi_b}{1-\pi_b}\right) = \beta_0 + \beta_1 x_{1b} + \beta_2 x_2 + \dots \tag{2}$$

Subtracting 1 and 2 yields

$$\log\left(\frac{\pi_a/(1-\pi_a)}{\pi_b/(1-\pi_b)}\right) = \beta_1(x_{1a} - x_{2a}) = \beta_1 \Delta x$$

For small π_a and π_b:

$$\frac{\pi_a}{\pi_b} \approx \frac{\pi_a/(1-\pi_a)}{\pi_b/(1-\pi_b)} = e^{\beta_1 \Delta x_1}$$

Interpretation Continued

$$\boldsymbol{RR} = \frac{\text{Probability of death with } \boldsymbol{x_{1a}}}{\text{Probability of death with } \boldsymbol{x_{1b}}} = \boldsymbol{e^{\beta_1 \Delta x}}$$

- Using oxygen: $\boldsymbol{RR = 1.35}$
- Hired staff: $\boldsymbol{RR = 1.63}$
- Increasing age by 10 years: $\boldsymbol{RR = 1.14}$
- Climbing in summer/autumn: $\boldsymbol{RR = 0.72}$
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Thank You

Any Questions?


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