## TITLE

#### Steph Reinke, Olivia Fu, Srika Gopal

#### October 14, 2025

- 1 Background and Motivation
- 2 Data and Exploratory Analysis
- 3 Model Rationale, Implementation, and Evaluation
- 3.1 Rationale & Selection
- 3.2 Implementation
- 3.3 Evaluation
- 4 Results
- 5 Limitations and Conclusion

### 6 Appendix

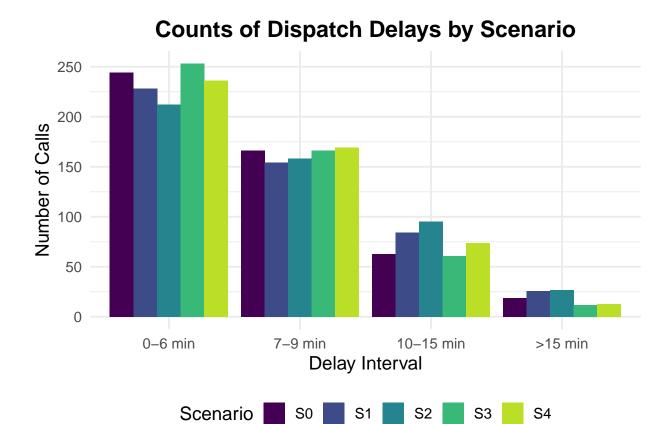


Figure 1: CAPTION

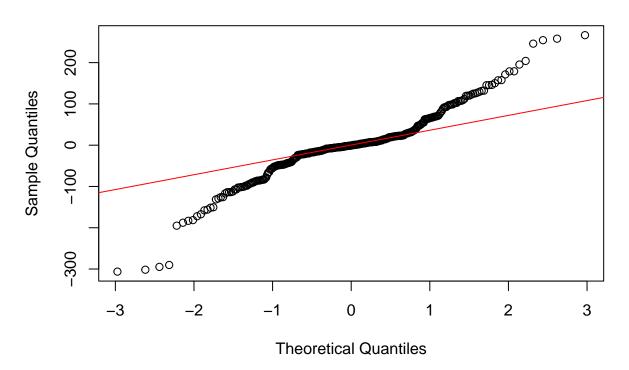
Table 1: CAPTION

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	-1.077	0.104	-10.400	0.000	-1.284	-0.877
ScenarioS2	-0.099	0.148	-0.667	0.505	-0.390	0.192
ScenarioS3	-1.037	0.179	-5.810	0.000	-1.394	-0.693
ScenarioS4	-1.195	0.186	-6.413	0.000	-1.568	-0.836

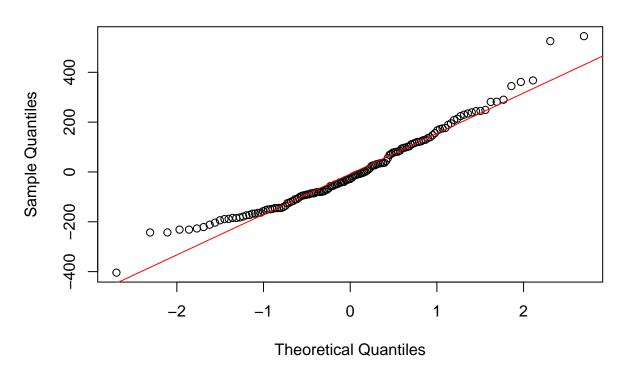
Table 2: CAPTION

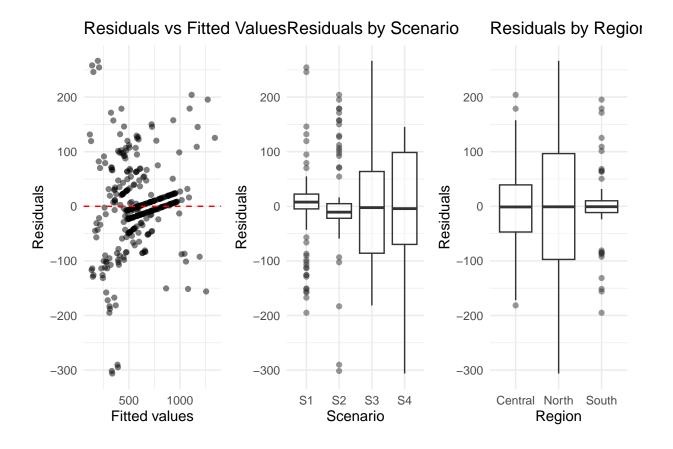
Scenario	predicted_prob
S1	0.254
S2	0.236
S3	0.108
S4	0.093

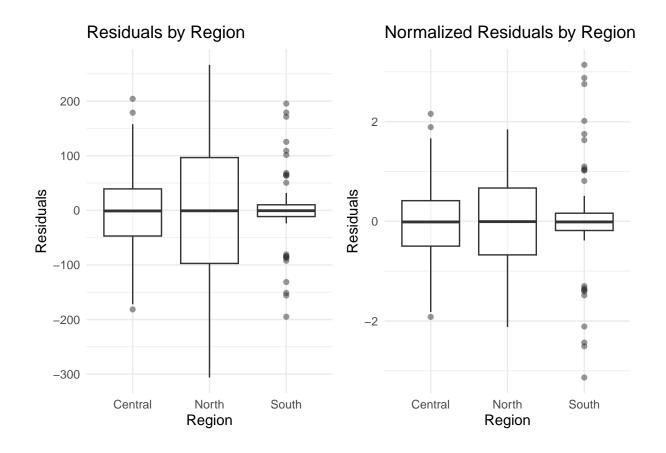
# Residuals



### **Random Effects**







```
## region = Central:
   Scenario emmean
                      SE df lower.CL upper.CL
##
##
               520 33.3 142
                                  454
                                           586
##
   S2
                590 34.4 142
                                  522
                                           658
   S3
                534 35.6 142
                                  464
                                           604
##
##
   S4
                649 36.2 142
                                  577
                                           720
##
## region = North:
                      SE df lower.CL upper.CL
##
   Scenario emmean
##
                296 44.7 140
                                  208
                                           385
   S2
                                  382
                                           571
##
                477 47.8 140
   S3
                284 45.8 140
                                  194
                                           375
##
##
   S4
                481 49.4 140
                                  384
                                           579
##
## region = South:
   Scenario emmean
                      SE df lower.CL upper.CL
##
##
                712 21.1 140
                                  670
                                           754
##
  S2
                728 21.1 140
                                  686
                                           769
##
   S3
                648 36.0 140
                                  577
                                           720
                798 37.5 140
                                  724
                                           872
##
   S4
##
## Degrees-of-freedom method: containment
## Confidence level used: 0.95
## region = Central:
  contrast estimate
                        SE df t.ratio p.value
## S1 - S2
              -69.92 26.4 188 -2.650 0.0430
```

```
S1 - S3
              -14.23 35.4 188 -0.402 0.9780
##
   S1 - S4
             -128.83 36.6 188
                               -3.517 0.0031
##
   S2 - S3
               55.69 37.2 188
                                1.497 0.4414
## S2 - S4
              -58.91 37.8 188
                               -1.558 0.4053
##
   S3 - S4
             -114.60 29.7 188
                               -3.856 0.0009
##
## region = North:
##
   contrast estimate
                       SE df t.ratio p.value
                               -4.082 0.0004
   S1 - S2
             -180.60 44.2 188
## S1 - S3
                                0.287 0.9917
              12.09 42.1 188
  S1 - S4
             -185.22 45.9 188
                               -4.033 0.0005
## S2 - S3
              192.70 45.6 188
                                4.230 0.0002
##
   S2 - S4
               -4.62 47.4 188
                               -0.097 0.9997
## S3 - S4
             -197.31 46.5 188
                              -4.245 0.0002
##
## region = South:
##
   contrast estimate
                       SE df t.ratio p.value
  S1 - S2
              -15.61 10.4 188
                               -1.497 0.4411
## S1 - S3
               63.59 31.8 188
                                2.000 0.1918
## S1 - S4
               -85.63 33.6 188
                               -2.550 0.0557
## S2 - S3
               79.20 32.0 188
                                2.474 0.0673
## S2 - S4
              -70.02 33.7 188
                               -2.079 0.1637
## S3 - S4
             -149.22 32.7 188
                              -4.563 0.0001
## Degrees-of-freedom method: containment
## P value adjustment: tukey method for comparing a family of 4 estimates
## region = Central:
   Scenario emmean
                        SE df lower.CL upper.CL
##
              6.19 0.0646 142
                                  6.06
                                           6.32
              6.34 0.0676 142
                                  6.21
                                           6.47
##
  S2
##
   S3
              6.22 0.0711 142
                                  6.08
                                           6.36
##
  S4
              6.46 0.0726 142
                                           6.60
                                  6.31
##
## region = North:
                       SE df lower.CL upper.CL
   Scenario emmean
## S1
                                  5.12
              5.44 0.1641 140
                                           5.76
              5.96 0.1831 140
                                  5.60
                                           6.33
  S2
##
  S3
              5.37 0.1710 140
                                  5.03
                                           5.71
##
              5.94 0.1928 140
                                  5.55
                                           6.32
##
## region = South:
   Scenario emmean
                       SE df lower.CL upper.CL
## S1
              6.53 0.0360 140
                                  6.46
                                           6.60
## S2
              6.56 0.0361 140
                                  6.49
                                           6.63
## S3
              6.38 0.0791 140
                                  6.23
                                           6.54
##
   S4
              6.66 0.0832 140
                                  6.50
                                           6.83
##
## Degrees-of-freedom method: containment
## Results are given on the log (not the response) scale.
## Confidence level used: 0.95
```