Spinal Cord Injury Challenge Exploratory Analysis

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Goal

The goal is to predict neurologic status at 6-13 moths after traumatic spinal cord injury based on acute phase assessments one week after injury. We require to prognosticate long-term recovery after SCI by analyzing a subset of the data from the Sygen multicenter clinical trial. The data used to make the prediction of recovery at 6-13 months will be data available in the first month after spinal cord injury. One piece of data that is commonly used to make such predictions are the internacional Standards for Neurological Classification of SCI (INCSCI). This clinical outcome assessment evaluates motor and sensory impairment across the body and helps localize the neurologic level of the SCI and grade the severity of that injury. Additional data includes demographic information, comorbidities, surgical interventions and medical complications.

Data

The following files are provided and explained based on the description given at https://asia-spinalinjury.org/.

File 1: metada.csv

Includes time-invariante features (including age, bmi, but also information on previous conditions). PID is the patient ID.

```
## # A tibble: 797 x 14
##    PID   bmi_category age_category sexcd tx1_r srdecc1 surgcd1 spcsuc1 scdecc1
##    <chr> <chr>        <chr>        <dbl> <chr>   <dbl>   <dbl>   <dbl>   <dbl>
##  1 PID_0 Healthy      >65              2 D2         NA      NA      NA      NA
##  2 PID_1 Healthy      <65              2 D1          0       1      NA       1
##  3 PID_2 Overweight   <65              1 P           0       0      NA       0
##  4 PID_3 Healthy      <65              2 D1          0       1      NA       1
##  5 PID_4 Healthy      <65              2 D2         NA       1       0      NA
##  6 PID_5 Healthy      <65              2 P           1       1       0       1
##  7 PID_6 Healthy      <65              2 P           0       1      NA       0
##  8 PID_7 Healthy      <65              1 D1          1       1      NA       1
##  9 PID_8 Healthy      <65              2 D2          0       1       0       1
## 10 PID_9 Healthy      <65              2 D1          0       1      NA       0
## # i 787 more rows
## # i 5 more variables: hemccd1 <dbl>, mhpsyccd <dbl>, mhneurcd <dbl>,
## #   mhcardcd <dbl>, mhmetacd <dbl>
```

```
##  [1] "PID"          "bmi_category" "age_category" "sexcd"        "tx1_r"
##  [6] "srdecc1"      "surgcd1"      "spcsuc1"      "scdecc1"      "hemccd1"
## [11] "mhpsyccd"     "mhneurcd"     "mhcardcd"     "mhmetacd"
```

Variable Descriptions

Variable	Type	Description	Values
PID	Fixed	patient id	-
age_category	Fixed	age at time of injury either above or below 65 years	<65, >65
sexcd	Fixed	sex	1, female | 2, male
bmi_category	Fixed	bmi categorized	underweight, healthy, overweight
srdecc1	Fixed	first spinal surgery: were spinal roots decompressed during surgery	0, no | 1, yes
surgcd1	Fixed	first spinal surgery: was spinal surgery performed	0, no | 1, yes
spcsuc1	Fixed	first spinal surgery: Are there more than one area of spinal column surgery	0, no | 1, yes
scdecc1	Fixed	first spinal surgery: was the spinal cord decompressed	0, no | 1, yes
hemccd1	Fixed	first spinal surgery: did significant changes in the hemodynamic or pulmonary function occur during the operation	0, no | 1, yes
mhpsyccd	Fixed	has the patient had a past history of psychiatric abnormalities	0, no | 1, yes | 9, unknown
mhneurcd	Fixed	has the patient had a past history of neurological abnormalities	0, no | 1, yes | 9, unknown
mhcardcd	Fixed	has the patient had a past history of cardiac abnormalities	0, no | 1, yes | 9, unknown

Variable	Type	Description	Values
mhmetacd	Fixed	has the patient had a past history of metabolic or endocrinologic abnormalities	0, no | 1, yes | 9, unknown
tx1_r	Fixed	treatment group	D1, dose 1 | D2, dose 2 | P, placebo

File 2: train_features.csv

All features, including ISNCSCI and AIS grades, at the time points 1,4,8 and 16 weeks after injury. Each row corresponds a specific patient ID, columns are features at various time points as given in the column names

AIS grade and motor scores

Variable	Time Points	Description	Side	Values
ais	1,4,8,16	Calculated AIS grade at baseline	-	A, B, C, D, E
elbfll	1,4,8,16	Motor score C5	Left	0,1,2,3,4,5
wrextl	1,4,8,16	Motor score C6	Left	0,1,2,3,4,5
elbexl	1,4,8,16	Motor score C7	Left	0,1,2,3,4,5
finfll	1,4,8,16	Motor score C8	Left	0,1,2,3,4,5
finabl	1,4,8,16	Motor score T1	Left	0,1,2,3,4,5
hipfll	1,4,8,16	Motor score L2	Left	0,1,2,3,4,5
kneexl	1,4,8,16	Motor score L3	Left	0,1,2,3,4,5
ankdol	1,4,8,16	Motor score L4	Left	0,1,2,3,4,5
gretol	1,4,8,16	Motor score L5	Left	0,1,2,3,4,5
ankpll	1,4,8,16	Motor score S1	Left	0,1,2,3,4,5
elbflr	1,4,8,16	Motor score C5	Right	0,1,2,3,4,5
wrextr	1,4,8,16	Motor score C6	Right	0,1,2,3,4,5
elbexr	1,4,8,16	Motor score C7	Right	0,1,2,3,4,5
finflr	1,4,8,16	Motor score C8	Right	0,1,2,3,4,5
finabr	1,4,8,16	Motor score T1	Right	0,1,2,3,4,5
hipflr	1,4,8,16	Motor score L2	Right	0,1,2,3,4,5
kneetr	1,4,8,16	Motor score L3	Right	0,1,2,3,4,5
ankdor	1,4,8,16	Motor score L4	Right	0,1,2,3,4,5
gretor	1,4,8,16	Motor score L5	Right	0,1,2,3,4,5
ankplr	1,4,8,16	Motor score S1	Right	0,1,2,3,4,5

Light touch scores

Variable	Time Points	Description	Side	Values
c2ltl	1,4,8,16	Light touch C2	Left	0,1,2
c3ltl	1,4,8,16	Light touch C3	Left	0,1,2
c4ltl	1,4,8,16	Light touch C4	Left	0,1,2
c5ltl	1,4,8,16	Light touch C5	Left	0,1,2

Variable	Time Points	Description	Side	Values
c6ltl	1,4,8,16	Light touch C6	Left	0,1,2
c7ltl	1,4,8,16	Light touch C7	Left	0,1,2
c8ltl	1,4,8,16	Light touch C8	Left	0,1,2
t1ltl	1,4,8,16	Light touch T1	Left	0,1,2
t2ltl	1,4,8,16	Light touch T2	Left	0,1,2
t3ltl	1,4,8,16	Light touch T3	Left	0,1,2
t4ltl	1,4,8,16	Light touch T4	Left	0,1,2
t5ltl	1,4,8,16	Light touch T5	Left	0,1,2
t6ltl	1,4,8,16	Light touch T6	Left	0,1,2
t7ltl	1,4,8,16	Light touch T7	Left	0,1,2
t8ltl	1,4,8,16	Light touch T8	Left	0,1,2
t9ltl	1,4,8,16	Light touch T9	Left	0,1,2
t10ltl	1,4,8,16	Light touch T10	Left	0,1,2
t11ltl	1,4,8,16	Light touch T11	Left	0,1,2
t12ltl	1,4,8,16	Light touch T12	Left	0,1,2
l1ltl	1,4,8,16	Light touch L1	Left	0,1,2
l2ltl	1,4,8,16	Light touch L2	Left	0,1,2
l3ltl	1,4,8,16	Light touch L3	Left	0,1,2
l4ltl	1,4,8,16	Light touch L4	Left	0,1,2
l5ltl	1,4,8,16	Light touch L5	Left	0,1,2
s1ltl	1,4,8,16	Light touch S1	Left	0,1,2
s2ltl	1,4,8,16	Light touch S2	Left	0,1,2
s3ltl	1,4,8,16	Light touch S3	Left	0,1,2
s45ltl	1,4,8,16	Light touch S4/5	Left	0,1,2
c2ltr	1,4,8,16	Light touch C2	Right	0,1,2
c3ltr	1,4,8,16	Light touch C3	Right	0,1,2
c4ltr	1,4,8,16	Light touch C4	Right	0,1,2
c5ltr	1,4,8,16	Light touch C5	Right	0,1,2
c6ltr	1,4,8,16	Light touch C6	Right	0,1,2
c7ltr	1,4,8,16	Light touch C7	Right	0,1,2
c8ltr	1,4,8,16	Light touch C8	Right	0,1,2
t1ltr	1,4,8,16	Light touch T1	Right	0,1,2
t2ltr	1,4,8,16	Light touch T2	Right	0,1,2
t3ltr	1,4,8,16	Light touch T3	Right	0,1,2
t4ltr	1,4,8,16	Light touch T4	Right	0,1,2
t5ltr	1,4,8,16	Light touch T5	Right	0,1,2
t6ltr	1,4,8,16	Light touch T6	Right	0,1,2
t7ltr	1,4,8,16	Light touch T7	Right	0,1,2
t8ltr	1,4,8,16	Light touch T8	Right	0,1,2
t9ltr	1,4,8,16	Light touch T9	Right	0,1,2
t10ltr	1,4,8,16	Light touch T10	Right	0,1,2
t11ltr	1,4,8,16	Light touch T11	Right	0,1,2
t12ltr	1,4,8,16	Light touch T12	Right	0,1,2
l1ltr	1,4,8,16	Light touch L1	Right	0,1,2
l2ltr	1,4,8,16	Light touch L2	Right	0,1,2
l3ltr	1,4,8,16	Light touch L3	Right	0,1,2
l4ltr	1,4,8,16	Light touch L4	Right	0,1,2
l5ltr	1,4,8,16	Light touch L5	Right	0,1,2
s1ltr	1,4,8,16	Light touch S1	Right	0,1,2
s2ltr	1,4,8,16	Light touch S2	Right	0,1,2
s3ltr	1,4,8,16	Light touch S3	Right	0,1,2
s45ltr	1,4,8,16	Light touch S4/5	Right	0,1,2

Prin Prick

Variable	Time Points	Description	Side	Values
c2ppl	1,4,8,16	Pin prick C2	Left	0,1,2
c3ppl	1,4,8,16	Pin prick C3	Left	0,1,2
c4ppl	1,4,8,16	Pin prick C4	Left	0,1,2
c5ppl	1,4,8,16	Pin prick C5	Left	0,1,2
c6ppl	1,4,8,16	Pin prick C6	Left	0,1,2
c7ppl	1,4,8,16	Pin prick C7	Left	0,1,2
c8ppl	1,4,8,16	Pin prick C8	Left	0,1,2
t1ppl	1,4,8,16	Pin prick T1	Left	0,1,2
t2ppl	1,4,8,16	Pin prick T2	Left	0,1,2
t3ppl	1,4,8,16	Pin prick T3	Left	0,1,2
t4ppl	1,4,8,16	Pin prick T4	Left	0,1,2
t5ppl	1,4,8,16	Pin prick T5	Left	0,1,2
t6ppl	1,4,8,16	Pin prick T6	Left	0,1,2
t7ppl	1,4,8,16	Pin prick T7	Left	0,1,2
t8ppl	1,4,8,16	Pin prick T8	Left	0,1,2
t9ppl	1,4,8,16	Pin prick T9	Left	0,1,2
t10ppl	1,4,8,16	Pin prick T10	Left	0,1,2
t11ppl	1,4,8,16	Pin prick T11	Left	0,1,2
t12ppl	1,4,8,16	Pin prick T12	Left	0,1,2
l1ppl	1,4,8,16	Pin prick L1	Left	0,1,2
l2ppl	1,4,8,16	Pin prick L2	Left	0,1,2
l3ppl	1,4,8,16	Pin prick L3	Left	0,1,2
l4ppl	1,4,8,16	Pin prick L4	Left	0,1,2
l5ppl	1,4,8,16	Pin prick L5	Left	0,1,2
s1ppl	1,4,8,16	Pin prick S1	Left	0,1,2
s2ppl	1,4,8,16	Pin prick S2	Left	0,1,2
s3ppl	1,4,8,16	Pin prick S3	Left	0,1,2
s45ppl	1,4,8,16	Pin prick S4/5	Left	0,1,2
c2ppr	1,4,8,16	Pin prick C2	Right	0,1,2
c3ppr	1,4,8,16	Pin prick C3	Right	0,1,2
c4ppr	1,4,8,16	Pin prick C4	Right	0,1,2
c5ppr	1,4,8,16	Pin prick C5	Right	0,1,2
c6ppr	1,4,8,16	Pin prick C6	Right	0,1,2
c7ppr	1,4,8,16	Pin prick C7	Right	0,1,2
c8ppr	1,4,8,16	Pin prick C8	Right	0,1,2
t1ppr	1,4,8,16	Pin prick T1	Right	0,1,2
t2ppr	1,4,8,16	Pin prick T2	Right	0,1,2
t3ppr	1,4,8,16	Pin prick T3	Right	0,1,2
t4ppr	1,4,8,16	Pin prick T4	Right	0,1,2
t5ppr	1,4,8,16	Pin prick T5	Right	0,1,2
t6ppr	1,4,8,16	Pin prick T6	Right	0,1,2
t7ppr	1,4,8,16	Pin prick T7	Right	0,1,2
t8ppr	1,4,8,16	Pin prick T8	Right	0,1,2
t9ppr	1,4,8,16	Pin prick T9	Right	0,1,2
t10ppr	1,4,8,16	Pin prick T10	Right	0,1,2
t11ppr	1,4,8,16	Pin prick T11	Right	0,1,2
t12ppr	1,4,8,16	Pin prick T12	Right	0,1,2
l1ppr	1,4,8,16	Pin prick L1	Right	0,1,2
l2ppr	1,4,8,16	Pin prick L2	Right	0,1,2
l3ppr	1,4,8,16	Pin prick L3	Right	0,1,2

Variable	Time Points	Description	Side	Values
l4ppr	1,4,8,16	Pin prick L4	Right	0,1,2
l5ppr	1,4,8,16	Pin prick L5	Right	0,1,2
s1ppr	1,4,8,16	Pin prick S1	Right	0,1,2
s2ppr	1,4,8,16	Pin prick S2	Right	0,1,2
s3ppr	1,4,8,16	Pin prick S3	Right	0,1,2
s45ppr	1,4,8,16	Pin prick S4/5	Right	0,1,2

File 3: train_outcomes_MS.csv

ISNCSCI motor scores assessed at either 26 or 52 weeks (as indicated in column "time"). Rows indicate patient IDs.

Variable	Time Points	Description	Side	Values
modben	26, 52	Modified Benzel Classification	-	1, no motor or sensory function is preserved in the segments S4 to S5 2, sensory but not motor function is preserved in the sacral segments S4 to S5 3, motor function is preserved below the neurological level and the majority of key muscles below the neurological level have a muscle grade less than three and they are unable to walk 4, unable to walk and some functional motor control below the level of injury that is significantly useful (for example assist in transfers) but that is not sufficient for independent walking

Variable	Time Points	Description	Side	Values
				5, limited walking and motor function allows walking with assistance or unassisted but significant problems secondary to lack of endurance or fear of falling limit patient mobility 6, unlimited walking and ambulatory without assistance and without significant limitations other than one or both of the following (difficulties with micturition or slightly dyscoordinated gait) 7, neurologically intact with the exception of minimal deficits that cause no functional difficulties 9, not able to assess
elbfll	26, 52	Motor score C5	Left	0,1,2,3,4,5
wrextl	26, 52	Motor score C6	Left	0,1,2,3,4,5
elbexl	26, 52	Motor score C7	Left	0,1,2,3,4,5
finfll	26, 52	Motor score C8	Left	0,1,2,3,4,5
finabl	26, 52	Motor score T1	Left	0,1,2,3,4,5
hipfll	26, 52	Motor score L2	Left	0,1,2,3,4,5
kneexl	26, 52	Motor score L3	Left	0,1,2,3,4,5
ankdol	26, 52	Motor score L4	Left	0,1,2,3,4,5
gretol	26, 52	Motor score L5	Left	0,1,2,3,4,5
ankpll	26, 52	Motor score S1	Left	0,1,2,3,4,5
elbflr	26, 52	Motor score C5	Right	0,1,2,3,4,5
wrextr	26, 52	Motor score C6	Right	0,1,2,3,4,5
elbexr	26, 52	Motor score C7	Right	0,1,2,3,4,5

Variable	Time Points	Description	Side	Values
finflr	26, 52	Motor score C8	Right	0,1,2,3,4,5
finabr	26, 52	Motor score T1	Right	0,1,2,3,4,5
hipflr	26, 52	Motor score L2	Right	0,1,2,3,4,5
kneetr	26, 52	Motor score L3	Right	0,1,2,3,4,5
ankdor	26, 52	Motor score L4	Right	0,1,2,3,4,5
gretor	26, 52	Motor score L5	Right	0,1,2,3,4,5
ankplr	26, 52	Motor score S1	Right	0,1,2,3,4,5

File 3: test_features.csv

All features, including ISNCSCI assessments and AIS grades, at 1 week after injury. Each row corresponds to a specific patient ID, columns are features.

```
## spc_tbl_ [122 x 136] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ PID     : chr [1:122] "PID_510" "PID_448" "PID_334" "PID_581" ...
##  $ elbfll01: num [1:122] 4 4 5 5 4 0 4 5 3 5 ...
##  $ wrextl01: num [1:122] 1 1 5 5 4 0 1 5 0 2 ...
##  $ elbexl01: num [1:122] 0 0 5 5 0 0 0 5 0 0 ...
##  $ finfll01: num [1:122] 0 0 5 5 0 0 0 5 0 0 ...
##  $ finabl01: num [1:122] 0 0 5 5 0 0 0 5 0 0 ...
##  $ hipfll01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ kneexl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ ankdol01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ gretol01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ ankpll01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ elbflr01: num [1:122] 4 4 5 5 4 1 5 5 3 5 ...
##  $ wrextr01: num [1:122] 1 0 5 5 4 0 1 5 0 2 ...
##  $ elbexr01: num [1:122] 0 0 5 5 0 0 0 5 0 0 ...
##  $ finflr01: num [1:122] 0 0 5 5 0 0 0 5 0 0 ...
##  $ finabr01: num [1:122] 0 0 5 5 0 0 0 3 0 0 ...
##  $ hipflr01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ kneetr01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ ankdor01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ gretor01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ ankplr01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ c2ltl01 : num [1:122] 2 2 2 2 2 2 2 2 2 2 ...
##  $ c3ltl01 : num [1:122] 2 2 2 2 2 0 2 2 2 2 ...
##  $ c4ltl01 : num [1:122] 2 2 2 2 2 0 2 2 2 2 ...
##  $ c5ltl01 : num [1:122] 2 1 2 2 2 0 2 2 2 2 ...
##  $ c6ltl01 : num [1:122] 1 0 2 2 0 0 1 2 0 1 ...
##  $ c7ltl01 : num [1:122] 0 0 2 2 0 0 0 2 0 0 ...
##  $ c8ltl01 : num [1:122] 0 0 2 2 0 0 0 2 0 0 ...
##  $ t1ltl01 : num [1:122] 0 0 2 2 0 0 0 2 0 0 ...
##  $ t2ltl01 : num [1:122] 0 0 2 2 0 0 0 2 0 1 ...
##  $ t3ltl01 : num [1:122] 0 0 2 2 0 0 0 1 0 1 ...
##  $ t4ltl01 : num [1:122] 0 0 2 2 0 0 0 0 0 0 ...
##  $ t5ltl01 : num [1:122] 0 0 2 2 0 0 0 0 0 0 ...
##  $ t6ltl01 : num [1:122] 0 0 2 2 0 0 0 0 0 0 ...
##  $ t7ltl01 : num [1:122] 0 0 2 2 0 0 0 0 0 NA ...
##  $ t8ltl01 : num [1:122] 0 0 0 2 0 0 0 0 0 NA ...
##  $ t9ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 NA ...
```

```
##  $ t10ltl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ t11ltl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ t12ltl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l1ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l2ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l3ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l4ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l5ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s1ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s2ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s3ltl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s45ltl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ c2ltr01 : num [1:122] 2 2 2 2 2 2 2 2 2 2 ...
##  $ c3ltr01 : num [1:122] 2 2 2 2 2 2 2 2 2 2 ...
##  $ c4ltr01 : num [1:122] 2 2 2 2 2 2 2 2 2 2 ...
##  $ c5ltr01 : num [1:122] 1 2 2 2 2 0 2 2 2 2 ...
##  $ c6ltr01 : num [1:122] 1 2 2 2 0 0 0 2 0 1 ...
##  $ c7ltr01 : num [1:122] 0 0 2 2 0 0 0 2 0 0 ...
##  $ c8ltr01 : num [1:122] 0 0 2 2 0 0 0 2 0 0 ...
##  $ t1ltr01 : num [1:122] 0 0 2 2 0 0 0 2 0 1 ...
##  $ t2ltr01 : num [1:122] 0 0 2 2 0 0 0 2 0 1 ...
##  $ t3ltr01 : num [1:122] 0 0 2 2 0 0 0 1 0 0 ...
##  $ t4ltr01 : num [1:122] 0 0 2 2 0 0 0 0 0 1 ...
##  $ t5ltr01 : num [1:122] 0 0 2 2 0 0 0 0 0 0 ...
##  $ t6ltr01 : num [1:122] 0 0 2 2 0 0 0 0 0 NA ...
##  $ t7ltr01 : num [1:122] 0 0 2 2 0 0 0 0 0 NA ...
##  $ t8ltr01 : num [1:122] 0 0 0 2 0 0 0 0 0 NA ...
##  $ t9ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 NA ...
##  $ t10ltr01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ t11ltr01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ t12ltr01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l1ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l2ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l3ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l4ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l5ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s1ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s2ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s3ltr01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ s45ltr01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ c2ppl01 : num [1:122] 2 2 2 2 2 2 2 2 2 2 ...
##  $ c3ppl01 : num [1:122] 2 2 2 2 2 2 2 2 2 2 ...
##  $ c4ppl01 : num [1:122] 2 2 2 2 2 2 2 2 2 2 ...
##  $ c5ppl01 : num [1:122] 1 1 2 2 2 0 2 2 0 2 ...
##  $ c6ppl01 : num [1:122] 0 0 2 2 0 0 1 2 2 1 ...
##  $ c7ppl01 : num [1:122] 0 0 2 2 0 0 0 2 2 0 ...
##  $ c8ppl01 : num [1:122] 0 0 2 2 0 0 0 2 2 0 ...
##  $ t1ppl01 : num [1:122] 0 0 2 2 0 0 0 2 2 0 ...
##  $ t2ppl01 : num [1:122] 0 0 2 2 0 0 0 2 2 1 ...
##  $ t3ppl01 : num [1:122] 0 0 2 2 0 0 0 1 0 1 ...
##  $ t4ppl01 : num [1:122] 0 0 2 2 0 0 0 0 0 0 ...
##  $ t5ppl01 : num [1:122] 0 0 2 2 0 0 0 0 0 0 ...
##  $ t6ppl01 : num [1:122] 0 0 2 2 0 0 0 0 0 0 ...
##  $ t7ppl01 : num [1:122] 0 0 1 2 0 0 0 0 0 9 ...
```

```
##  $ t8ppl01 : num [1:122] 0 0 0 1 0 0 0 0 0 9 ...
##  $ t9ppl01 : num [1:122] 0 0 0 0 0 0 0 0 0 9 ...
##  $ t10ppl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ t11ppl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ t12ppl01: num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l1ppl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l2ppl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##  $ l3ppl01 : num [1:122] 0 0 0 0 0 0 0 0 0 0 ...
##   [list output truncated]
##  - attr(*, "spec")=
##   .. cols(
##   ..   PID = col_character(),
##   ..   elbfll01 = col_double(),
##   ..   wrextl01 = col_double(),
##   ..   elbexl01 = col_double(),
##   ..   finfll01 = col_double(),
##   ..   finabl01 = col_double(),
##   ..   hipfll01 = col_double(),
##   ..   kneexl01 = col_double(),
##   ..   ankdol01 = col_double(),
##   ..   gretol01 = col_double(),
##   ..   ankpll01 = col_double(),
##   ..   elbflr01 = col_double(),
##   ..   wrextr01 = col_double(),
##   ..   elbexr01 = col_double(),
##   ..   finflr01 = col_double(),
##   ..   finabr01 = col_double(),
##   ..   hipflr01 = col_double(),
##   ..   kneetr01 = col_double(),
##   ..   ankdor01 = col_double(),
##   ..   gretor01 = col_double(),
##   ..   ankplr01 = col_double(),
##   ..   c2ltl01 = col_double(),
##   ..   c3ltl01 = col_double(),
##   ..   c4ltl01 = col_double(),
##   ..   c5ltl01 = col_double(),
##   ..   c6ltl01 = col_double(),
##   ..   c7ltl01 = col_double(),
##   ..   c8ltl01 = col_double(),
##   ..   t1ltl01 = col_double(),
##   ..   t2ltl01 = col_double(),
##   ..   t3ltl01 = col_double(),
##   ..   t4ltl01 = col_double(),
##   ..   t5ltl01 = col_double(),
##   ..   t6ltl01 = col_double(),
##   ..   t7ltl01 = col_double(),
##   ..   t8ltl01 = col_double(),
##   ..   t9ltl01 = col_double(),
##   ..   t10ltl01 = col_double(),
##   ..   t11ltl01 = col_double(),
##   ..   t12ltl01 = col_double(),
##   ..   l1ltl01 = col_double(),
##   ..   l2ltl01 = col_double(),
##   ..   l3ltl01 = col_double(),
```

```
##   ..   l4ltl01 = col_double(),
##   ..   l5ltl01 = col_double(),
##   ..   s1ltl01 = col_double(),
##   ..   s2ltl01 = col_double(),
##   ..   s3ltl01 = col_double(),
##   ..   s45ltl01 = col_double(),
##   ..   c2ltr01 = col_double(),
##   ..   c3ltr01 = col_double(),
##   ..   c4ltr01 = col_double(),
##   ..   c5ltr01 = col_double(),
##   ..   c6ltr01 = col_double(),
##   ..   c7ltr01 = col_double(),
##   ..   c8ltr01 = col_double(),
##   ..   t1ltr01 = col_double(),
##   ..   t2ltr01 = col_double(),
##   ..   t3ltr01 = col_double(),
##   ..   t4ltr01 = col_double(),
##   ..   t5ltr01 = col_double(),
##   ..   t6ltr01 = col_double(),
##   ..   t7ltr01 = col_double(),
##   ..   t8ltr01 = col_double(),
##   ..   t9ltr01 = col_double(),
##   ..   t10ltr01 = col_double(),
##   ..   t11ltr01 = col_double(),
##   ..   t12ltr01 = col_double(),
##   ..   l1ltr01 = col_double(),
##   ..   l2ltr01 = col_double(),
##   ..   l3ltr01 = col_double(),
##   ..   l4ltr01 = col_double(),
##   ..   l5ltr01 = col_double(),
##   ..   s1ltr01 = col_double(),
##   ..   s2ltr01 = col_double(),
##   ..   s3ltr01 = col_double(),
##   ..   s45ltr01 = col_double(),
##   ..   c2ppl01 = col_double(),
##   ..   c3ppl01 = col_double(),
##   ..   c4ppl01 = col_double(),
##   ..   c5ppl01 = col_double(),
##   ..   c6ppl01 = col_double(),
##   ..   c7ppl01 = col_double(),
##   ..   c8ppl01 = col_double(),
##   ..   t1ppl01 = col_double(),
##   ..   t2ppl01 = col_double(),
##   ..   t3ppl01 = col_double(),
##   ..   t4ppl01 = col_double(),
##   ..   t5ppl01 = col_double(),
##   ..   t6ppl01 = col_double(),
##   ..   t7ppl01 = col_double(),
##   ..   t8ppl01 = col_double(),
##   ..   t9ppl01 = col_double(),
##   ..   t10ppl01 = col_double(),
##   ..   t11ppl01 = col_double(),
##   ..   t12ppl01 = col_double(),
##   ..   l1ppl01 = col_double(),
```

```
##   ..   l2ppl01 = col_double(),
##   ..   l3ppl01 = col_double(),
##   ..   l4ppl01 = col_double(),
##   ..   l5ppl01 = col_double(),
##   ..   s1ppl01 = col_double(),
##   ..   s2ppl01 = col_double(),
##   ..   s3ppl01 = col_double(),
##   ..   s45ppl01 = col_double(),
##   ..   c2ppr01 = col_double(),
##   ..   c3ppr01 = col_double(),
##   ..   c4ppr01 = col_double(),
##   ..   c5ppr01 = col_double(),
##   ..   c6ppr01 = col_double(),
##   ..   c7ppr01 = col_double(),
##   ..   c8ppr01 = col_double(),
##   ..   t1ppr01 = col_double(),
##   ..   t2ppr01 = col_double(),
##   ..   t3ppr01 = col_double(),
##   ..   t4ppr01 = col_double(),
##   ..   t5ppr01 = col_double(),
##   ..   t6ppr01 = col_double(),
##   ..   t7ppr01 = col_double(),
##   ..   t8ppr01 = col_double(),
##   ..   t9ppr01 = col_double(),
##   ..   t10ppr01 = col_double(),
##   ..   t11ppr01 = col_double(),
##   ..   t12ppr01 = col_double(),
##   ..   l1ppr01 = col_double(),
##   ..   l2ppr01 = col_double(),
##   ..   l3ppr01 = col_double(),
##   ..   l4ppr01 = col_double(),
##   ..   l5ppr01 = col_double(),
##   ..   s1ppr01 = col_double(),
##   ..   s2ppr01 = col_double(),
##   ..   s3ppr01 = col_double(),
##   ..   s45ppr01 = col_double(),
##   ..   vaccd01 = col_double(),
##   ..   anyana01 = col_double(),
##   ..   ais1 = col_character()
##   .. )
##   - attr(*, "problems")=<externalptr>

##      PID            elbfll01  wrextl01  elbexl01  finfll01  finabl01
##   Length:122        0   :14   0   :36   0   :52   0   :75   0   :79
##   Class :character  1   : 9   1   :15   1   :12   1   : 7   1   : 5
##   Mode  :character  2   : 2   2   :12   2   :10   2   : 2   2   : 2
##                     3   :10   3   : 5   3   : 5   3   : 4   3   : 2
##                     4   :33   4   :19   4   : 9   4   : 6   4   : 7
##                     5   :51   5   :33   5   :31   5   :27   5   :25
##                     NA's: 3   NA's: 2   NA's: 3   NA's: 1   NA's: 2
##   hipfll01   kneexl01   ankdol01   gretol01   ankpll01   elbflr01 wrextr01
##   0   :102   0   :101   0   :108   0   :109   0   :104   0:15     0   :38
##   1   :  8   1   :  6   1   :  3   1   :  4   1   :  4   1: 6     1   :13
##   2   :  3   2   :  4   2   :  3   2   :  2   2   :  4   2: 2     2   : 9
```

```
##  3   :  3   3   :  2   3   :  1   4   :  3   3   :  1   3:12     3   : 8
##  4   :  2   4   :  4   4   :  1   5   :  2   4   :  4   4:33     4   :14
##  5   :  2   5   :  3   5   :  4   NA's:  2   5   :  3   5:54     5   :36
##  NA's:  2   NA's:  2   NA's:  2              NA's:  2            NA's: 4
##  elbexr01  finflr01  finabr01  hipflr01 kneetr01 ankdor01 gretor01 ankplr01
##  0   :56   0   :70   0   :75   0:106    0:105    0:113    0:113    0:109
##  1   :13   1   :11   1   : 8   1:  6    1:  6    1:  2    1:  6    1:  7
##  2   : 4   2   : 1   2   : 1   2:  6    2:  5    2:  3    3:  1    2:  2
##  3   : 9   3   : 4   3   : 4   3:  2    3:  3    3:  2    4:  1    3:  1
##  4   : 9   4   : 5   4   : 6   4:  1    4:  2    4:  1    5:  1    4:  2
##  5   :30   5   :30   5   :27   5:  1    5:  1    5:  1             5:  1
##  NA's: 1   NA's: 1   NA's: 1
##  c2ltl01    c3ltl01    c4ltl01 c5ltl01   c6ltl01 c7ltl01 c8ltl01 t1ltl01
##  0   :  1   0   :  8   0:  9   0   :15   0:32    0:45    0:55    0   :51
##  1   :  1   2   :112   1:  4   1   :14   1:22    1:26    1:24    1   :20
##  2   :111   NA's:  2   2:109   2   :91   2:68    2:51    2:43    2   :50
##  NA's:  9                      NA's: 2                          NA's: 1
##
##
##
##  t2ltl01 t3ltl01 t4ltl01 t5ltl01   t6ltl01   t7ltl01   t8ltl01   t9ltl01
##  0:51    0:53    0:62    0   :66   0   :73   0   :76   0   :81   0   :92
##  1:22    1:19    1:22    1   :21   1   :20   1   :15   1   :16   1   :14
##  2:49    2:50    2:38    2   :32   2   :26   2   :26   2   :20   2   :14
##                          NA's: 3   NA's: 3   NA's: 5   NA's: 5   NA's: 2
##
##
##
##  t10ltl01 t11ltl01 t12ltl01 l1ltl01   l2ltl01   l3ltl01   l4ltl01   l5ltl01
##  0:100    0:102    0:104    0   :99   0   :98   0   :97   0   :95   0   :93
##  1: 14    1: 12    1: 12    1   :16   1   :15   1   :14   1   :14   1   :14
##  2:  8    2:  8    2:  6    2   : 6   2   : 8   2   : 9   2   :11   2   :13
##                             NA's: 1   NA's: 1   NA's: 2   NA's: 2   NA's: 2
##
##
##
##  s1ltl01   s2ltl01   s3ltl01 s45ltl01 c2ltr01    c3ltr01    c4ltr01 c5ltr01
##  0   :94   0   :94   0:95    0:87     1   :  1   0   :  7   0:  9   0:20
##  1   :14   1   :15   1:18    1:23     2   :112   1   :  3   1:  4   1:10
##  2   :12   2   :11   2: 9    2:12     NA's:  9   2   :110   2:109   2:92
##  NA's: 2   NA's: 2                              NA's:  2
##
##
##
##  c6ltr01   c7ltr01   c8ltr01   t1ltr01 t2ltr01 t3ltr01 t4ltr01 t5ltr01
##  0   :34   0   :47   0   :54   0:50    0:53    0:57    0:66    0   :70
##  1   :18   1   :22   1   :21   1:19    1:18    1:17    1:19    1   :17
##  2   :69   2   :52   2   :46   2:53    2:51    2:48    2:37    2   :32
##  NA's: 1   NA's: 1   NA's: 1                                    NA's: 3
##
##
##
##  t6ltr01   t7ltr01   t8ltr01   t9ltr01   t10ltr01 t11ltr01 t12ltr01 l1ltr01
##  0   :77   0   :81   0   :84   0   :92   0:101    0:103    0:107    0:102
```

```
##  1   :18   1   :17   1   :17   1   :17   1: 12    1: 12    1:  9    1: 13
##  2   :23   2   :19   2   :16   2   :11   2:  9    2:  7    2:  6    2:  7
##  NA's: 4   NA's: 5   NA's: 5   NA's: 2
##
##
##
##  l2ltr01 l3ltr01    l4ltr01   l5ltr01   s1ltr01   s2ltr01   s3ltr01 s45ltr01
##  0:102   0   :100   0   :97   0   :94   0   :98   0   :97   0:94    0:88
##  1: 11   1   :  9   1   :11   1   :15   1   :12   1   :15   1:19    1:22
##  2:  9   2   : 12   2   :13   2   :12   2   :11   2   : 9   2: 9    2:12
##          NA's:  1   NA's: 1   NA's: 1   NA's: 1   NA's: 1
##
##
##
##  c2ppl01 c3ppl01 c4ppl01 c5ppl01 c6ppl01 c7ppl01 c8ppl01 t1ppl01 t2ppl01
##  0:  1   0:  6   0: 11   0:21    0:43    0:50    0:55    0:55    0:54
##  1:  1   1:  1   1:  3   1:13    1:15    1:18    1:21    1:17    1:19
##  2:111   2:113   2:108   2:86    2:64    2:54    2:46    2:49    2:49
##  9:  9   9:  2           9: 2                                    9: 1
##
##
##
##  t3ppl01 t4ppl01 t5ppl01 t6ppl01 t7ppl01 t8ppl01 t9ppl01 t10ppl01 t11ppl01
##  0:62    0:71    0:76    0:82    0:86    0:90    0:99    0:106    0:106
##  1:15    1:13    1:16    1:16    1:12    1:13    1:12    1:  9    1: 11
##  2:45    2:38    2:27    2:21    2:19    2:14    2: 9    2:  7    2:  5
##                  9: 3    9: 3    9: 5    9: 5    9: 2
##
##
##
##  t12ppl01 l1ppl01 l2ppl01 l3ppl01 l4ppl01 l5ppl01 s1ppl01 s2ppl01 s3ppl01
##  0:104    0:105   0:105   0:101   0:99    0:98    0:100   0:101   0:98
##  1: 12    1: 11   1: 10   1: 12   1:14    1:14    1: 12   1: 12   1:18
##  2:  5    2:  5   2:  6   2:  7   2: 7    2: 8    2:  8   2:  7   2: 6
##  9:  1    9:  1   9:  1   9:  2   9: 2    9: 2    9:  2   9:  2
##
##
##
##  s45ppl01 c2ppr01 c3ppr01 c4ppr01 c5ppr01 c6ppr01 c7ppr01 c8ppr01 t1ppr01
##  0:99     1:  1   0:  6   0: 12   0:24    0:42    0:51    0:57    0:54
##  1:18     2:112   1:  4   1:  3   1:12    1:15    1:20    1:17    1:20
##  2: 5     9:  9   2:110   2:107   2:86    2:64    2:50    2:47    2:48
##                   9:  2                   9: 1    9: 1    9: 1
##
##
##
##  t2ppr01 t3ppr01 t4ppr01 t5ppr01 t6ppr01 t7ppr01 t8ppr01 t9ppr01 t10ppr01
##  0:61    0:67    0:71    0:77    0:86    0:89    0:90    0:99    0:106
##  1:15    1:11    1:12    1:14    1:11    1:14    1:14    1:13    1:  8
##  2:46    2:44    2:39    2:28    2:21    2:14    2:13    2: 8    2:  8
##                          9: 3    9: 4    9: 5    9: 5    9: 2
##
##
##
```

```
##  t11ppr01 t12ppr01 l1ppr01 l2ppr01 l3ppr01 l4ppr01 l5ppr01 s1ppr01 s2ppr01
##  0:107    0:109    0:107   0:107   0:107   0:103   0:104   0:103   0:104
##  1:  9    1:  7    1:  9   1:  8   1:  8   1: 12   1: 10   1: 11   1: 11
##  2:  6    2:  6    2:  6   2:  7   2:  6   2:  6   2:  7   2:  7   2:  6
##                                    9:  1   9:  1   9:  1   9:  1   9:  1
##
##
##
##  s3ppr01 s45ppr01 vaccd01 anyana01     ais1
##  0:104   0:101    0:103   0:81     Length:122
##  1: 12   1: 14    1: 19   1:41     Class :character
##  2:  6   2:  7                     Mode  :character
##
##
##
##
```

	Variable	Unique_Values	Missing_Values
PID	PID	122	0
elbfll01	elbfll01	7	3
wrextl01	wrextl01	7	2
elbexl01	elbexl01	7	3
finfll01	finfll01	7	1
finabl01	finabl01	7	2
hipfll01	hipfll01	7	2
kneexl01	kneexl01	7	2
ankdol01	ankdol01	7	2
gretol01	gretol01	6	2
ankpll01	ankpll01	7	2
elbflr01	elbflr01	6	0
wrextr01	wrextr01	7	4
elbexr01	elbexr01	7	1
finflr01	finflr01	7	1
finabr01	finabr01	7	1
hipflr01	hipflr01	6	0
kneetr01	kneetr01	6	0
ankdor01	ankdor01	6	0
gretor01	gretor01	5	0
ankplr01	ankplr01	6	0
c2ltl01	c2ltl01	4	9
c3ltl01	c3ltl01	3	2
c4ltl01	c4ltl01	3	0
c5ltl01	c5ltl01	4	2
c6ltl01	c6ltl01	3	0
c7ltl01	c7ltl01	3	0
c8ltl01	c8ltl01	3	0
t1ltl01	t1ltl01	4	1
t2ltl01	t2ltl01	3	0
t3ltl01	t3ltl01	3	0
t4ltl01	t4ltl01	3	0
t5ltl01	t5ltl01	4	3
t6ltl01	t6ltl01	4	3
t7ltl01	t7ltl01	4	5
t8ltl01	t8ltl01	4	5

```
## t9ltl01   t9ltl01            4             2
## t10ltl01 t10ltl01            3             0
## t11ltl01 t11ltl01            3             0
## t12ltl01 t12ltl01            3             0
## l1ltl01   l1ltl01            4             1
## l2ltl01   l2ltl01            4             1
## l3ltl01   l3ltl01            4             2
## l4ltl01   l4ltl01            4             2
## l5ltl01   l5ltl01            4             2
## s1ltl01   s1ltl01            4             2
## s2ltl01   s2ltl01            4             2
## s3ltl01   s3ltl01            3             0
## s45ltl01 s45ltl01            3             0
## c2ltr01   c2ltr01            3             9
## c3ltr01   c3ltr01            4             2
## c4ltr01   c4ltr01            3             0
## c5ltr01   c5ltr01            3             0
## c6ltr01   c6ltr01            4             1
## c7ltr01   c7ltr01            4             1
## c8ltr01   c8ltr01            4             1
## t1ltr01   t1ltr01            3             0
## t2ltr01   t2ltr01            3             0
## t3ltr01   t3ltr01            3             0
## t4ltr01   t4ltr01            3             0
## t5ltr01   t5ltr01            4             3
## t6ltr01   t6ltr01            4             4
## t7ltr01   t7ltr01            4             5
## t8ltr01   t8ltr01            4             5
## t9ltr01   t9ltr01            4             2
## t10ltr01 t10ltr01            3             0
## t11ltr01 t11ltr01            3             0
## t12ltr01 t12ltr01            3             0
## l1ltr01   l1ltr01            3             0
## l2ltr01   l2ltr01            3             0
## l3ltr01   l3ltr01            4             1
## l4ltr01   l4ltr01            4             1
## l5ltr01   l5ltr01            4             1
## s1ltr01   s1ltr01            4             1
## s2ltr01   s2ltr01            4             1
## s3ltr01   s3ltr01            3             0
## s45ltr01 s45ltr01            3             0
## c2ppl01   c2ppl01            4             0
## c3ppl01   c3ppl01            4             0
## c4ppl01   c4ppl01            3             0
## c5ppl01   c5ppl01            4             0
## c6ppl01   c6ppl01            3             0
## c7ppl01   c7ppl01            3             0
## c8ppl01   c8ppl01            3             0
## t1ppl01   t1ppl01            4             0
## t2ppl01   t2ppl01            3             0
## t3ppl01   t3ppl01            3             0
## t4ppl01   t4ppl01            3             0
## t5ppl01   t5ppl01            4             0
## t6ppl01   t6ppl01            4             0
```

```
## t7ppl01   t7ppl01            4             0
## t8ppl01   t8ppl01            4             0
## t9ppl01   t9ppl01            4             0
## t10ppl01 t10ppl01            3             0
## t11ppl01 t11ppl01            3             0
## t12ppl01 t12ppl01            4             0
## l1ppl01   l1ppl01            4             0
## l2ppl01   l2ppl01            4             0
## l3ppl01   l3ppl01            4             0
## l4ppl01   l4ppl01            4             0
## l5ppl01   l5ppl01            4             0
## s1ppl01   s1ppl01            4             0
## s2ppl01   s2ppl01            4             0
## s3ppl01   s3ppl01            3             0
## s45ppl01 s45ppl01            3             0
## c2ppr01   c2ppr01            3             0
## c3ppr01   c3ppr01            4             0
## c4ppr01   c4ppr01            3             0
## c5ppr01   c5ppr01            3             0
## c6ppr01   c6ppr01            4             0
## c7ppr01   c7ppr01            4             0
## c8ppr01   c8ppr01            4             0
## t1ppr01   t1ppr01            3             0
## t2ppr01   t2ppr01            3             0
## t3ppr01   t3ppr01            3             0
## t4ppr01   t4ppr01            3             0
## t5ppr01   t5ppr01            4             0
## t6ppr01   t6ppr01            4             0
## t7ppr01   t7ppr01            4             0
## t8ppr01   t8ppr01            4             0
## t9ppr01   t9ppr01            4             0
## t10ppr01 t10ppr01            3             0
## t11ppr01 t11ppr01            3             0
## t12ppr01 t12ppr01            3             0
## l1ppr01   l1ppr01            3             0
## l2ppr01   l2ppr01            3             0
## l3ppr01   l3ppr01            4             0
## l4ppr01   l4ppr01            4             0
## l5ppr01   l5ppr01            4             0
## s1ppr01   s1ppr01            4             0
## s2ppr01   s2ppr01            4             0
## s3ppr01   s3ppr01            3             0
## s45ppr01 s45ppr01            3             0
## vaccd01   vaccd01            2             0
## anyana01 anyana01            2             0
## ais1         ais1            4             0
```

File 4: test_outcomes_MS_template.csv

All features, including ISNCSCI assessments and AIS grades, at 1 week after injury. Each row corresponds to a specific patient ID, columns are features.