Thesis

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Checkpoint start: Uncomment to recreate the plots

Checkpoint end: Uncomment to recreate the plots

Start analysis

Old code: When the we assume every patients has his/her own unique treatment period without any differentiation

lme4 code for treatment and diagnosis interaction: BASMI

```
# Make sure that the reference level for treatment_reclassified is "Standard Non-High Cost Dr
dataframe_sorted_and_reclassified_basmi$treatment_reclassified <- relevel(dataframe_sorted_ar

# Make sure that the reference level for hlba27status is "undiagnosed"
dataframe_sorted_and_reclassified_basmi$hlab27status <- relevel(dataframe_sorted_and_reclass:

# Make sure that the reference level for diagnosis is "Axial SpA- nr-axSpA"
dataframe_sorted_and_reclassified_basmi$diagnosis <- relevel(dataframe_sorted_and_reclassifie

# Make sure that the reference level for treatment_order is 0
dataframe_sorted_and_reclassified_basmi$treatment_order <- relevel(dataframe_sorted_and_recla

# Make sure that the reference level for last_known_smoking_status is "no information"
dataframe_sorted_and_reclassified_basmi$last_known_smoking_status <- relevel(dataframe_sorted

# Make sure that the reference level for last_known_vaping_status is "no information"
```

```
dataframe_sorted_and_reclassified_basmi$last_known_vaping_status <- relevel(dataframe_sorted_

# Define the full and reduced models
model_1_full <- lmer(basmi_score ~ gender + hlab27status + age_at_basmi + diagnosis + treatme
                     control = lmerControl(optimizer = "bobyqa", optCtrl = list(maxfun =
                )
model_1_reduced <- lmer(basmi_score ~ gender + hlab27status + age_at_basmi + treatment_order
                     control = lmerControl(optimizer = "bobyqa", optCtrl = list(maxfun =
                )
```

```
print(summary(model_1_full, corr = FALSE))
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula: basmi_score ~ gender + hlab27status + age_at_basmi + diagnosis +
    treatment_order + last_known_smoking_status + last_known_vaping_status +
    treatment_reclassified * diagnosis + time_in_years + (time_in_years |
    ttas_id)
   Data: dataframe_sorted_and_reclassified_basmi
Control: lmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))

REML criterion at convergence: 42649.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.9712 -0.5719 -0.0037  0.5632  6.0621

Random effects:
 Groups   Name         Variance Std.Dev. Corr
 ttas_id  (Intercept)  2.688242 1.63959
          time_in_years 0.003774 0.06144  -0.16
 Residual              0.485653 0.69689
Number of obs: 17483, groups:  ttas_id, 1043

Fixed effects:
                                               Estimate
(Intercept)                                   1.036e+00
genderMale                                    4.986e-01
hlab27statusNegative                         -3.084e-02
hlab27statusPositive                         -8.758e-02
age_at_basmi                                  4.851e-02
diagnosisAxial SpA- nr-axSpA                 -8.901e-01
```

```
treatment_order2                                                         -1.577e-01
treatment_order3                                                         -8.230e-02
treatment_order4                                                         -2.951e-01
treatment_order5                                                         -2.202e-01
treatment_order6                                                         -3.334e-01
treatment_order7                                                         -4.816e-01
treatment_order8                                                         -9.411e-01
treatment_order9                                                         -6.343e-02
treatment_order11                                                         1.429e+00
last_known_smoking_statusex-smoker                                        5.167e-01
last_known_smoking_statusnever                                           3.532e-01
last_known_smoking_statussmoker                                          6.993e-01
last_known_vaping_statusex-vaper                                        -1.997e+00
last_known_vaping_statusnever                                           -8.279e-01
last_known_vaping_statusvaper                                           -6.080e-01
treatment_reclassifiedAnti-IL17                                          2.737e-02
treatment_reclassifiedAnti-TNF                                          -8.745e-02
treatment_reclassifiedJAK Inhibitor                                      1.320e-01
time_in_years                                                            4.150e-03
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-IL17            -5.263e-01
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-TNF            -1.944e-01
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedJAK Inhibitor -6.290e-02
                                                                        Std. Error
(Intercept)                                                              2.228e-01
genderMale                                                               1.146e-01
hlab27statusNegative                                                     1.872e-01
hlab27statusPositive                                                     1.295e-01
age_at_basmi                                                             4.047e-03
diagnosisAxial SpA- nr-axSpA                                             1.594e-01
treatment_order2                                                         7.513e-02
treatment_order3                                                         6.199e-02
treatment_order4                                                         9.066e-02
treatment_order5                                                         1.010e-01
treatment_order6                                                         1.346e-01
treatment_order7                                                         1.968e-01
treatment_order8                                                         2.839e-01
treatment_order9                                                         3.354e-01
treatment_order11                                                        5.077e-01
last_known_smoking_statusex-smoker                                       2.615e-01
last_known_smoking_statusnever                                          2.619e-01
last_known_smoking_statussmoker                                         3.278e-01
last_known_vaping_statusex-vaper                                        5.955e-01
last_known_vaping_statusnever                                           2.520e-01
```

```
last_known_vaping_statusvaper                                              3.686e-01
treatment_reclassifiedAnti-IL17                                            1.173e-01
treatment_reclassifiedAnti-TNF                                             7.201e-02
treatment_reclassifiedJAK Inhibitor                                        3.882e-01
time_in_years                                                              4.786e-03
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-IL17               3.316e-01
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-TNF               1.330e-01
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedJAK Inhibitor           6.862e-01
                                                                                 df
(Intercept)                                                                1.108e+03
genderMale                                                                 1.024e+03
hlab27statusNegative                                                       1.037e+03
hlab27statusPositive                                                       1.024e+03
age_at_basmi                                                               1.165e+03
diagnosisAxial SpA- nr-axSpA                                               1.063e+03
treatment_order2                                                           1.464e+04
treatment_order3                                                           1.392e+04
treatment_order4                                                           1.456e+04
treatment_order5                                                           1.257e+04
treatment_order6                                                           1.354e+04
treatment_order7                                                           8.835e+03
treatment_order8                                                           1.601e+04
treatment_order9                                                           1.594e+04
treatment_order11                                                          1.384e+04
last_known_smoking_statusex-smoker                                         1.022e+03
last_known_smoking_statusnever                                             1.023e+03
last_known_smoking_statussmoker                                            1.028e+03
last_known_vaping_statusex-vaper                                           1.044e+03
last_known_vaping_statusnever                                              1.021e+03
last_known_vaping_statusvaper                                              1.022e+03
treatment_reclassifiedAnti-IL17                                            1.319e+04
treatment_reclassifiedAnti-TNF                                             1.478e+04
treatment_reclassifiedJAK Inhibitor                                        4.443e+03
time_in_years                                                              1.698e+03
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-IL17               1.292e+04
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-TNF               1.026e+04
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedJAK Inhibitor           1.276e+04
                                                                            t value
(Intercept)                                                                  4.647
genderMale                                                                   4.350
hlab27statusNegative                                                        -0.165
hlab27statusPositive                                                        -0.676
age_at_basmi                                                                11.986
```

```
diagnosisAxial SpA- nr-axSpA                                         -5.585
treatment_order2                                                     -2.099
treatment_order3                                                     -1.328
treatment_order4                                                     -3.255
treatment_order5                                                     -2.179
treatment_order6                                                     -2.477
treatment_order7                                                     -2.447
treatment_order8                                                     -3.315
treatment_order9                                                     -0.189
treatment_order11                                                     2.814
last_known_smoking_statusex-smoker                                    1.976
last_known_smoking_statusnever                                        1.349
last_known_smoking_statussmoker                                       2.134
last_known_vaping_statusex-vaper                                     -3.353
last_known_vaping_statusnever                                        -3.286
last_known_vaping_statusvaper                                        -1.649
treatment_reclassifiedAnti-IL17                                       0.233
treatment_reclassifiedAnti-TNF                                       -1.214
treatment_reclassifiedJAK Inhibitor                                   0.340
time_in_years                                                         0.867
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-IL17         -1.587
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-TNF          -1.462
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedJAK Inhibitor     -0.092
                                                                     Pr(>|t|)
(Intercept)                                                          3.77e-06 ***
genderMale                                                           1.50e-05 ***
hlab27statusNegative                                                 0.869156
hlab27statusPositive                                                 0.499073
age_at_basmi                                                          < 2e-16 ***
diagnosisAxial SpA- nr-axSpA                                         2.97e-08 ***
treatment_order2                                                    0.035796 *
treatment_order3                                                    0.184333
treatment_order4                                                    0.001136 **
treatment_order5                                                    0.029325 *
treatment_order6                                                    0.013263 *
treatment_order7                                                    0.014429 *
treatment_order8                                                    0.000920 ***
treatment_order9                                                    0.849998
treatment_order11                                                   0.004897 **
last_known_smoking_statusex-smoker                                  0.048397 *
last_known_smoking_statusnever                                      0.177759
last_known_smoking_statussmoker                                     0.033114 *
last_known_vaping_statusex-vaper                                    0.000829 ***
```

```
last_known_vaping_statusnever                                              0.001052 **
last_known_vaping_statusvaper                                              0.099406 .
treatment_reclassifiedAnti-IL17                                            0.815559
treatment_reclassifiedAnti-TNF                                             0.224596
treatment_reclassifiedJAK Inhibitor                                        0.733896
time_in_years                                                              0.385991
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-IL17              0.112479
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedAnti-TNF               0.143804
diagnosisAxial SpA- nr-axSpA:treatment_reclassifiedJAK Inhibitor 0.926968
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
print(summary(model_1_reduced, corr = FALSE))
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's method [
lmerModLmerTest]
Formula:
basmi_score ~ gender + hlab27status + age_at_basmi + treatment_order +
    last_known_smoking_status + last_known_vaping_status + treatment_reclassified +
    diagnosis + time_in_years + (time_in_years | ttas_id)
   Data: dataframe_sorted_and_reclassified_basmi
Control: lmerControl(optimizer = "bobyqa", optCtrl = list(maxfun = 2e+05))

REML criterion at convergence: 42652.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-5.9701 -0.5730 -0.0043  0.5634  6.0617

Random effects:
 Groups    Name        Variance Std.Dev. Corr
 ttas_id  (Intercept)  2.681583 1.63755
          time_in_years 0.003781 0.06149  -0.16
 Residual              0.485725 0.69694
Number of obs: 17483, groups:  ttas_id, 1043

Fixed effects:
                                   Estimate Std. Error        df t value
(Intercept)                       1.038e+00  2.225e-01  1.109e+03   4.664
genderMale                        4.993e-01  1.145e-01  1.025e+03   4.362
hlab27statusNegative             -3.719e-02  1.869e-01  1.037e+03  -0.199
hlab27statusPositive             -8.643e-02  1.294e-01  1.025e+03  -0.668
```

```
age_at_basmi                             4.846e-02  4.042e-03  1.165e+03  11.988
treatment_order2                        -1.573e-01  7.511e-02  1.466e+04  -2.094
treatment_order3                        -8.758e-02  6.184e-02  1.396e+04  -1.416
treatment_order4                        -2.943e-01  9.042e-02  1.459e+04  -3.255
treatment_order5                        -2.437e-01  9.980e-02  1.256e+04  -2.441
treatment_order6                        -3.191e-01  1.333e-01  1.380e+04  -2.393
treatment_order7                        -4.777e-01  1.929e-01  8.793e+03  -2.476
treatment_order8                        -9.651e-01  2.832e-01  1.594e+04  -3.408
treatment_order9                        -7.127e-02  3.353e-01  1.596e+04  -0.213
treatment_order11                        1.413e+00  5.075e-01  1.388e+04   2.784
last_known_smoking_statusex-smoker       5.279e-01  2.610e-01  1.022e+03   2.022
last_known_smoking_statusnever           3.644e-01  2.614e-01  1.023e+03   1.394
last_known_smoking_statussmoker          7.057e-01  3.273e-01  1.028e+03   2.156
last_known_vaping_statusex-vaper        -2.007e+00  5.948e-01  1.045e+03  -3.375
last_known_vaping_statusnever           -8.376e-01  2.516e-01  1.021e+03  -3.330
last_known_vaping_statusvaper           -6.161e-01  3.681e-01  1.022e+03  -1.674
treatment_reclassifiedAnti-IL17         -1.653e-02  1.122e-01  1.362e+04  -0.147
treatment_reclassifiedAnti-TNF          -9.914e-02  7.166e-02  1.464e+04  -1.383
treatment_reclassifiedJAK Inhibitor      1.153e-01  3.248e-01  7.203e+03   0.355
diagnosisAxial SpA- nr-axSpA            -9.194e-01  1.582e-01  1.045e+03  -5.812
time_in_years                            4.168e-03  4.783e-03  1.699e+03   0.871
                                        Pr(>|t|)
(Intercept)                             3.49e-06 ***
genderMale                              1.42e-05 ***
hlab27statusNegative                    0.842288
hlab27statusPositive                    0.504176
age_at_basmi                             < 2e-16 ***
treatment_order2                        0.036249 *
treatment_order3                        0.156788
treatment_order4                        0.001137 **
treatment_order5                        0.014646 *
treatment_order6                        0.016721 *
treatment_order7                        0.013293 *
treatment_order8                        0.000655 ***
treatment_order9                        0.831694
treatment_order11                       0.005382 **
last_known_smoking_statusex-smoker      0.043403 *
last_known_smoking_statusnever          0.163641
last_known_smoking_statussmoker         0.031290 *
last_known_vaping_statusex-vaper        0.000766 ***
last_known_vaping_statusnever           0.000901 ***
last_known_vaping_statusvaper           0.094520 .
treatment_reclassifiedAnti-IL17         0.882914
```

```
treatment_reclassifiedAnti-TNF      0.166563
treatment_reclassifiedJAK Inhibitor 0.722733
diagnosisAxial SpA- nr-axSpA        8.21e-09 ***
time_in_years                       0.383648
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

anova(model_1_full, model_1_reduced)

```
refitting model(s) with ML (instead of REML)


Data: dataframe_sorted_and_reclassified_basmi
Models:
model_1_reduced: basmi_score ~ gender + hlab27status + age_at_basmi + treatment_order + last_
model_1_full: basmi_score ~ gender + hlab27status + age_at_basmi + diagnosis + treatment_orde
                npar   AIC   BIC logLik deviance  Chisq Df Pr(>Chisq)
model_1_reduced   29 42644 42869 -21293    42586
model_1_full      32 42646 42894 -21291    42582 3.8121  3     0.2825
```