Propensity Score Analysis with ASES as Outcome

Run Fan and Dan Ayers

July 30, 2018

Contents

1 Patient population

- The total sample size in clean dataset is 469.
- Exclude 79 patients that didn't return their baseline questionnaires (total sample size=390).
- Exclude 4 patients without degree of certainty information (total sample size=386).
- Exclude 228 baseline-only patients (total sample size=158).
- Among 158 patients,138 of them are RCT+ (DOC+/MRI+ or DOC+/MRI missing). 5 patients are RCT- (DOC-). 15 patients are RCT missing (DOC+/MRI-).
- Among 138 RCT+ patients, 77 of them are non-operative (group2: non-operative and group6: delayed surgery without surgery date). 50 of them are operative group. The sample size is 127.

2 Summary Table

. $_a$ b $_c$ represent the lower quartile a, the median b, and the upper quartile c for continuous variables. $x \pm s$ represents $\bar{X} \pm 1$ SD. N is the number of non-missing values. Numbers after proportions are frequencies.

	N	Surgery $N = 50$	Non-operative $N = 77$	Combined $N = 127$
Age	127	51.6 59.1 64.6 (59.3 ± 8.9)	59.3 64.6 68.6 (63.8 ± 8.3)	54.8 63.0 67.9 (62.0 ± 8.8)
Biceps tendonitis	127			
No		0.7 (35)	0.7 (54)	0.7 (89)
Yes		0.3 (15)	0.3 (23)	0.3 (38)
Boileau	127			
0/1		0.58 (29)	0.64 (49)	0.61 (78)
2		0.38 (19)	0.17 (13)	0.25 (32)
NA		0.04 (2)	0.19 (15)	0.13 (17)
Daily shoulder use at work	127			
Light/No manual labor		0.74 (37)	0.82 (63)	0.79 (100)
Heavy/Moderate manual labor		0.24 (12)	0.18 (14)	0.20 (26)
NA		0.02 (1)	0.00 (0)	0.01 (1)
Do you drink alcohol?	127			
2-3 times per month or less		0.36 (18)	0.56 (43)	0.48 (61)
1-2 times per week or more		0.60 (30)	0.43 (33)	0.50 (63)
NA		0.04 (2)	0.01 (1)	0.02 (3)
Education	127			
Less than college		0.32 (16)	0.34 (26)	0.33 (42)
College or above		0.64 (32)	0.65 (50)	0.65 (82)
NA		0.04 (2)	0.01 (1)	0.02 (3)
External Rotation Ratio	119	0.31 0.51 0.71 (0.54 ±0.29)	0.59 0.76 0.98 (0.83 ±0.45)	0.49 0.68 0.91 (0.72 ±0.42)
FABQ	122	17.0 19.0 22.8 (19.0 ± 4.3)	12.0 18.0 21.0 (16.4 ± 6.1)	15.0 18.5 21.0 (17.5 ± 5.6)
Fatty infiltration	127			
No		0.46 (23)	0.53 (41)	0.50 (64)
Yes		0.38 (19)	0.21 (16)	0.28 (35)
NA		0.16 (8)	0.26 (20)	0.22 (28)
Gender	127			
Female		0.38 (19)	0.51 (39)	0.46 (58)
Male		0.62 (31)	0.49 (38)	0.54 (69)

- Fatty infitration and cross-sectional area are excluded due to high percent of missingness.

. $_a$ b $_c$ represent the lower quartile a, the median b, and the upper quartile c for continuous variables. $x \pm s$ represents $\bar{X} \pm 1$ SD. N is the number of non-missing values. Numbers after proportions are frequencies.

	N	Surgery $N = 50$	Non-operative $N = 77$	Combined $N = 127$
Infraspinatus	127			
No tear		0.58 (29)	0.58 (45)	0.58 (74)
Full/partial thickness tear		0.38 (19)	0.22 (17)	0.28 (36)
NA		0.04 (2)	0.19 (15)	0.13 (17)
Is dominant shoulder affected?	127			
No		0.22 (11)	0.23 (18)	0.23 (29)
Yes		0.74 (37)	0.71 (55)	0.72 (92)
NA		0.04 (2)	0.05 (4)	0.05 (6)
Isolated Abduction Ratio	117	0.76 0.94 1.00 (0.87 ±0.20)	0.80 0.94 1.00 (0.89 ±0.18)	0.79 0.94 1.00 (0.88 ±0.19)
Marital status	127			
Single/Divorced/Widowed		0.22 (11)	0.27 (21)	0.25 (32)
Married		0.78 (39)	0.70 (54)	0.73 (93)
NA		0.00 (0)	0.03 (2)	0.02 (2)
MHI-5	125	76 85 90 (80 ±17)	75 85 90 (80 ±15)	75 85 90 (80 ±16)
Number of comorbidities	127			
≤1		0.58 (29)	0.44 (34)	0.50 (63)
>1		0.42 (21)	0.56 (43)	0.50 (64)
Number of torn	127			
0 or 1		0.58 (29)	0.57 (44)	0.57 (73)
2 or 3		0.38 (19)	0.23 (18)	0.29 (37)
NA		0.04 (2)	0.19 (15)	0.13 (17)
Smoking status	127			
Never		0.48 (24)	0.48 (37)	0.48 (61)
Past/current		0.48 (24)	0.51 (39)	0.50 (63)
NA		0.04 (2)	0.01 (1)	0.02 (3)
Trauma	127			
No		0.46 (23)	0.55 (42)	0.51 (65)
Yes		0.54 (27)	0.38 (29)	0.44 (56)
NA		0.00 (0)	0.08 (6)	0.05 (6)
When did problem start?	122	2.2 6.0 18.0 (22.6 ±40.6)	4.0 6.0 18.0 (24.9 ±54.3)	3.2 6.0 18.0 (23.9 ±49.0)
ASES at Baseline	123	42 60 68 (57 ±18)	34 48 59 (46 ±19)	38 51 63 (50 ±19)
Cross-sectional area	100	1.82 3.23 20.86 (14.48 ±19.35)	0.00 0.72 4.40 (7.93 ±15.34)	0.00 2.21 12.03 (10.88 ±17.48)
Full tear of any tendons?	127			
No		0.10 (5)	0.36 (28)	0.26 (33)
Yes		0.86 (43)	0.44 (34)	0.61 (77)
NA		0.04 (2)	0.19 (15)	0.13 (17)
Patient expectation	127			
A great improvement		0.94 (47)	0.64 (49)	0.76 (96)
Other		0.06 (3)	0.34 (26)	0.23 (29)
NA		0.00 (0)	0.03 (2)	0.02 (2)

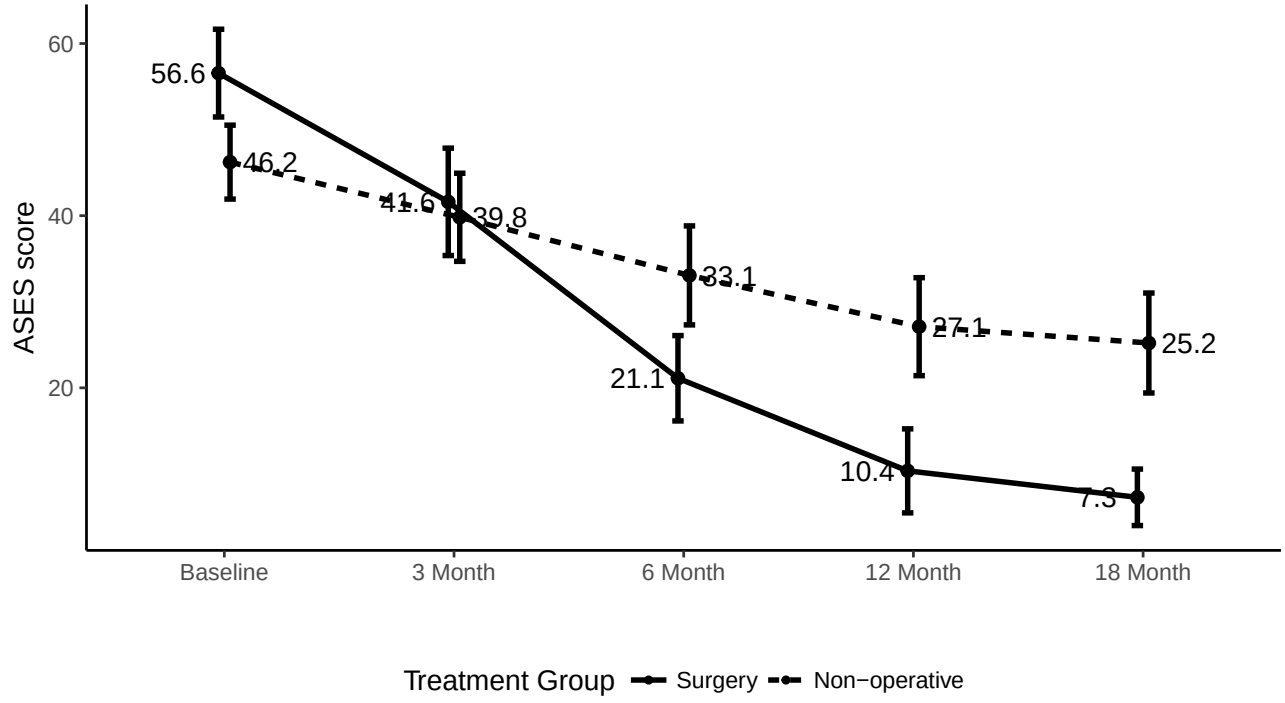
3 ASES and ASES Change by Visit

	Baseline	3 Month	6 Month	12 Month	18 Month
	$N = 127$	$N = 109$	$N = 93$	$N = 93$	$N = 82$
ASES (0-100)	37.7 51.2 63.1 (50.3 ±18.8)	28.8 37.9 55.7 (40.5 ±20.1)	12.7 26.2 41.6 (28.1 ±19.5)	2.0 15.0 32.7 (19.9 ±19.4)	2.6 11.7 24.1 (17.5 ±18.1)
ASES_30					
0	97% (123)	54% (59)	35% (33)	22% (20)	20% (16)
1	0% (0)	39% (42)	58% (54)	67% (62)	73% (60)
NA	3% (4)	7% (8)	6% (6)	12% (11)	7% (6)
ASES_50					
0	97% (123)	72% (78)	53% (49)	32% (30)	27% (22)
1	0% (0)	21% (23)	41% (38)	56% (52)	66% (54)
NA	3% (4)	7% (8)	6% (6)	12% (11)	7% (6)

$_a\ b\ _c$ represent the lower quartile a, the median b, and the upper quartile c for continuous variables. $x \pm s$ represents $\bar{X} \pm 1$ SD. Numbers after percents are frequencies.

- Baseline ASES is included in MI and calculation of propensity score.
- Baseline ASES_30 and ASES_50 are constant (all zeros) and not included in MI and PS calculation.
- ASES_30 measures the difference between ASES at follow-up visit and baseline. If the difference is greater than 30% of baseline ASES. ASES_30 is 1. If the difference is less than 30% of baseline ASES. ASES_30 is 0. If either baseline or follow-up ASES is missing, ASES_30 is missing.
- ASES_50 measures the difference between ASES at follow-up visit and baseline. If the difference is greater than 50% of baseline ASES. ASES_50 is 1. If the difference is less than 50% of baseline ASES. ASES_50 is 0. If either baseline or follow-up ASES is missing, ASES_50 is missing.

4 ASES Change Over Time by Treatment Groups (with 95% confidence interval)



tab	Surgery	Non-operative	Difference	Lower CI	Upper CI	P value
Baseline	56.562	46.223	10.340	3.389	17.333	0.003
3 Month	41.606	39.813	1.794	−7.000	9.333	0.771
6 Month	21.113	33.062	−11.949	−20.500	−3.750	0.005
12 Month	10.355	27.106	−16.751	−23.463	−8.667	0.000
18 Month	7.282	25.209	−17.927	−21.333	−7.950	0.000

5 Multiple Imputation for Baseline Values

- Missingness in our dataset is Missing At Random (MAR).
- Multiple Imputation (MI) was implemented using the "aregImpute" function in *Hmisc* R package for predictor imputation.
- MI imputes missing variables using the Predictive Mean Matching (PMM) method with weighted probability sampling of available data. All 24 predictors, including baseline ASES, were included in MI procedure. ASES at follow-up and treatment information were not included in MI.
- MI was repeated for 20 times to account for potential variability introduced by imputation. All imputed "complete" datasets were saved.

6 Model Probability of Treatment (Propensity Score)

6.1 Calculation of Propensity Score

- The propensity score is each patient's predicted probability of being assigned to surgical group, given the estimates from the logit model. Covariates that are related to both the treatment assignments and potential outcomes are included. (all 24 covariates)

$$\begin{aligned} logit(e_i) = \beta_0 + \beta_1 * age_i + \beta_2 * BicepsTendonitis_i + \beta_3 * Boileau_i + \beta_4 * DailyShoulderUseAtWork_i \\ +\beta_5 * DoYouDrinkAlcohol_i + \beta_6 * Education_i + \beta_7 * ExternalRotationRatio_i + \beta_8 * FABQ_i \\ +\beta_9 * FattyInfiltration_i + \beta_{10} * Gender_i + \beta_{11} * Infraspinatus_i + \beta_{12} * DominantAffected_i \\ +\beta_{13} * IsolatedAbductionRatio_i + \beta_{14} * MaritalStatus_i + \beta_{15} * MHI_i + \beta_{16} * Comorbidities_i \\ +\beta_{17} * NumOfTorn_i + \beta_{18} * SmokingStatus_i + \beta_{19} * Trauma_i + \beta_{20} * SymptomDuration_i \\ +\beta_{21} * BaselineASES_i + \beta_{22} * CrossArea_i + \beta_{23} * FullTear_i + \beta_{24} * Expectation_i \end{aligned}$$

- Final propensity score is the average predicted value from all imputation datasets.
- Restrict cubic splines were not applied on continuous variables.

6.2 Calculation of Matching Weights

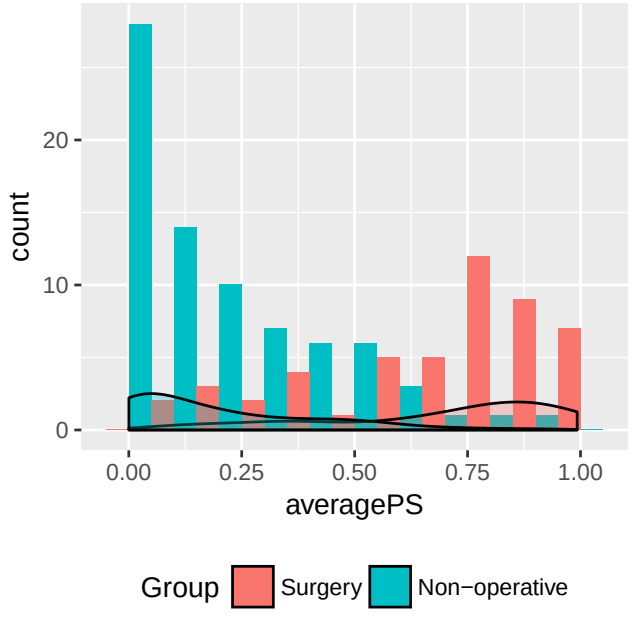
- Matched weights for treatment group:

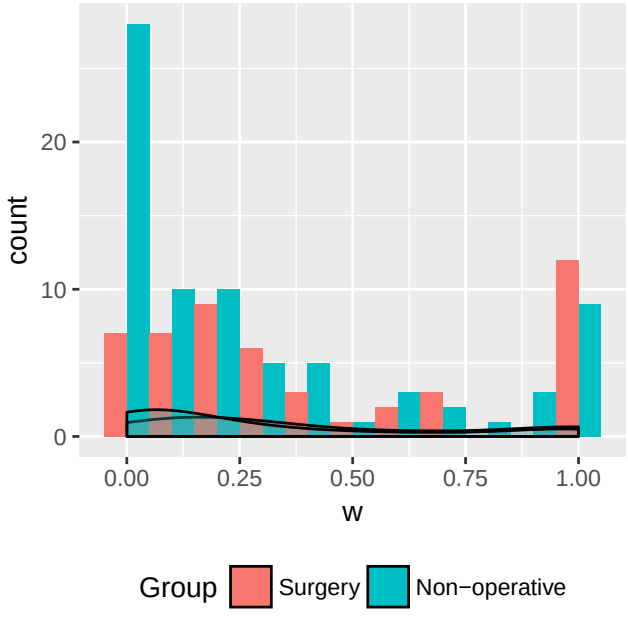
$$min\{e_i, 1 - e_i\}/e_i$$

- Matched weights for control group:

$$min\{e_i, 1 - e_i\}/(1 - e_i)$$

6.3 Plots of Estimated Propensity Score and Matching Weights by Treatment





6.4 Summary Table after Weighting

		before weighting			after weighting		
		Surgery	Non-operative	SMD	Surgery	Non-operative	SMD
Age (mean(sd))		59.89 (8.65)	62.87 (8.45)	0.534	62.40 (7.87)	59.13 (6.92)	0.044
Biceps tendonitis/tenosynovitis (%)	1	35.0 (70.0)	54.0 (70.1)	0.003	15.1 (71.1)	16.5 (72.2)	0.024
	2	15.0 (30.0)	23.0 (29.9)		6.1 (28.9)	6.4 (27.8)	
Boileau (%)	1	29.0 (60.4)	49.0 (79.0)	0.414	13.3 (67.1)	12.5 (64.1)	0.062
	2	19.0 (39.6)	13.0 (21.0)		6.6 (32.9)	7.0 (35.9)	
Daily shoulder use at work (%)	1	37.0 (75.5)	63.0 (81.8)	0.154	16.2 (78.4)	17.6 (76.9)	0.036
	2	12.0 (24.5)	14.0 (18.2)		4.5 (21.6)	5.3 (23.1)	
Do you drink alcohol? (%)	1	18.0 (37.5)	43.0 (56.6)	0.389	10.0 (48.9)	11.3 (49.7)	0.017
	2	30.0 (62.5)	33.0 (43.4)		10.5 (51.1)	11.4 (50.3)	
Education (%)	1	16.0 (33.3)	26.0 (34.2)	0.019	5.8 (28.6)	7.7 (33.8)	0.114
	2	32.0 (66.7)	50.0 (65.8)		14.6 (71.4)	15.0 (66.2)	
external rotation ratio (mean(sd))		0.52 (0.30)	0.83 (0.42)	0.768	0.65 (0.34)	0.71 (0.28)	0.172
FABQ (mean(sd))		18.89 (4.30)	16.55 (6.03)	0.495	18.08 (4.23)	17.89 (4.95)	0.023
Fatty infiltration (%)	1	23.0 (54.8)	41.0 (71.9)	0.362	9.4 (54.5)	11.1 (62.6)	0.166
	2	19.0 (45.2)	16.0 (28.1)		7.8 (45.5)	6.6 (37.4)	
Gender (%)	1	19.0 (38.0)	39.0 (50.6)	0.257	10.5 (49.7)	10.4 (45.3)	0.088
	2	31.0 (62.0)	38.0 (49.4)		10.7 (50.3)	12.5 (54.7)	
Infraspinatus (%)	1	29.0 (60.4)	45.0 (72.6)	0.260	11.3 (56.8)	11.3 (58.1)	0.025
	2	19.0 (39.6)	17.0 (27.4)		8.6 (43.2)	8.2 (41.9)	
Is dominant shoulder affected? (%)	1	11.0 (22.9)	18.0 (24.7)	0.041	5.4 (27.1)	6.2 (29.1)	0.045
	2	37.0 (77.1)	55.0 (75.3)		14.7 (72.9)	15.2 (70.9)	
Isolated abduction ratio (mean(sd))		0.86 (0.21)	0.87 (0.19)	0.110	0.88 (0.20)	0.92 (0.16)	0.031
Marital status (%)	1	11.0 (22.0)	21.0 (28.0)	0.139	5.1 (24.1)	5.2 (23.1)	0.023
	2	39.0 (78.0)	54.0 (72.0)		16.1 (75.9)	17.4 (76.9)	
MHI-5 (mean(sd))		80.24 (18.82)	81.02 (13.93)	0.013	78.95 (20.56)	84.29 (8.46)	0.051
Number of Comorbidities (%)	1	29.0 (58.0)	34.0 (44.2)	0.280	10.8 (51.0)	12.3 (53.7)	0.055
	2	21.0 (42.0)	43.0 (55.8)		10.4 (49.0)	10.6 (46.3)	
Number of torn (%)	1	29.0 (60.4)	44.0 (71.0)	0.224	11.2 (56.2)	11.3 (58.0)	0.036
	2	19.0 (39.6)	18.0 (29.0)		8.7 (43.8)	8.2 (42.0)	
Smoking Status (%)	1	24.0 (50.0)	37.0 (48.7)	0.026	9.1 (44.4)	10.4 (45.9)	0.029
	2	24.0 (50.0)	39.0 (51.3)		11.4 (55.6)	12.3 (54.1)	
Trauma (%)	1	23.0 (46.0)	42.0 (59.2)	0.266	11.1 (52.2)	9.7 (49.0)	0.064
	2	27.0 (54.0)	29.0 (40.8)		10.1 (47.8)	10.1 (51.0)	
Symptom Duration (mean(sd))		24.27 (43.52)	22.78 (42.14)	0.048	25.84 (48.47)	29.01 (53.97)	0.013
ASES at baseline (mean(sd))		58.53 (16.18)	45.82 (17.20)	0.570	54.25 (13.97)	45.86 (18.07)	0.026
Cross-sectional Area (mean(sd))		14.73 (19.29)	8.02 (16.15)	0.376	12.79 (20.99)	18.81 (23.73)	0.122
Full tear of any tendons? (%)	1	5.0 (10.4)	28.0 (45.2)	0.841	4.2 (21.0)	4.2 (21.3)	0.007
	2	43.0 (89.6)	34.0 (54.8)		15.7 (79.0)	15.4 (78.7)	
Patient Expectation (%)	1	47.0 (94.0)	49.0 (65.3)	0.762	18.5 (87.2)	19.7 (86.2)	0.030
	2	3.0 (6.0)	26.0 (34.7)		2.7 (12.8)	3.2 (13.8)	

7 Linear Mixed Effect Model with Weighted Propensity Score

7.1 Identify the Best Model of ASES Over Time

- Model 1: ases ~visit + visit^2, numeric visit, compound symmetry correlation structure. AIC for model 1 is 3565.77.
- Model 2: ases ~visit + visit^2, numeric visit, AR(1) Correlation Structure. AIC for model 2 is 3618.15.
- Model 3: ases ~visit + visit^2, numeric visit, unstructured correlation. AIC for model 3 is 3501.71.
- Model 4: ases ~visit, visit as factor variable, compound symmetry correlation structure. AIC for model 4 is 3562.6.
- Model 5: ases ~visit, visit as factor variable, AR(1) Correlation Structure. AIC for model 5 is 3611.91.
- Model 6: ases ~visit, visit as factor variable, unstructured correlation. AIC for model 6 is 3494.55.
- The model with factor visit and unstructured correlation structure (general correlation structure) yields smallest AIC.

7.2 Model Fit with Treatment and Weight

7.2.1 No interaction model

```
##                               lower  est. upper p.value
## (Intercept)                   22.39 27.71  33.0   0.000
## visit_new6 Month              -2.24  0.24   2.7   0.848
## visit_new12 Month             -9.27 -6.10  -2.9   0.000
## visit_new18 Month            -12.96 -9.71  -6.5   0.000
## operative_newNon-operative     0.72  7.34  14.0   0.031
```

7.2.2 Model with interaction

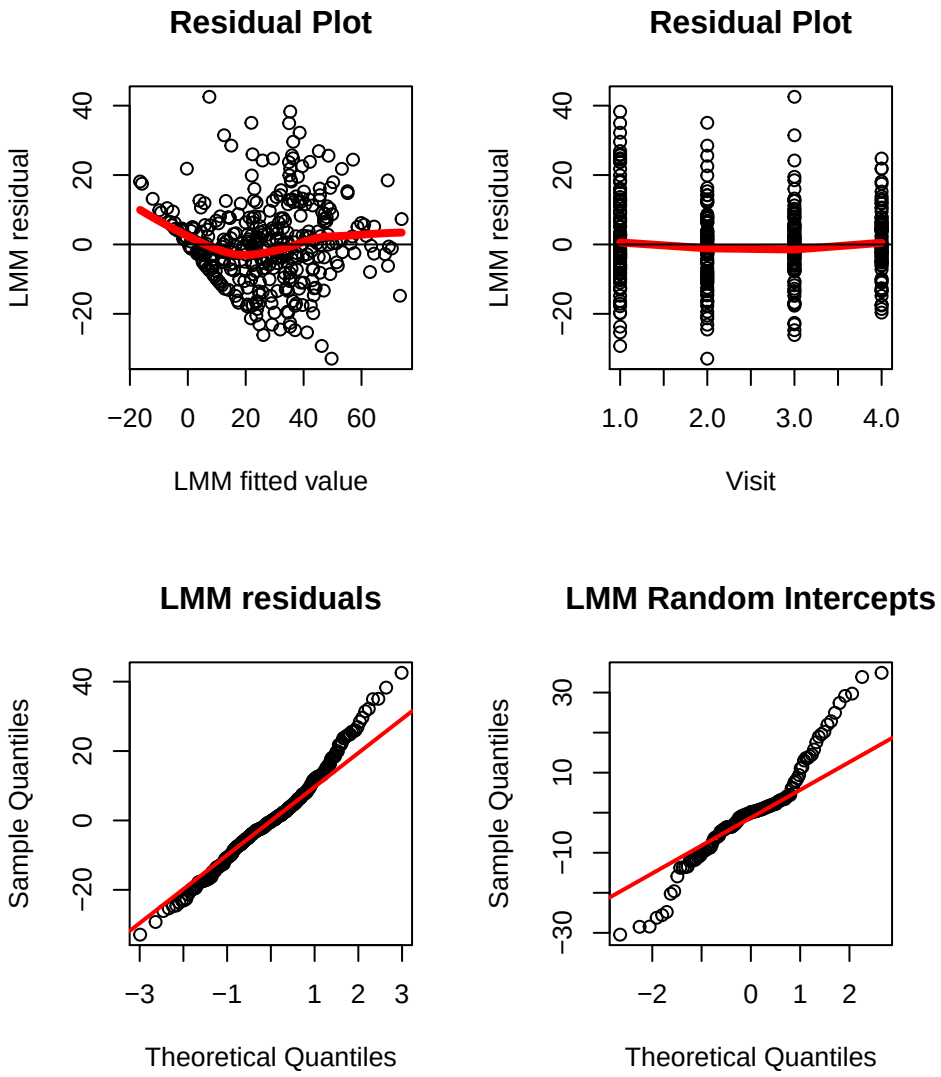
```
##                                              lower  est.  upper p.value
## (Intercept)                                     35  44.1  53.05   0.000
## visit_new6 Month                               -35 -23.4 -12.03   0.000
## visit_new12 Month                              -48 -33.7 -19.04   0.000
## visit_new18 Month                              -55 -40.3 -25.43   0.000
## operative_newNon-operative                     -20  -9.9   0.11   0.055
## visit_new6 Month:operative_newNon-operative     13  24.7  36.32   0.000
## visit_new12 Month:operative_newNon-operative    14  28.9  43.93   0.000
## visit_new18 Month:operative_newNon-operative    17  32.1  47.34   0.000
```

7.2.3 Model comparison

```
##           Model df  AIC  BIC logLik   Test L.Ratio p-value
## finalfit1     1 13 3492 3542  -1733
## finalfit2     2 16 3477 3539  -1722 1 vs 2      21   1e-04
```

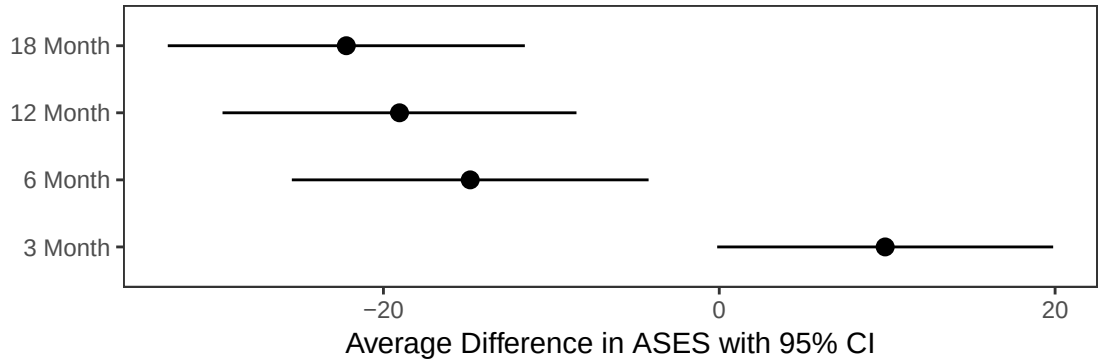
- finalfit1 is the no interaction model and finalfit2 is the interaction model.
- Model with visit and treatment interaction is the final model.

7.3 Residual Plot of Final Model



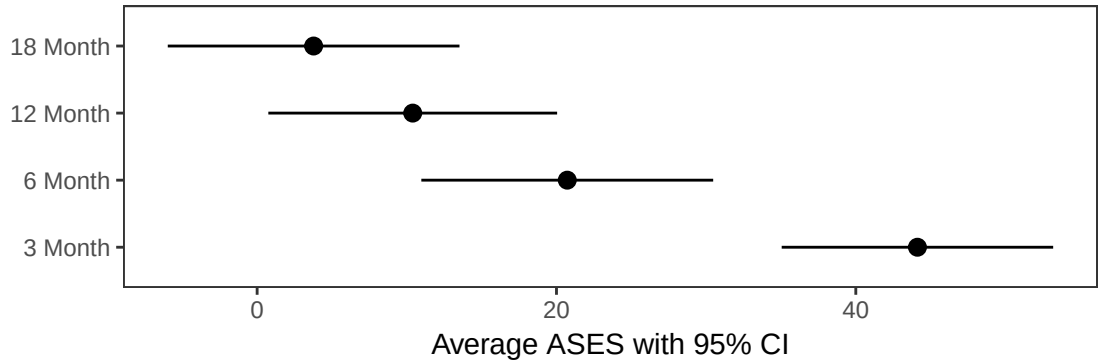
- Anderson-Darling normality test for LMM residuals is 1.04×10^{-4}.
- Anderson-Darling normality test for LMM random intercepts is 1.27×10^{-6}.

7.4 LS Means for Difference Between Operative and Non-operative Groups in Final Model



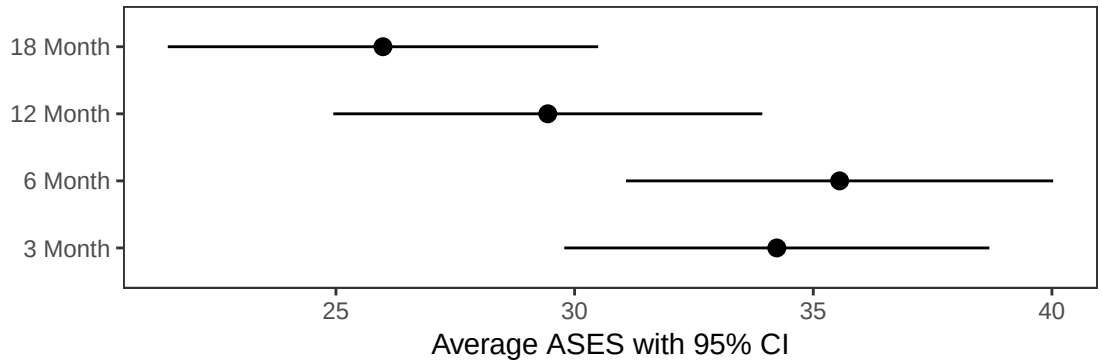
contrast	visit$_new$	estimate	SE	df	t.ratio	p.value	upper	lower
Surgery - Non-operative	3 Month	9.9	5.1	123	1.9	$5.5e-02$	19.9	−0.12
Surgery - Non-operative	6 Month	−14.8	5.4	123	−2.7	$7.1e-03$	−4.2	−25.46
Surgery - Non-operative	12 Month	−19.0	5.4	123	−3.5	$5.6e-04$	−8.5	−29.58
Surgery - Non-operative	18 Month	−22.2	5.4	123	−4.1	$7.6e-05$	−11.6	−32.84

7.5 LS Means for Operative Group in Final Model



operative$_new$	visit$_new$	lsmean	SE	df	lower.CL	upper.CL
Surgery	3 Month	44.1	4.6	124	35.05	53
Surgery	6 Month	20.7	4.9	124	10.97	30
Surgery	12 Month	10.4	4.9	124	0.75	20
Surgery	18 Month	3.8	4.9	124	−5.97	14

7.6 LS Means for Non-operative Group in Final Model



operative$_new$	visit$_new$	lsmean	SE	df	lower.CL	upper.CL
Non-operative	3 Month	34	2.2	123	30	39
Non-operative	6 Month	36	2.3	123	31	40
Non-operative	12 Month	29	2.3	123	25	34
Non-operative	18 Month	26	2.3	123	21	30

8 Linear Mixed Effect Model with Selected Variables

8.1 Selected Variables in Full Model

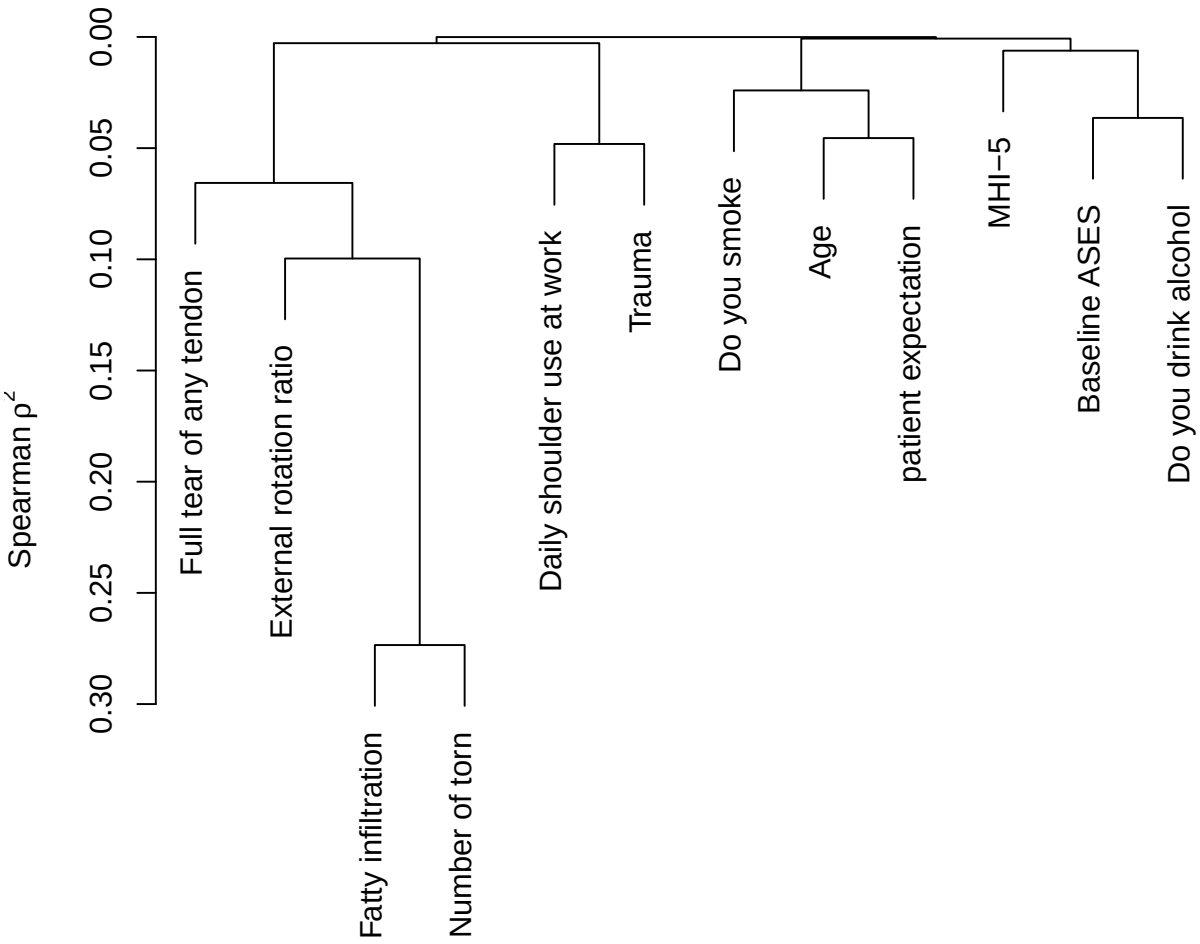
- Do you smoke
- Age
- Do you drink alcohol?
- Baseline ASES
- External rotatio ratio
- Daily shoulder use at work
- Trauma
- Fatty infiltration
- Number of torn
- MHI-5
- Patient expectation
- Full tear of any tendons?

8.2 Redundancy Analysis for Selected Variables at Baseline

```
##
## Redundancy Analysis
##
## redun(formula = ~baseases + pi_age + hx_f6_f + hx_e9_f + external.rotation.ratio +
##     fat_f + mhi + as.factor(torn_f) + hx_e8a_f + trauma_f + full_f +
##     hx_h1_f, data = dat1, r2 = 0.9, type = "adjusted", nk = 4)
##
## n: 83  p: 12  nk: 4
##
## Number of NAs:  44
## Frequencies of Missing Values Due to Each Variable
##                baseases                  pi_age                hx_f6_f
##                       4                       0                       1
##                hx_e9_f external.rotation.ratio                  fat_f
##                       3                       8                      28
##                    mhi       as.factor(torn_f)               hx_e8a_f
##                       2                      17                       3
##                trauma_f                  full_f                hx_h1_f
##                       6                      17                       2
##
##
## Transformation of target variables forced to be linear
##
## R-squared cutoff: 0.9  Type: adjusted
##
## R^2 with which each variable can be predicted from all other variables:
##
##                baseases                  pi_age                hx_f6_f
##                   0.058                   0.154                   0.002
##                hx_e9_f external.rotation.ratio                  fat_f
##                   0.000                   0.085                   0.424
##                    mhi       as.factor(torn_f)               hx_e8a_f
##                   0.100                   0.256                   0.017
##                trauma_f                  full_f                hx_h1_f
##                   0.042                   0.119                   0.012
##
## No redundant variables
```

- The predictor that can be predicted from the remaining set with the adjusted R^2 higher than 0.9 is removed.
- There is no redundant variable.

8.3 Cluster Analysis for Selected Variables at Baseline

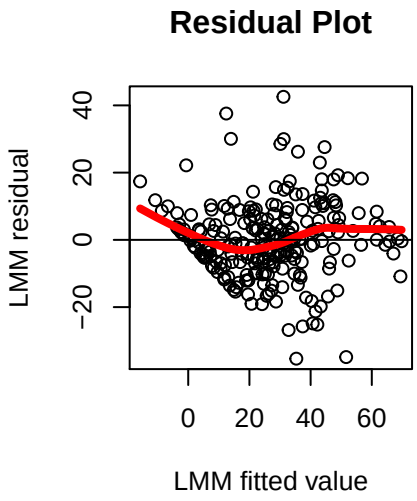


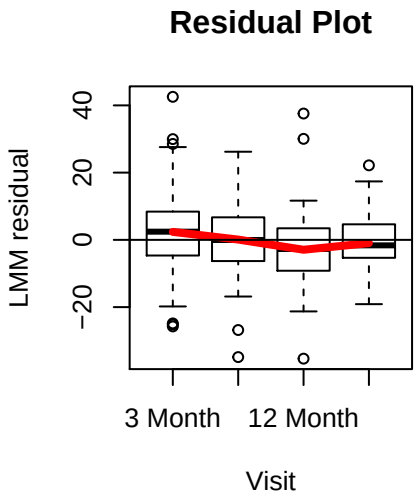
8.4 Model Fitting

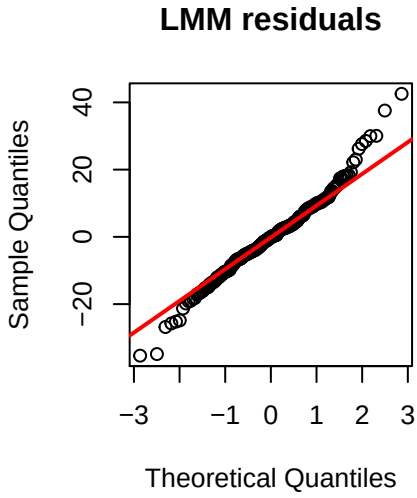
```
##                                                lower    est.  upper p.value
## (Intercept)                                   -26.32   8.978  44.28   0.631
## visit_new6 Month                              -31.19 -21.028 -10.87   0.000
## visit_new12 Month                             -42.65 -28.251 -13.86   0.000
## visit_new18 Month                             -49.47 -35.342 -21.21   0.000
## operative_newNon-operative                    -23.54 -11.457   0.62   0.074
## baseases                                        0.14   0.325   0.51   0.001
## pi_age                                         -0.23   0.158   0.55   0.444
## hx_f6_fHeavy/Moderate manual labor             -2.69   5.411  13.51   0.206
## hx_e9_f1-2 times per week or more             -12.69  -5.494   1.70   0.149
## external.rotation.ratio                        -4.08   3.642  11.36   0.371
## fat_fYes                                        3.15  11.001  18.85   0.009
## mhi                                            -0.18   0.079   0.34   0.563
## torn_f2 or 3                                   -6.93   0.669   8.27   0.867
## hx_e8a_fPast/current                           -9.95  -3.456   3.04   0.313
## trauma_fYes                                    -5.74   0.580   6.90   0.861
## hx_h1_fOther                                   -3.04   6.337  15.71   0.201
## full_fYes                                     -12.96  -4.313   4.33   0.344
## visit_new6 Month:operative_newNon-operative    13.22  23.696  34.17   0.000
## visit_new12 Month:operative_newNon-operative   11.96  26.849  41.73   0.001
## visit_new18 Month:operative_newNon-operative   16.24  30.840  45.44   0.000
```

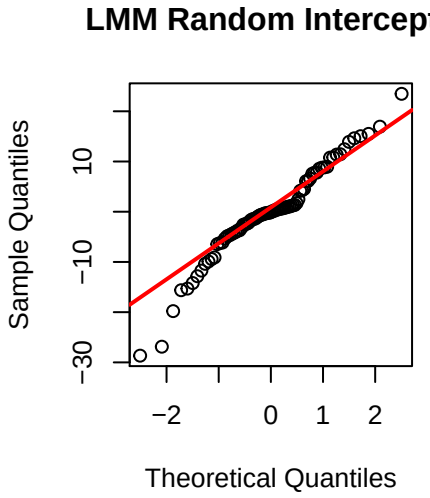
- The AIC for model with compound symmetric correlation structure is 2340.
- The AIC for model with auto-regressive correlation structure is 2353.25.
- The AIC for model with general (unstructured) correlation structure is 2254.53.
- Model with general correlation structure is the final model.
- Number of Observations: 239
- Number of Groups: 82

8.5 Residual Plot of Final Model









- Anderson-Darling normality test for LMM residuals is 0.01.
- Anderson-Darling normality test for LMM random intercepts is 0.

9 Comparison of ASES30 by Treatment

- If ASES_30 of any follow-up visit is 1, ASES_30_comb is 1.
- If ASES_30 of all follow-up visits are 0, ASES_30_comb is 0.
- If ASES_30 is missing for all follow-up visits, ASES_30_comb is missing.

. N is the number of non-missing values. Numbers after proportions are frequencies.

	N	Surgery $N = 50$	Non-operative $N = 77$	Combined $N = 127$
ases_30_comb	127			
0		0.10 (5)	0.35 (27)	0.25 (32)
1		0.88 (44)	0.61 (47)	0.72 (91)
NA		0.02 (1)	0.04 (3)	0.03 (4)

```
##                Surgery Non-operative
## ASES_30_comb=0       5            27
## ASES_30_comb=1      44            47
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  m
## X-squared = 9, df = 1, p-value = 0.002
```

10 Comparison of ASES50 by Treatment

- If ASES_50 of any follow-up visit is 1, ASES_50_comb is 1.
- If ASES_50 of all follow-up visits are 0, ASES_50_comb is 0.
- If ASES_50 is missing for all follow-up visits, ASES_50_comb is missing.

. N is the number of non-missing values. Numbers after proportions are frequencies.

	N	Surgery $N = 50$	Non-operative $N = 77$	Combined $N = 127$
ases_50_comb	127			
0		0.14 (7)	0.51 (39)	0.36 (46)
1		0.84 (42)	0.45 (35)	0.61 (77)
NA		0.02 (1)	0.04 (3)	0.03 (4)

```
##                Surgery Non-operative
## ASES_50_comb=0       7            39
## ASES_50_comb=1      42            35
##
##  Pearson's Chi-squared test with Yates' continuity correction
##
## data:  m
## X-squared = 20, df = 1, p-value = 4e-05
```