

Heart Rate Data

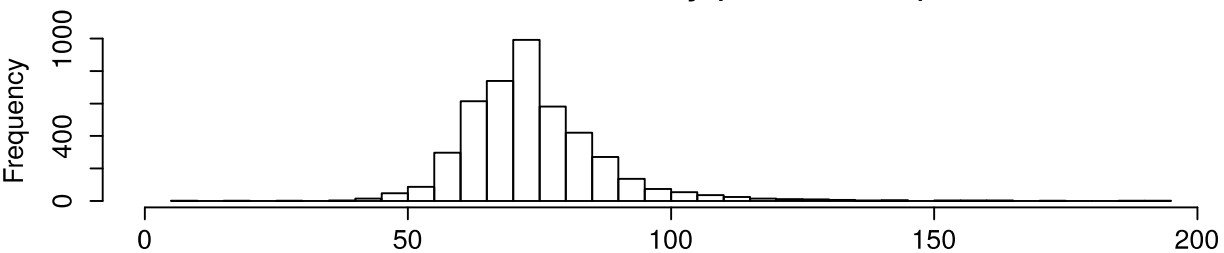
Health Kit

- Apple Watch heart rate for 1538 subjects
 - Apple Watch samples once every ~10 minutes when subject is inactive
 - Samples once every minute when subject is active
- Heart rate (from any device) for 4577 subjects
 - combined from “health_kit” & “cardiovascular displacement” tables

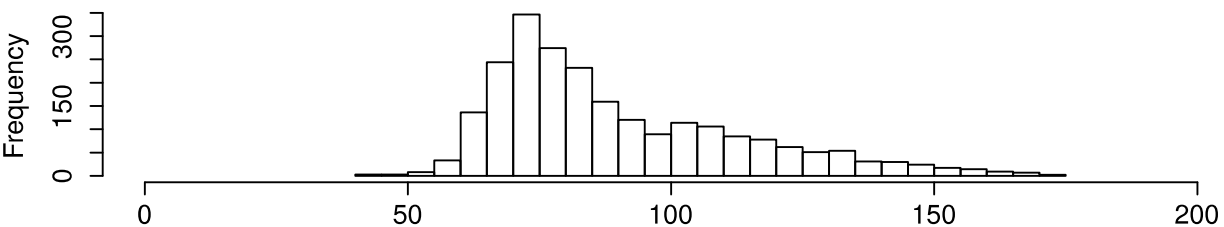
6-Minute Walk

- 6-minute-walk walking HR for 155 subjects
 - Of these, 118 have known age (for maximum heart rate estimate)
 - 108 subjects with both walking and recovery (rest) data

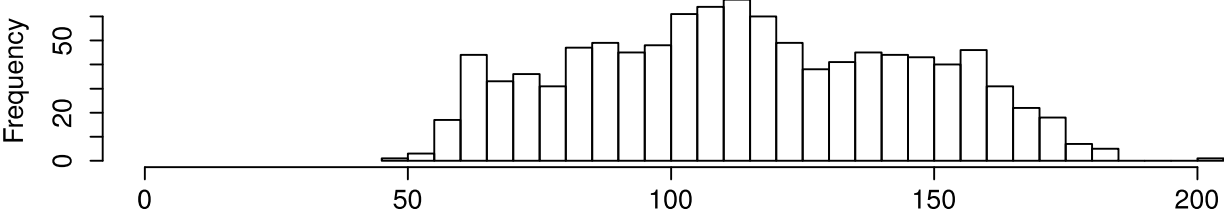
First HR of the Day (Before Noon)



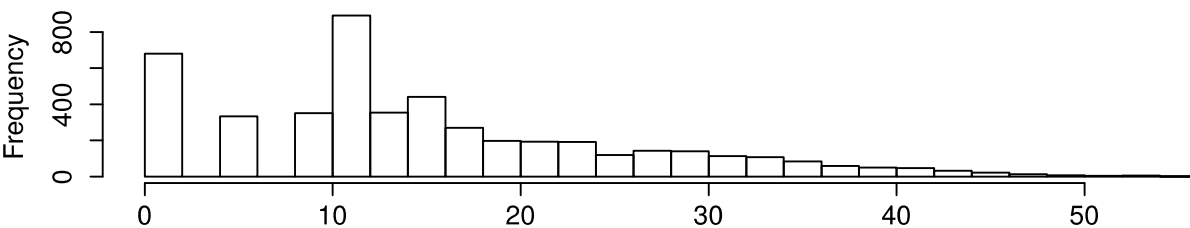
Mean Walking HR



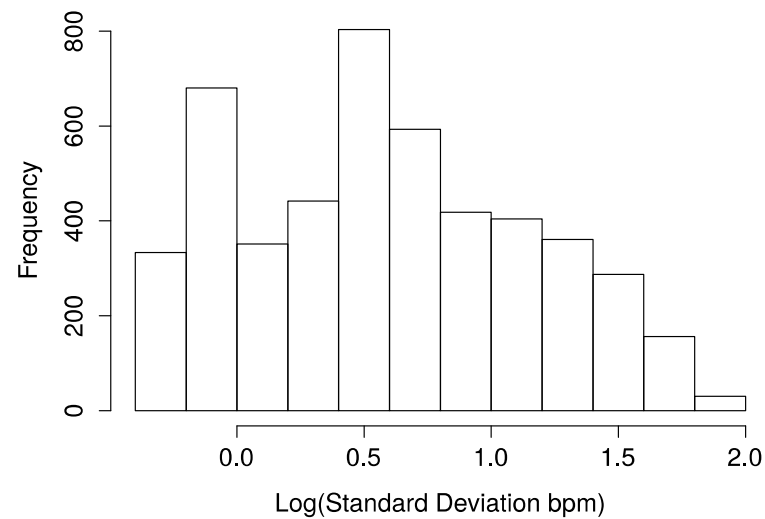
Mean Running HR



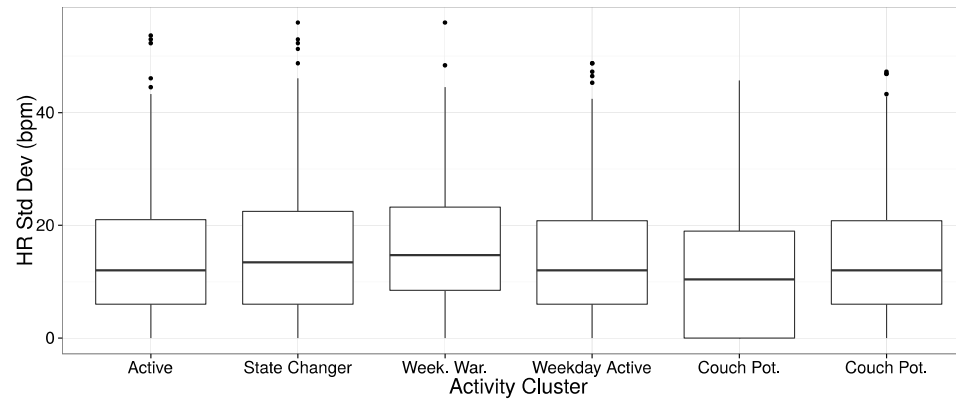
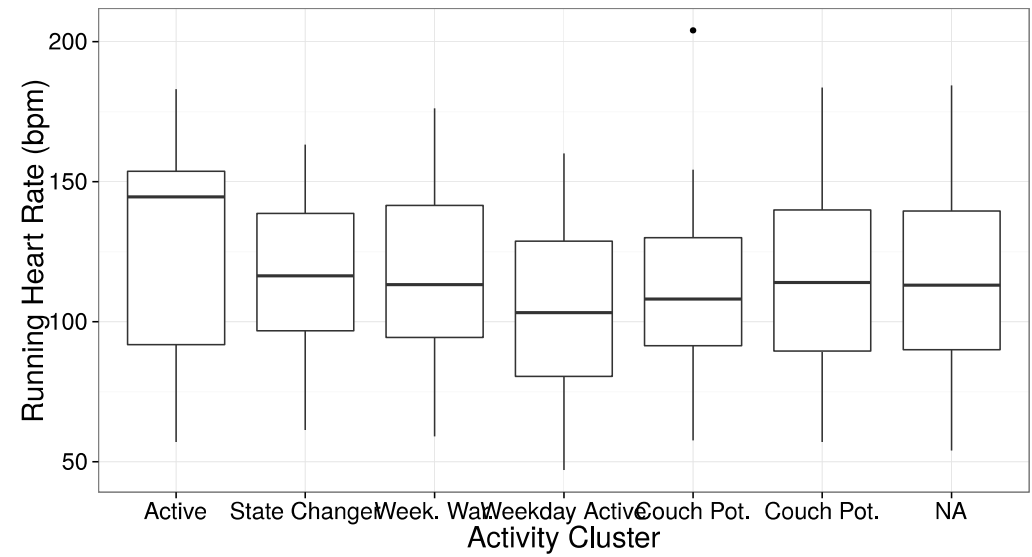
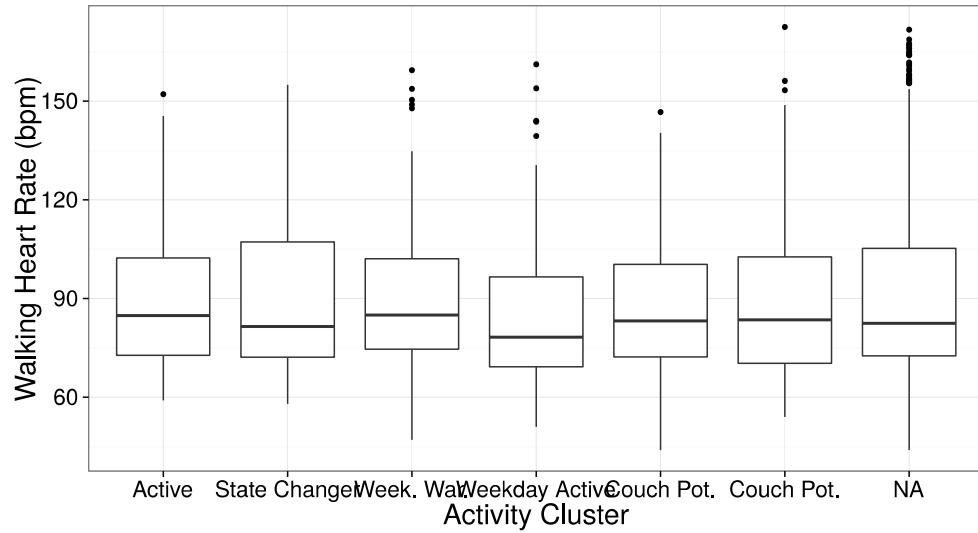
HR Standard Dev (bpm)



Log(HR Standard Dev)

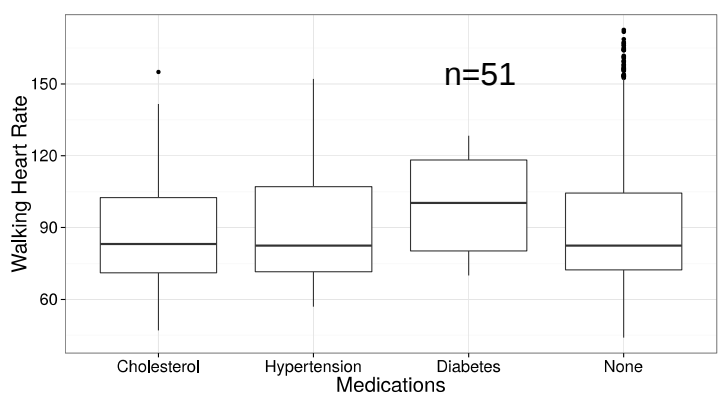


No significant relationship between HR and amount of time spent stationary

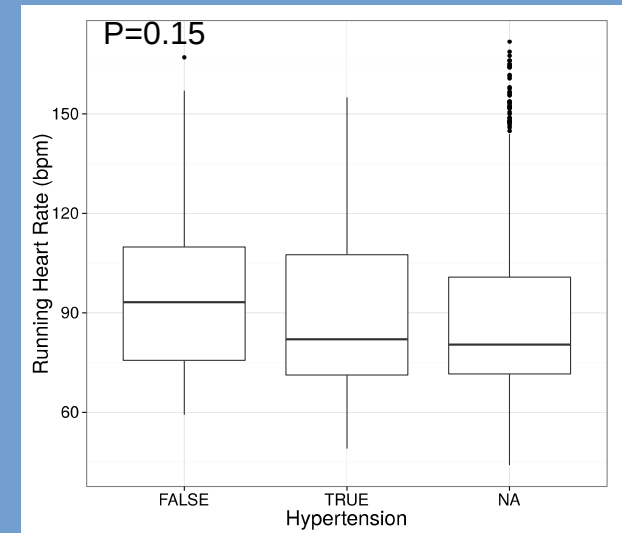
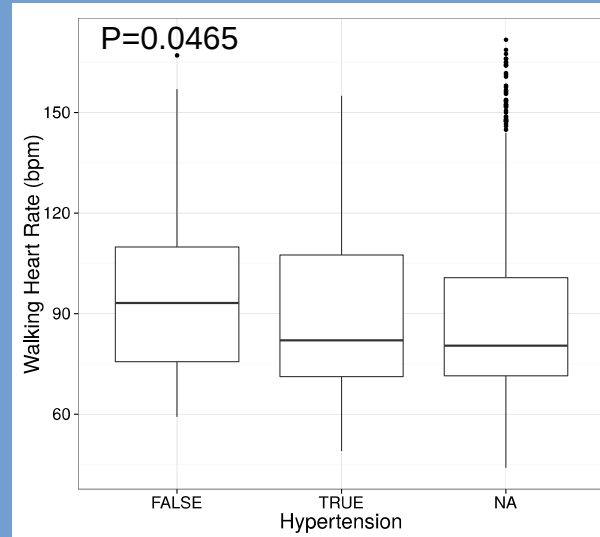


Walking Heart Rate vs. Hypertension: Medication Plays a Huge Role

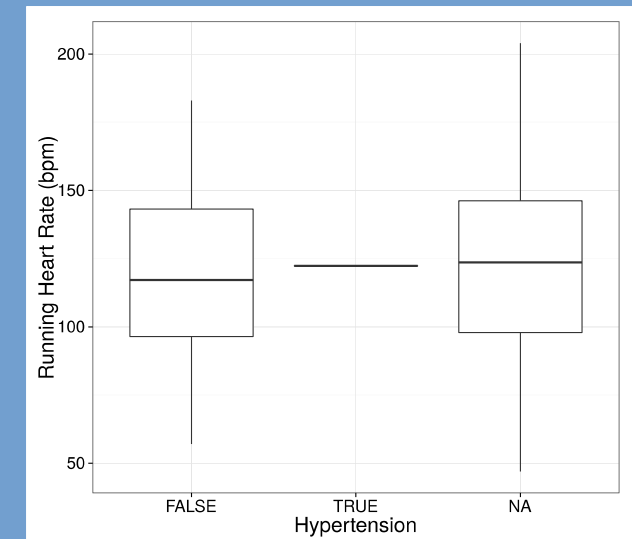
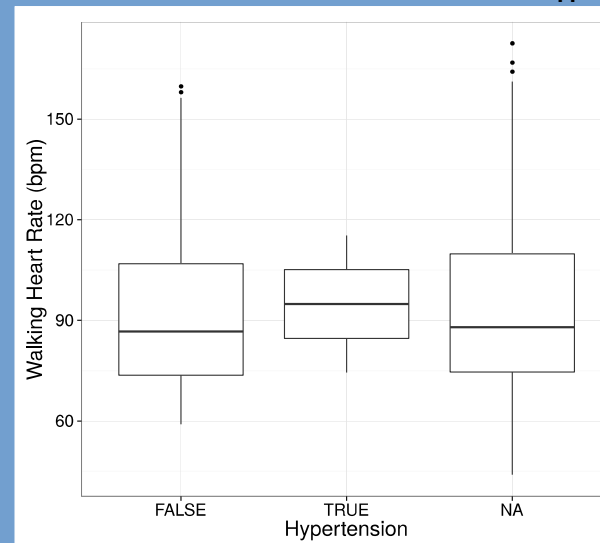
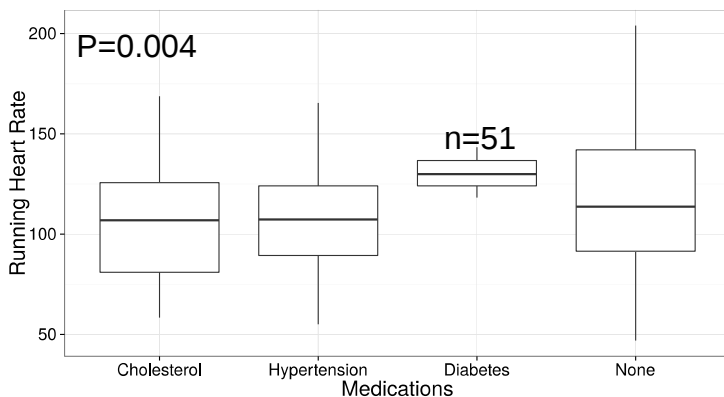
Use of Medication vs. Exercise Heart Rate



Subjects on Medication (n=2133)

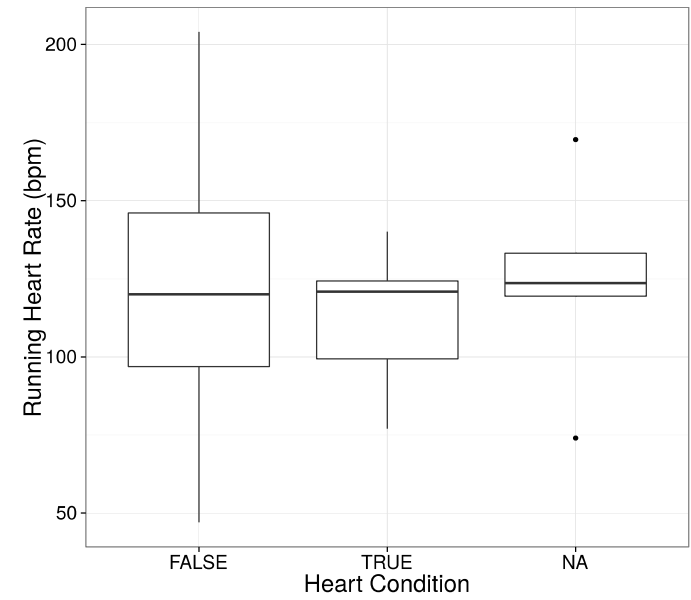
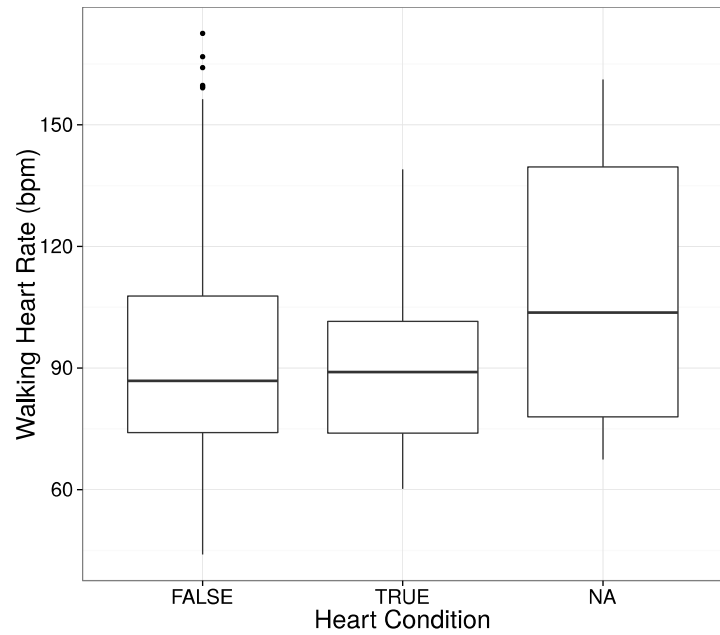


Subjects NOT on Medication (P-values not significant) n=1073

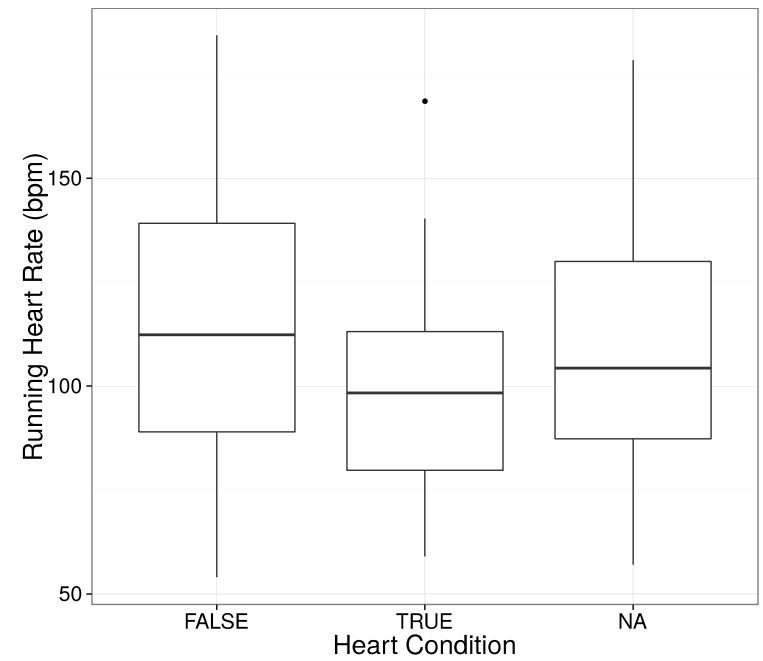
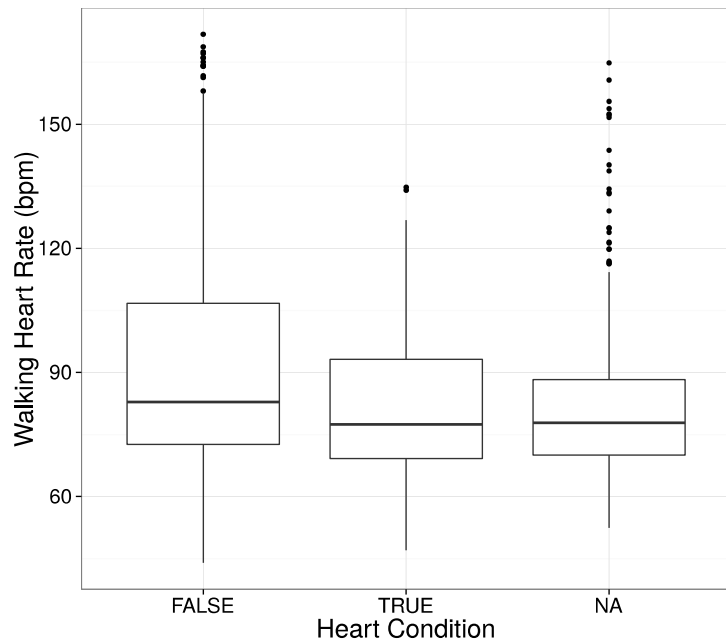


Heart Condition (P-value =0.008 run, 0.002 walk)

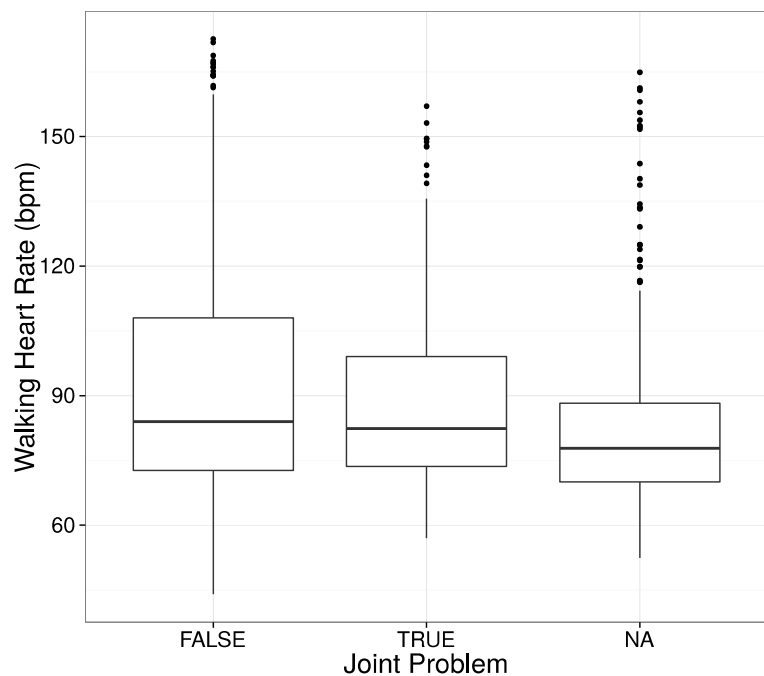
No Medication



Medicated



Walking and Running Heart Rate vs. Joint Problems (Logistic regression model)

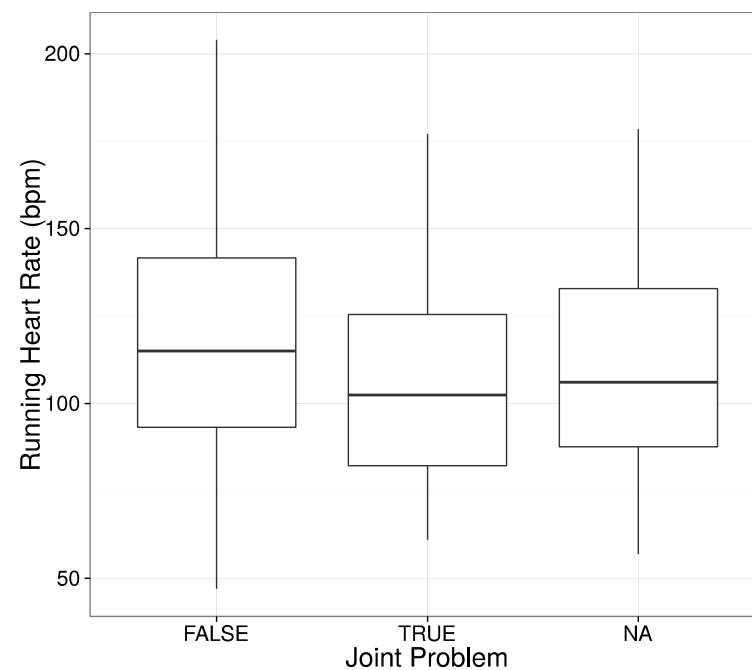


Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.6543	-0.5998	-0.5710	-0.5153	2.1277

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.1519	0.2530	-4.553	5.28e-06 ***
walk	-0.3829	0.1659	-2.308	0.021 *



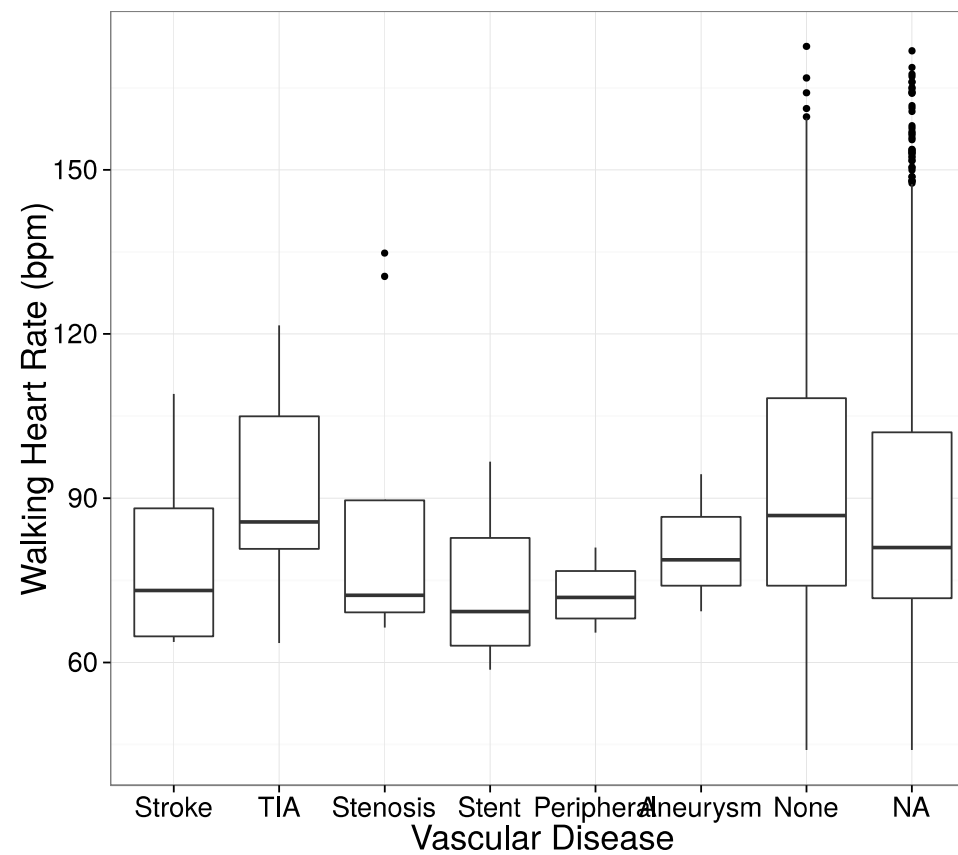
Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.7152	-0.5709	-0.5095	-0.4366	2.2833

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-0.7645	0.3535	-2.163	0.03056 *
run	-0.5982	0.1891	-3.163	0.00156 **

Walking Heart Rate vs. Vascular Disease



Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.81062	-0.31062	-0.09963	0.24815	1.33230

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	1.20957	0.10984	11.012	< 2e-16 ***
vascular	0.04777	0.01602	2.981	0.00296 **

Total Cholesterol

Deviance Residuals:

Min	1Q	Median	3Q	Max
-167.824	-29.875	-4.211	23.521	225.934

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	153.82843	8.96546	17.158	<2e-16 ***
run	0.18913	0.07717	2.451	0.0148 *

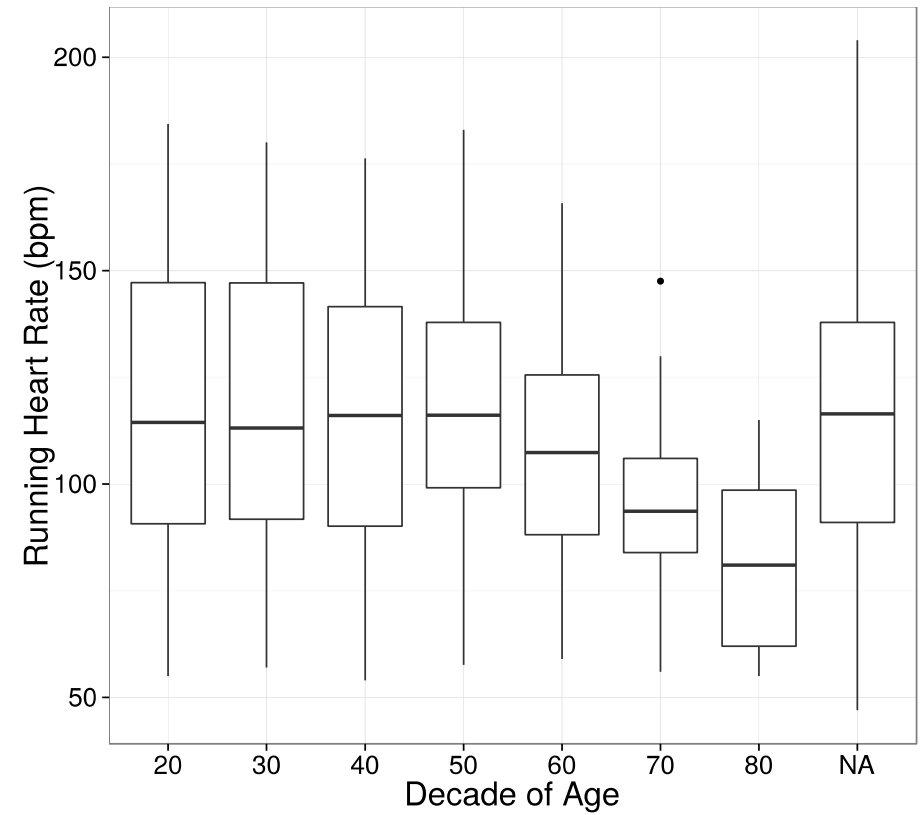
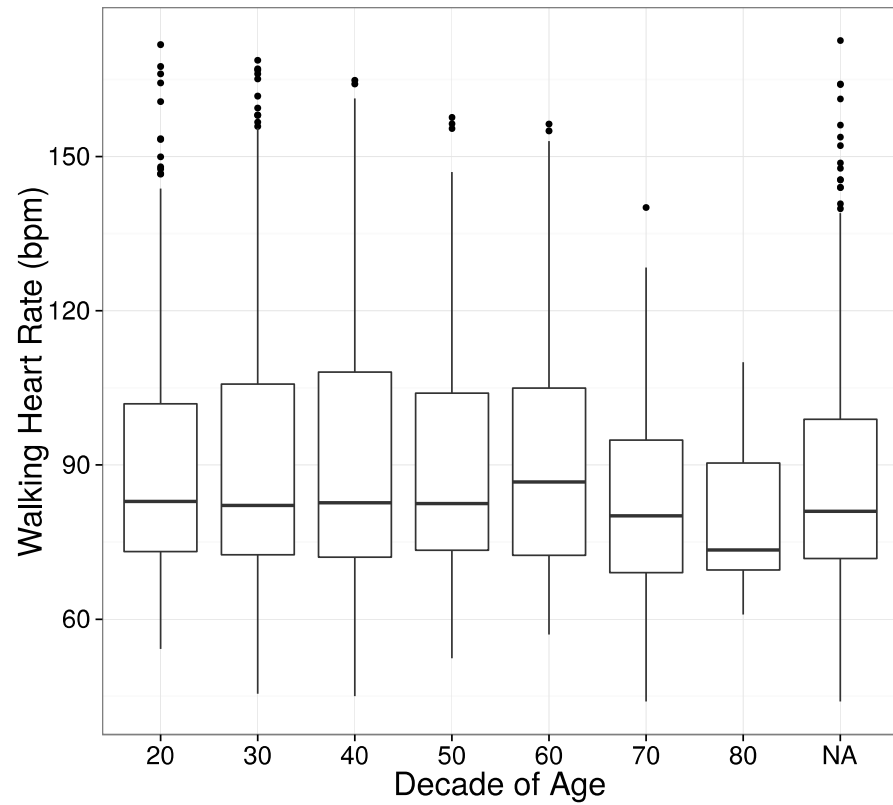
Deviance Residuals:

Min	1Q	Median	3Q	Max
-174.855	-33.070	-3.624	25.313	223.284

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	166.10797	7.22202	23.000	<2e-16 ***
walk	0.11378	0.07571	1.503	0.133

Age vs Heart Rate (p=0.01 walking, 1.67e-7 running)



6 Minute Walk HR

heartAgeDataBloodGlucose ~ Max_hr + Min_hr +
 Var_hr + Speed + Steady_state_hr + Recovery_hr

Deviance Residuals:

Min	1Q	Median	3Q	Max
-70.266	-42.327	7.758	41.597	80.675

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	36.488118	37.929186	0.962	0.3395
Max_hr	-0.697751	0.799099	-0.873	0.3857
Min_hr	-0.930895	0.400279	-2.326	0.0231 *
Var_hr	0.003749	0.047873	0.078	0.9378
Speed	2.685550	1.550364	1.732	0.0878 .
Steady_state_hr	1.582770	0.965266	1.640	0.1058
Recovery_hr	-0.109942	0.378649	-0.290	0.7724

heartAgeDataHdl ~ Max_hr + Min_hr + Var_hr +
 speed + Steady_state_hr + Steady_state_hr, data = full

Deviance Residuals:

Min	1Q	Median	3Q	Max
-59.566	-17.695	-3.039	17.223	191.308

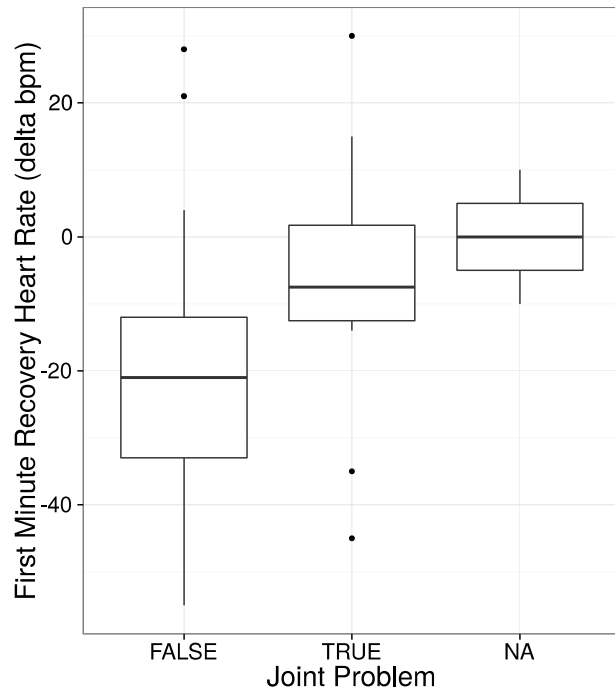
Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-1.02235	29.46138	-0.035	0.97242
Max_hr	3.13720	0.62070	5.054	3.57e-06 ***
Min_hr	0.85242	0.31092	2.742	0.00783 **
Var_hr	-0.06021	0.03719	-1.619	0.11009
Speed	-2.28087	1.20424	-1.894	0.06254 .
Steady_state_hr	-3.49688	0.74977	-4.664	1.53e-05 ***
Recovery_hr	0.20564	0.29411	0.699	0.48687

First Minute Recovery Heart Rate vs. Joint Problems (Logistic regression model)

```
jointProblem ~ Recovery_hr
Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.3038  -0.5035  -0.3782  -0.2823   2.7272

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  -1.23682    0.38402  -3.221   0.00128 **
Recovery_hr    0.05461    0.01975   2.764   0.00570 **
```



6-Minute Walk Max HR vs. Joint Problems (Logistic regression model)

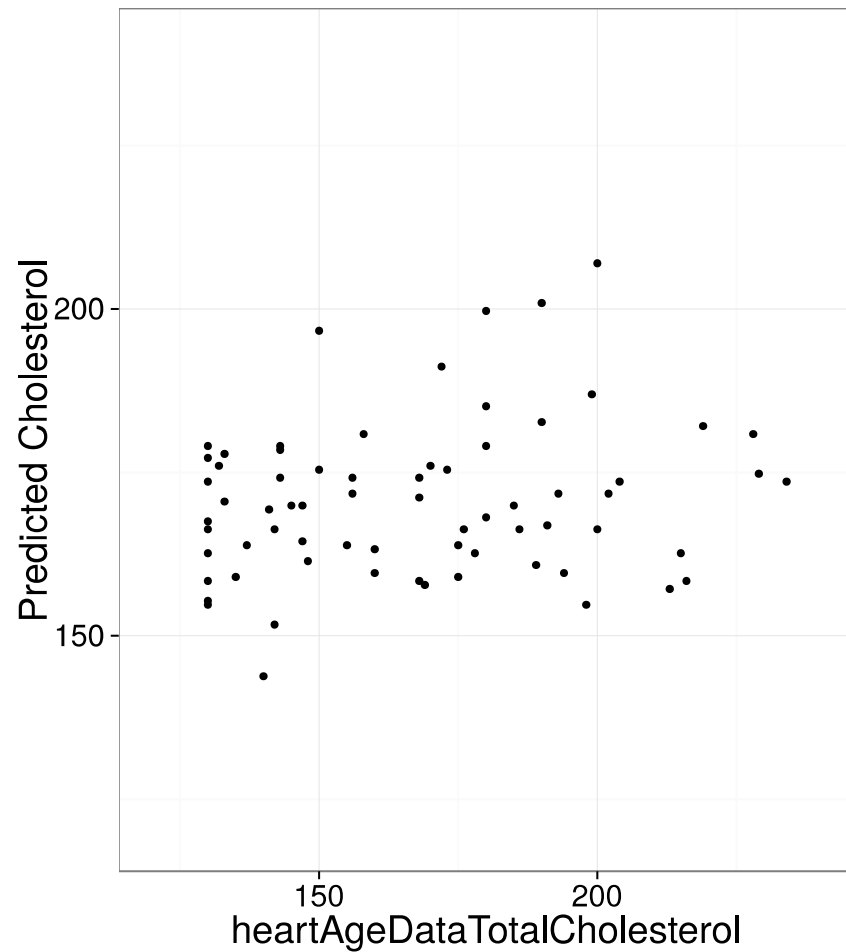
```
glm(formula = full$heartAgeDataTotalCholesterol ~ full$Max.x,  
     data = full)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-49.053	-25.250	-5.572	20.856	73.554

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	95.1946	23.4368	4.062	0.000123	***
full\$Max.x	0.6077	0.1838	3.307	0.001475	**



6-Minute Walk Recovery HR vs. Heart Disease (Logistic regression model) **very small sample sizes for disease cases**

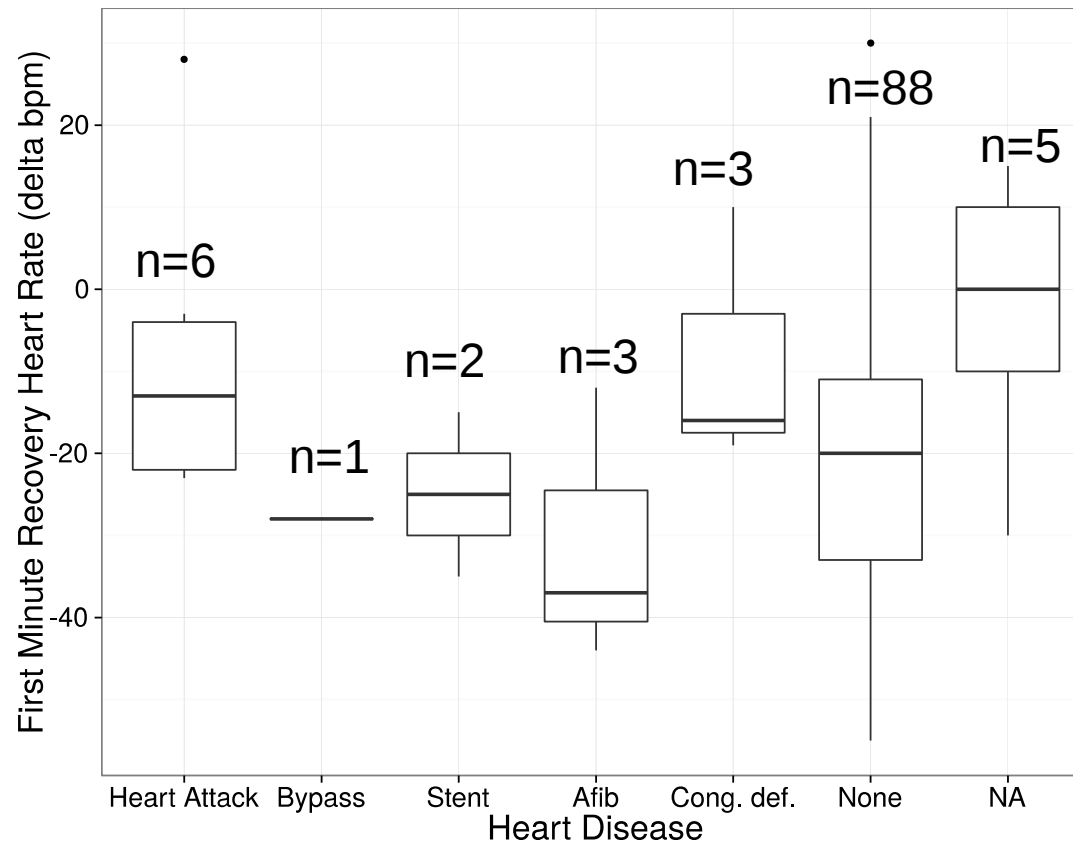
heart_disease ~ Recovery_hr

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.5305	0.2214	0.3017	0.3700	0.9026

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	2.08714	0.49075	4.253	2.11e-05	***
full\$delta1.y	-0.04666	0.02441	-1.911	0.056	.



6-Minute Walk Recovery HR vs. Heart Condition (Logistic regression model)

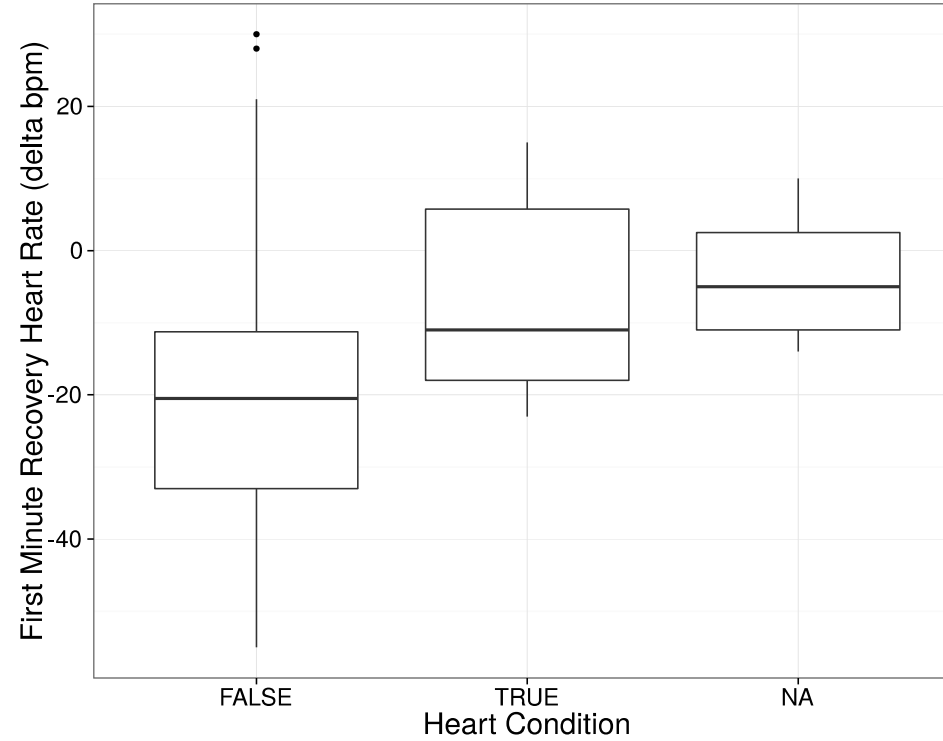
heartCondition ~ Recovery_hr

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.9203	-0.3633	-0.2832	-0.2137	2.5533

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)	
(Intercept)	-2.10063	0.47755	-4.399	1.09e-05	***
Recovery_hr	0.04869	0.02400	2.029	0.0425	*



Min/Max HR values vs. Life Satisfaction (Logistic regression model)

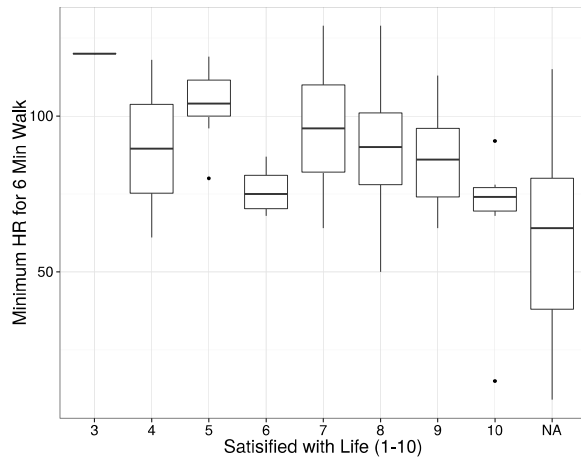
Satisfied with life ~ Min hr

Deviance Residuals:

Min	1Q	Median	3Q	Max
-4.3417	-0.5732	0.2366	0.8958	2.2985

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	9.60141	0.63313	15.165	< 2e-16 ***
Min_hr	-0.02065	0.00690	-2.993	0.00347 **



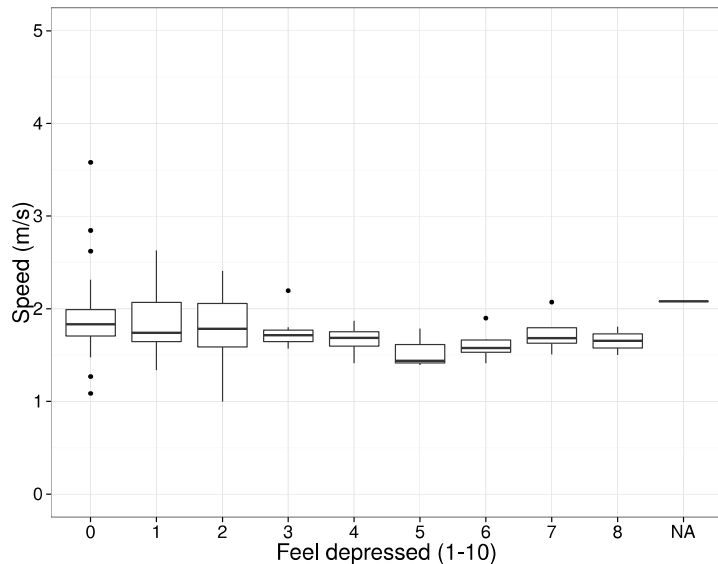
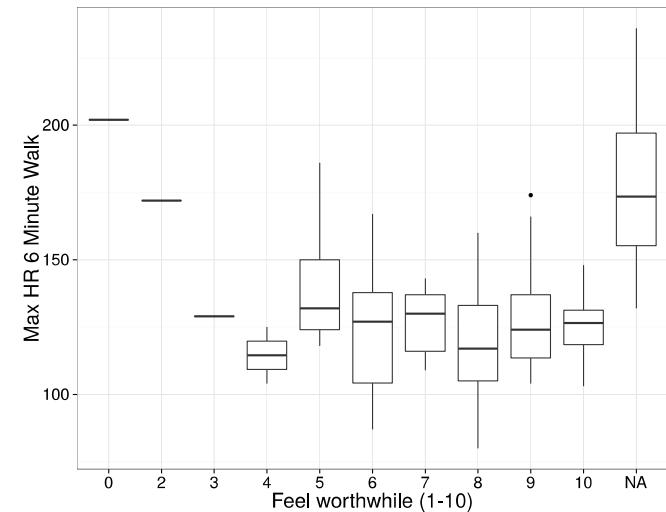
Feel worthwhile ~ Max hr

Deviance Residuals:

Min	1Q	Median	3Q	Max
-6.1412	-0.5170	0.0734	0.9494	2.7246

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	10.384183	0.957490	10.845	< 2e-16 ***
Max_hr	-0.021005	0.007503	-2.799	0.00612 **



Feel depressed ~ Max hr + Min hr + Var_hr + speed + Steady state hr + Recovery hr

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.9898	-1.2861	-0.5460	0.4998	6.8974

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.414038	1.396702	0.296	0.767528
Max_hr	-0.038725	0.027377	-1.415	0.160415
Min_hr	0.030168	0.016326	1.848	0.067672 .
Var_hr	0.003157	0.001631	1.935	0.055882 .
Speed	-0.268146	0.070465	-3.805	0.000248 ***
Steady_state_hr	0.036459	0.033808	1.078	0.283534
Recovery_hr	0.018848	0.013539	1.392	0.167074

HR Variance vs. Health Outcomes

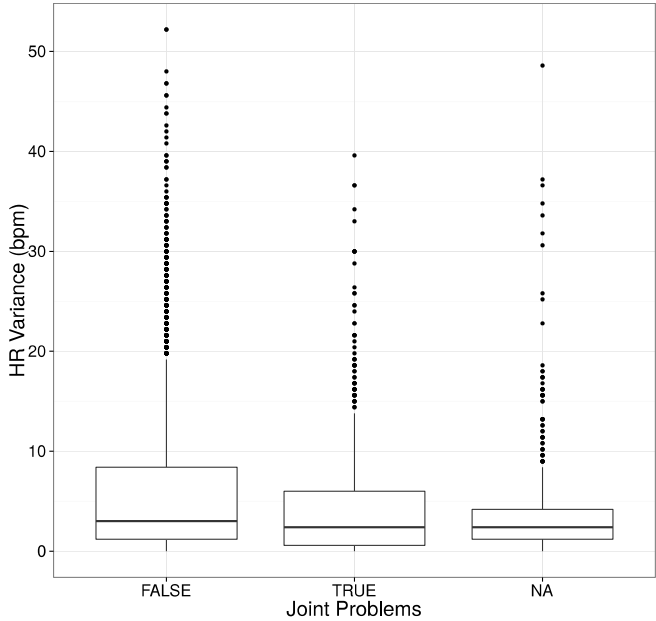
JoinProblem ~Variance

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.6483	-0.6294	-0.6050	-0.4894	2.4259

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	-1.453141	0.052655	-27.597	< 2e-16 ***
Variance	-0.036239	0.006718	-5.394	6.88e-08 ***



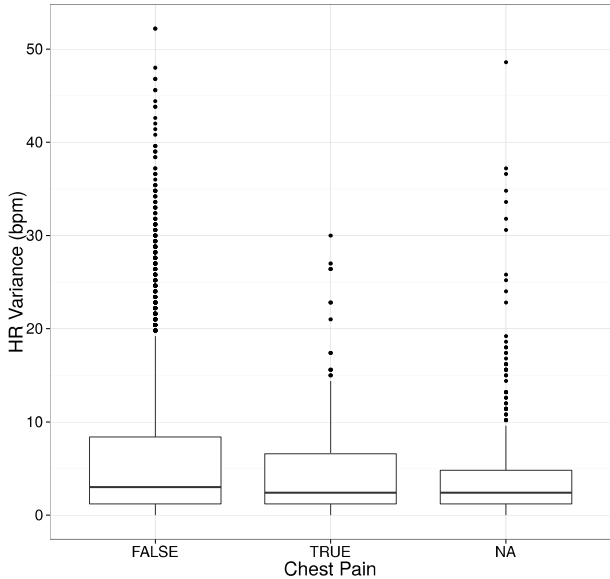
ChestPain ~Variance

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.04899	-0.04797	-0.04643	-0.04079	0.97663

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.048993	0.003979	12.312	<2e-16 ***
Variance	-0.051243	0.024628	-2.081	0.0375 *



vascular disease~ firstValue

Deviance Residuals:

Min	1Q	Median	3Q	Max
-5.9054	0.2130	0.2591	0.2953	0.6176

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	6.339688	0.107180	59.150	< 2e-16	***
firstValue	0.005481	0.001430	3.833	0.00013	***

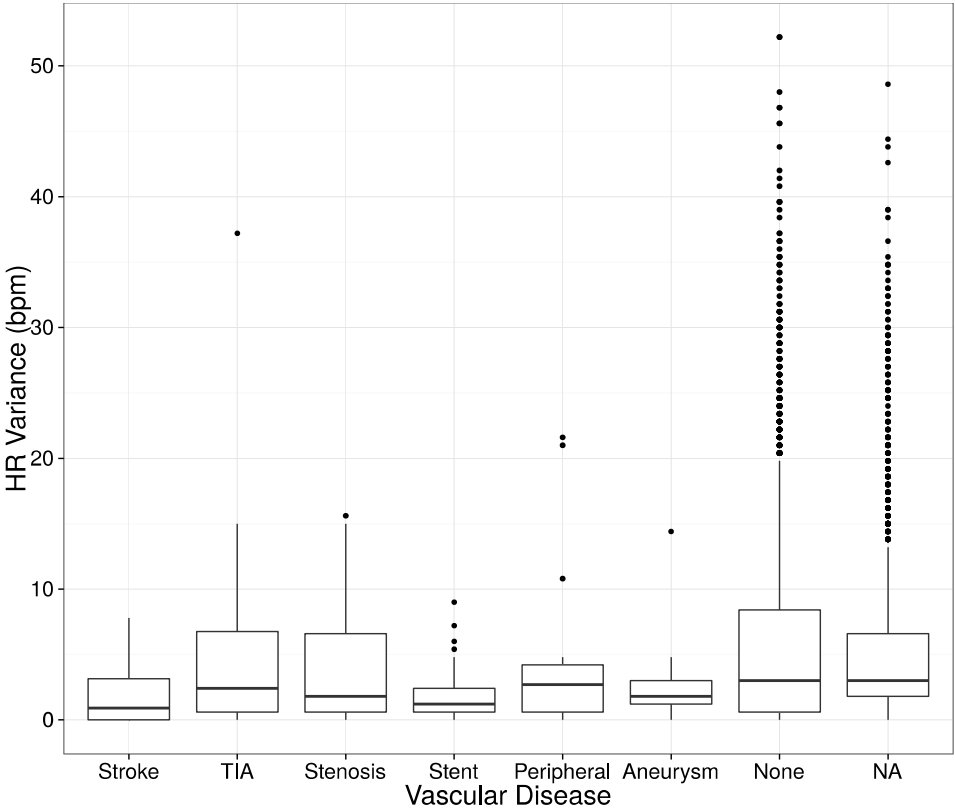
vascular disease ~variance

Deviance Residuals:

Min	1Q	Median	3Q	Max
-5.7627	0.2025	0.2861	0.3139	0.3279

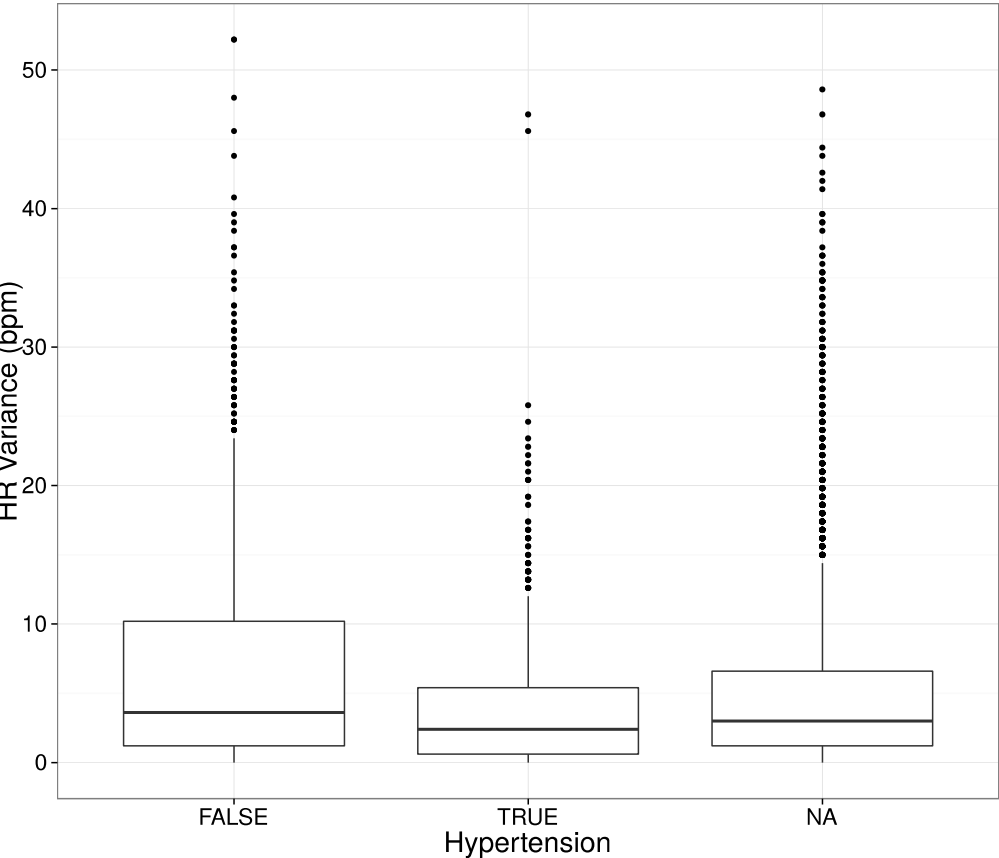
Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	6.672118	0.024293	274.653	< 2e-16	***
Variance	0.011613	0.002493	4.658	3.34e-06	***



heartAgeDataHypertension ~ variance

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-0.3281	-0.3054	-0.2543	0.6719	1.1147
Coefficients:				
	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.328111	0.012938	25.360	< 2e-16 ***
Variance	-0.009462	0.001344	-7.042	2.63e-12 ***



heartAgeDataHypertension ~ firstValue

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-0.4282	-0.2801	-0.2581	0.6906	0.9207
Coefficients:				
	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.4472133	0.0594803	7.519	8.7e-14 ***
firstValue	-0.0024431	0.0008019	-3.047	0.00235 **

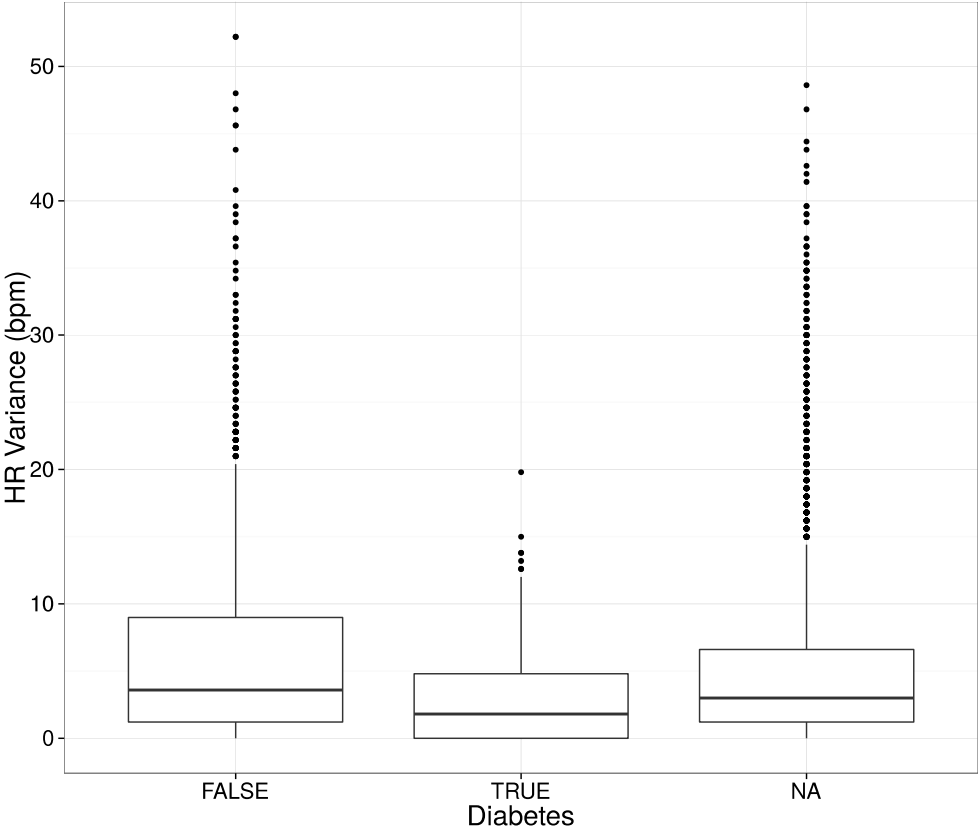
HeartAgeDataDiabetes ~variance

Deviance Residuals:

Min	1Q	Median	3Q	Max
-0.05843	-0.05584	-0.05065	-0.03638	0.98437

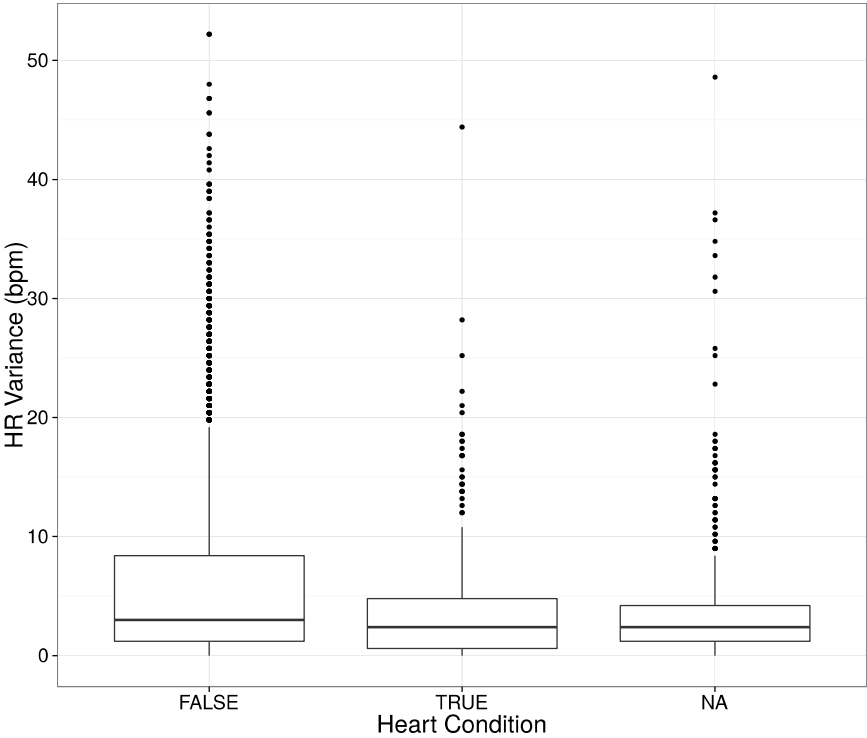
Coefficients:

	Estimate	Std. Error	t value	Pr(> t)	
(Intercept)	0.0584290	0.0061168	9.552	< 2e-16	***
Variance	-0.0021616	0.0006349	-3.405	0.000676	***



HeartCondition ~variance

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-0.07258	-0.07009	-0.06509	-0.05136	1.01980
Coefficients:				
	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.0725819	0.0046095	15.746	< 2e-16 ***
Variance	-0.0020807	0.0004749	-4.382	1.21e-05 ***



heart_disease ~variance

Deviance Residuals:				
Min	1Q	Median	3Q	Max
-3.1237	0.1651	0.2453	0.2731	0.2932
Coefficients:				
	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	3.12515	0.14588	21.423	< 2e-16 ***
Variance	0.12126	0.03248	3.734	0.000189 ***

