The SAS System

Practice 9

Sj2921

a) Import the dataset, obs 5.

Obs	ID	Systolic blood pressure	Tobacco	Low density lipoprotein cholesterol	Body adiposity index	Family history of heart disease(Present, Absent)	TypeA	Body Mass Index	Alcohol	Age	Coronary heart disease
1	1	160	12	5.73	23.11	Present	49	25.3	97.2	52	Case
2	2	144	0.01	4.41	28.61	Absent	55	28.87	2.06	63	Case
3	3	118	0.08	3.48	32.28	Present	52	29.14	3.81	46	Control
4	4	170	7.5	6.41	38.03	Present	51	31.99	24.26	58	Case
5	5	134	13.6	3.5	27.78	Present	60	25.99	57.34	49	Case

The SAS System

The FREQ Procedure

b. i. Cross-tabular frequency family history (rows) and CHD status (columns)

Table of Famhist by CHD			
Famhist(Family history of heart disease(Present, Absent))	**CHD(Coronary heart disease)**		
Frequency Percent Row Pct Col Pct	**0**	**1**	**Total**
Absent	206 44.59 76.30 68.21	64 13.85 23.70 40.00	270 58.44
Present	96 20.78 50.00 31.79	96 20.78 50.00 60.00	192 41.56
Total	302 65.37	160 34.63	462 100.00

b. ii. Distribution of systolic pressure

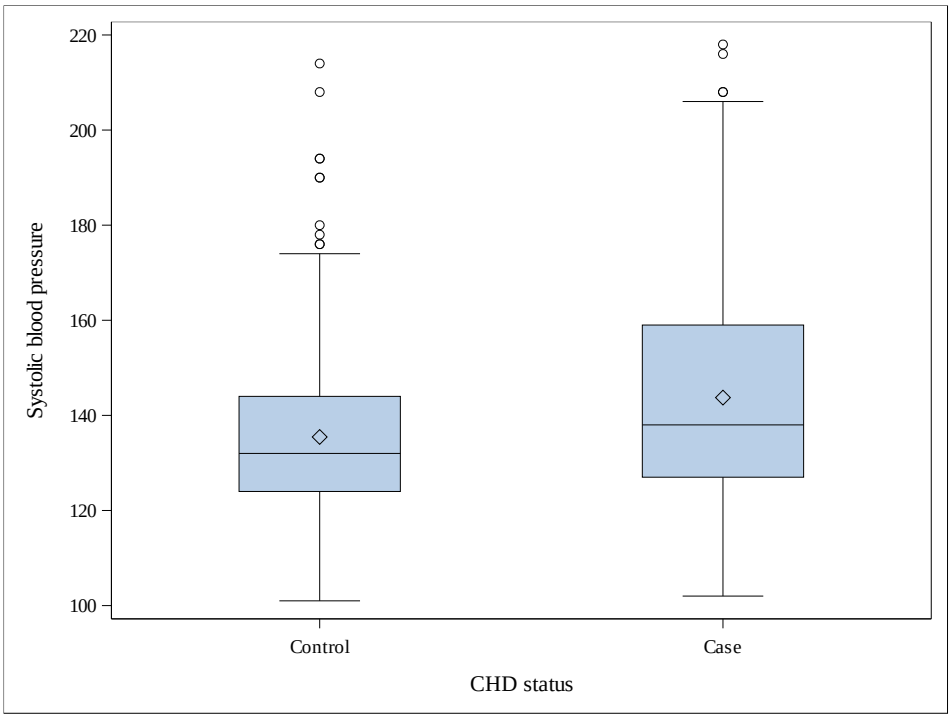
1) Descriptive statistics (n, mean, median, standard deviation, min, max) of systolic blood pressure for each level of CHD status.

Analysis Variable : SBP Systolic blood pressure							
Coronary heart disease	**N Obs**	**N**	**Mean**	**Median**	**Std Dev**	**Minimum**	**Maximum**
Control	302	302	135.46	132.00	17.98	101.00	214.00
Case	160	160	143.74	138.00	23.68	102.00	218.00

The SAS System

The MEANS Procedure

2) Boxplots of systolic pressure for each level of CHD status



This box-plot shows us that the systolic pressure differs greatly in two categories of CHD status groups, since the case group is higher than the control group and experiences greater variability than control group while for control group there are more outliers than case group, which may affect the mean comparison as mean is sensitive to control group.

The SAS System

The CORR Procedure

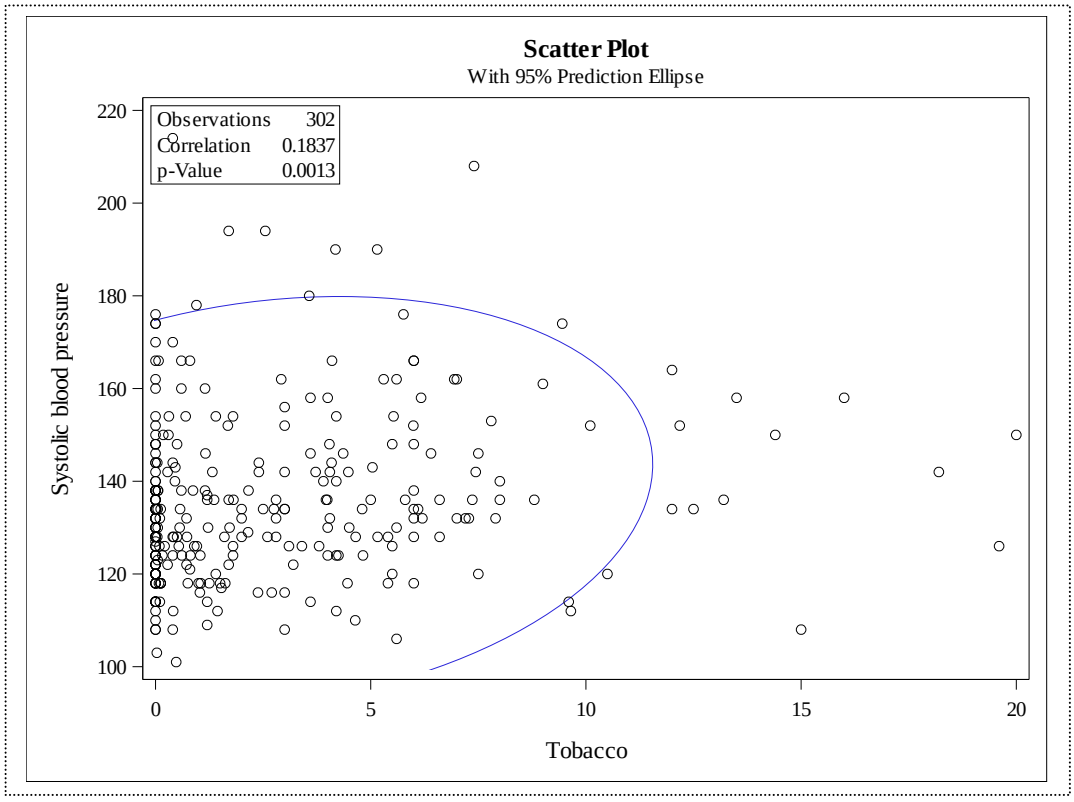
Coronary heart disease=0

2 Variables:	Tobacco SBP

Simple Statistics							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
Tobacco	302	2.63474	3.61210	795.69000	0	20.00000	Tobacco
SBP	302	135.46026	17.98495	40909	101.00000	214.00000	Systolic blood pressure

Pearson Correlation Coefficients, N = 302 Prob > |r| under H0: Rho=0		
	Tobacco	**SBP**
Tobacco Tobacco	1.00000	0.18373 0.0013
SBP Systolic blood pressure	0.18373 0.0013	1.00000

This Pearson correlation coefficient has
a P-value of < 0.05, implies significant weak correlation.

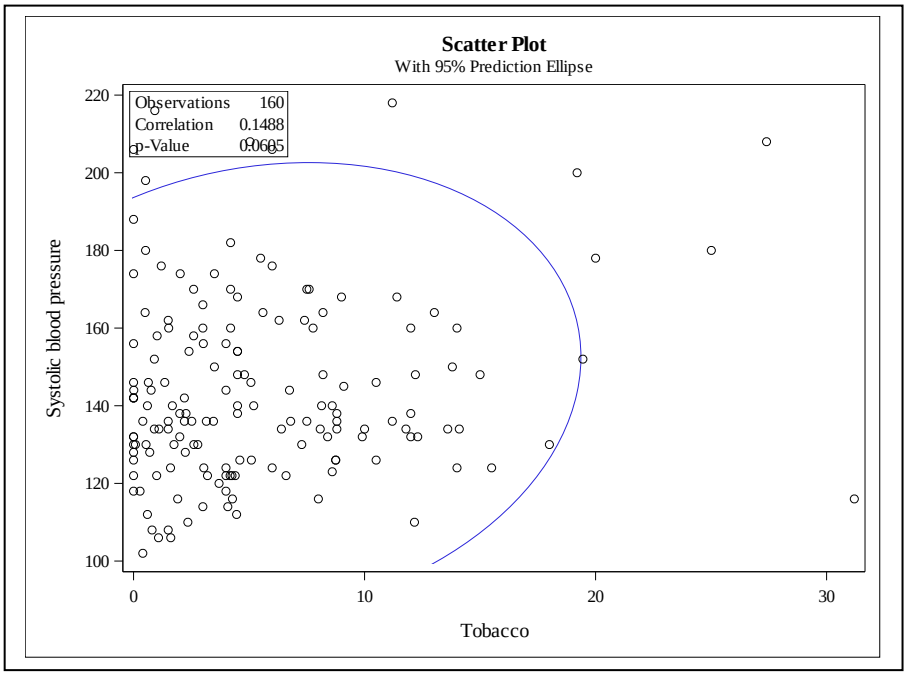


2 Variables:	Tobacco SBP

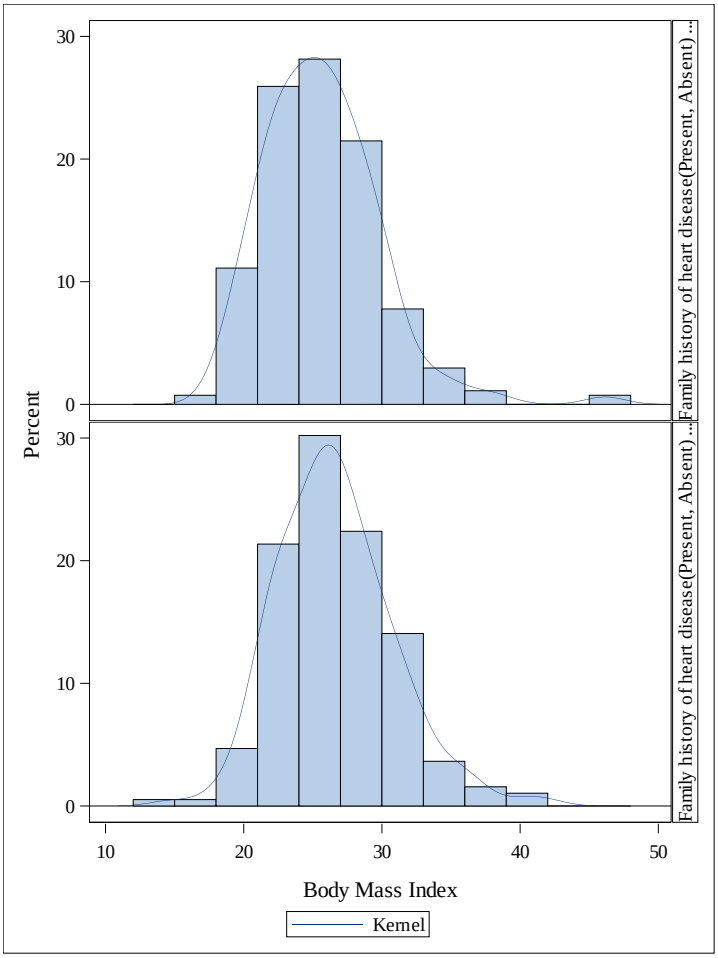
Simple Statistics							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
Tobacco	160	5.52487	5.56514	883.98000	0	31.20000	Tobacco
SBP	160	143.73750	23.67747	22998	102.00000	218.00000	Systolic blood pressure

Pearson Correlation Coefficients, N = 160 Prob > |r| under H0: Rho=0		
	Tobacco	**SBP**
Tobacco Tobacco	1.00000	0.14876 0.0605
SBP Systolic blood pressure	0.14876 0.0605	1.00000

This Pearson correlation coefficient has a P-value of 0.06 > 0.05, not significant.



iii. Histograms of body adiposity index for those with and without family history



This histogram shows that the BMI varies between subjects with and without family history, so we may need a stratification analysis.

c) Macro: Create a macro program named 'table' that takes two numeric variables

		Alcohol			Tobacco		
		Freq	Mean	Std Dev	Freq	Mean	Std Dev
Control	**Absent**	206	15.1	22.19	206	2.5	3.74
	Present	96	17.7	26.12	96	3.0	3.32
	Total	302	15.9	23.50	302	2.6	3.61
Case	**Absent**	64	16.3	19.81	64	5.9	6.67
	Present	96	21.1	29.63	96	5.3	4.70
	Total	160	19.1	26.18	160	5.5	5.57
Total	**Absent**	270	15.4	21.62	270	3.3	4.82
	Present	192	19.4	27.91	192	4.1	4.22
	Total	462	17.0	24.48	462	3.6	4.59

D – Hypo Testing (1)

Table of Famhist by CHD			
Famhist(Family history of heart disease(Present, Absent))	**CHD(Coronary heart disease)**		
Frequency Percent Row Pct Col Pct	**0**	**1**	**Total**
Absent	206 44.59 76.30 68.21	64 13.85 23.70 40.00	270 58.44
Present	96 20.78 50.00 31.79	96 20.78 50.00 60.00	192 41.56
Total	302 65.37	160 34.63	462 100.00

Statistics for Table of Famhist by CHD

Statistic	DF	Value	Prob
Chi-Square	1	34.2743	<.0001
Likelihood Ratio Chi-Square	1	34.2141	<.0001
Continuity Adj. Chi-Square	1	33.1226	<.0001
Mantel-Haenszel Chi-Square	1	34.2002	<.0001
Phi Coefficient		0.2724	
Contingency Coefficient		0.2628	
Cramer's V		0.2724	

Fisher's Exact Test	
Cell (1,1) Frequency (F)	206
Left-sided Pr <= F	1.0000
Right-sided Pr >= F	<.0001
Table Probability (P)	<.0001
Two-sided Pr <= P	<.0001

Sample Size = 462

D – Hypo Testing (2)

Variable: TypeA
(TypeA)
Famhist = Absent

Moments			
N	270	**Sum Weights**	270
Mean	52.7333333	**Sum Observations**	14238
Std Deviation	9.94124	**Variance**	98.8282528
Skewness	-0.4386072	**Kurtosis**	0.55127524
Uncorrected SS	777402	**Corrected SS**	26584.8
Coeff Variation	18.851909	**Std Error Mean**	0.6050046

Basic Statistical Measures			
Location		**Variability**	
Mean	52.73333	**Std Deviation**	9.94124
Median	53.00000	**Variance**	98.82825
Mode	49.00000	**Range**	64.00000
		Interquartile Range	13.00000

Note: The mode displayed is the smallest of 2 modes with a count of 14.

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	87.16187	**Pr > |t|**	<.0001
Sign	**M**	135	**Pr >= |M|**	<.0001
Signed Rank	**S**	18292.5	**Pr >= |S|**	<.0001

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	**W**	0.987295	**Pr < W**	0.0175
Kolmogorov-Smirnov	**D**	0.04699	**Pr > D**	>0.1500
Cramer-von Mises	**W-Sq**	0.081639	**Pr > W-Sq**	0.2042
Anderson-Darling	**A-Sq**	0.593444	**Pr > A-Sq**	0.1256

D – Hypo Testing (2)

Variable: TypeA
(TypeA)
Famhist = Absent

Quantiles (Definition 5)	
Level	**Quantile**
100% Max	77
99%	73
95%	67
90%	65
75% Q3	60
50% Median	53
25% Q1	47
10%	41
5%	35
1%	26
0% Min	13

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
13	73	72	309
25	243	73	188
26	142	73	420
28	422	74	314
29	223	77	105

The SAS System

The UNIVARIATE Procedure
Variable: TypeA
(TypeA)
Famhist = Present

Moments			
N	192	**Sum Weights**	192
Mean	53.625	**Sum Observations**	10296
Std Deviation	9.64256489	**Variance**	92.9790576
Skewness	-0.1984733	**Kurtosis**	0.32113333
Uncorrected SS	569882	**Corrected SS**	17759
Coeff Variation	17.981473	**Std Error Mean**	0.69589218

Basic Statistical Measures			
Location		**Variability**	
Mean	53.62500	**Std Deviation**	9.64256
Median	53.00000	**Variance**	92.97906
Mode	52.00000	**Range**	58.00000
		Interquartile Range	12.50000

Tests for Location: Mu0=0				
Test	**Statistic**		**p Value**	
Student's t	**t**	77.05935	**Pr > |t|**	<.0001
Sign	**M**	96	**Pr >= |M|**	<.0001
Signed Rank	**S**	9264	**Pr >= |S|**	<.0001

Tests for Normality				
Test	**Statistic**		**p Value**	
Shapiro-Wilk	**W**	0.991968	**Pr < W**	0.3693
Kolmogorov-Smirnov	**D**	0.056607	**Pr > D**	0.1361
Cramer-von Mises	**W-Sq**	0.066274	**Pr > W-Sq**	>0.2500
Anderson-Darling	**A-Sq**	0.421491	**Pr > A-Sq**	>0.2500

The SAS System

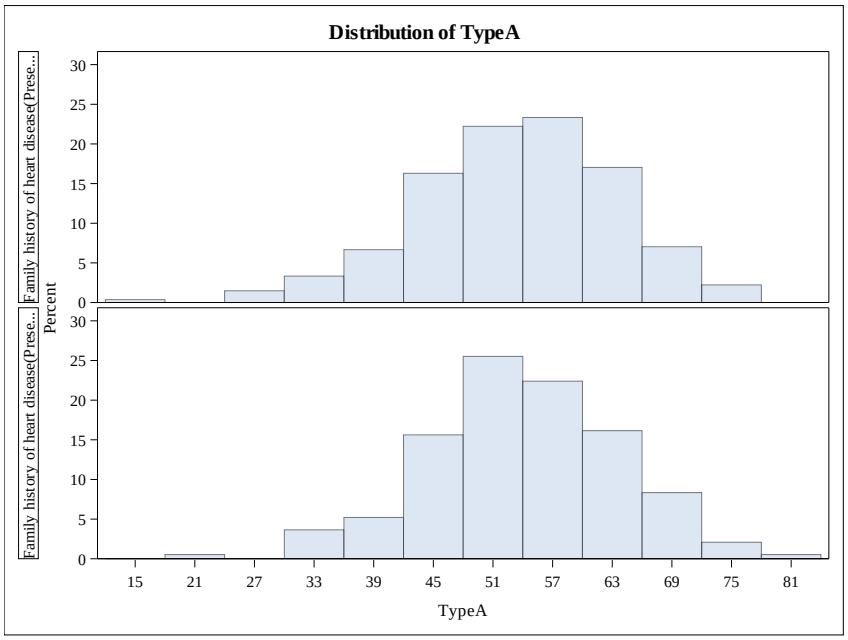
The UNIVARIATE Procedure
Variable: TypeA
(TypeA)
Famhist = Present

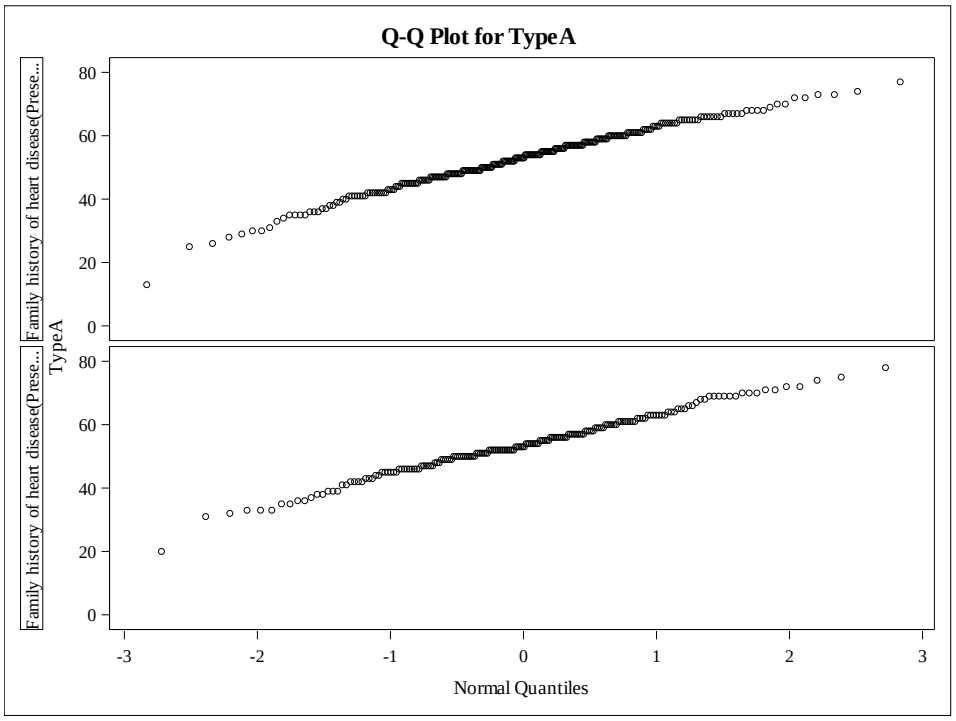
Quantiles (Definition 5)	
Level	**Quantile**
100% Max	78.0
99%	75.0
95%	70.0
90%	66.0
75% Q3	60.0
50% Median	53.0
25% Q1	47.5
10%	42.0
5%	36.0
1%	31.0
0% Min	20.0

Extreme Observations			
Lowest		**Highest**	
Value	**Obs**	**Value**	**Obs**
20	424	72	373
31	229	72	408
32	190	74	437
33	444	75	323
33	257	78	311

The SAS System

The UNIVARIATE Procedure





The SAS System

The NPAR1WAY Procedure

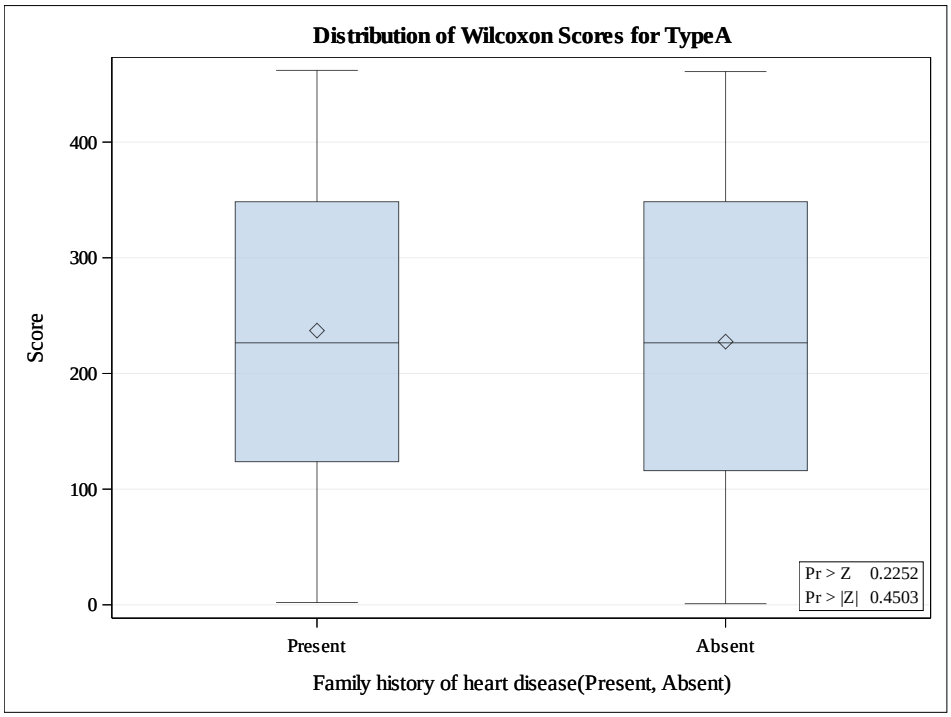
Wilcoxon Scores (Rank Sums) for Variable TypeA Classified by Variable Famhist					
Famhist	**N**	**Sum of Scores**	**Expected Under H0**	**Std Dev Under H0**	**Mean Score**
Present	192	45515.50	44448.0	1413.46144	237.059896
Absent	270	61437.50	62505.0	1413.46144	227.546296
Average scores were used for ties.					

Wilcoxon Two-Sample Test	
Statistic	45515.5000
Normal Approximation	
Z	0.7549
One-Sided Pr > Z	0.2252
Two-Sided Pr > |Z|	0.4503
t Approximation	
One-Sided Pr > Z	0.2254
Two-Sided Pr > |Z|	0.4507
Z includes a continuity correction of 0.5.	

Kruskal-Wallis Test	
Chi-Square	0.5704
DF	1
Pr > Chi-Square	0.4501

The SAS System

The NPAR1WAY Procedure



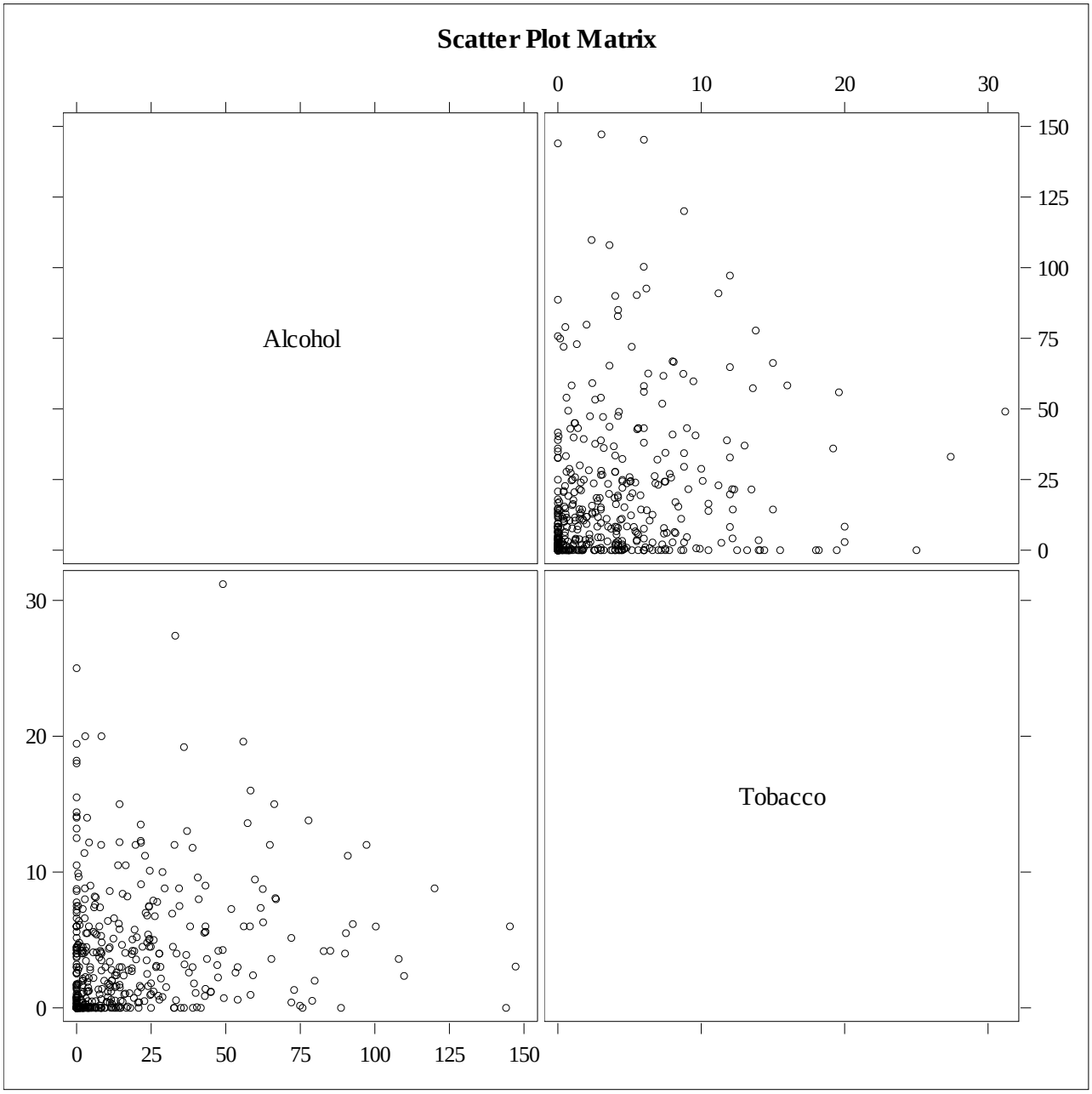
D- 3 Pearson

Simple Statistics							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
Alcohol	462	17.04439	24.48106	7875	0	147.19000	Alcohol
Tobacco	462	3.63565	4.59302	1680	0	31.20000	Tobacco

Pearson Correlation Coefficients, N = 462 Prob > |r| under H0: Rho=0		
	Alcohol	**Tobacco**
Alcohol Alcohol	1.00000	0.20081 <.0001
Tobacco Tobacco	0.20081 <.0001	1.00000

The SAS System

The CORR Procedure



The SAS System

The FREQ Procedure

Family history of heart disease(Present, Absent)				
Famhist	**Frequency**	**Percent**	**Cumulative Frequency**	**Cumulative Percent**
Absent	270	58.44	270	58.44
Present	192	41.56	462	100.00

Binomial Proportion	
Famhist = Absent	
Proportion	0.5844
ASE	0.0229
95% Lower Conf Limit	0.5395
95% Upper Conf Limit	0.6294
Exact Conf Limits	
95% Lower Conf Limit	0.5380
95% Upper Conf Limit	0.6298

Test of H0: Proportion = 0.4	
ASE under H0	0.0228
Z	8.0912
One-sided Pr > Z	<.0001
Two-sided Pr > |Z|	<.0001

Sample Size = 462

The SAS System

E- Model building

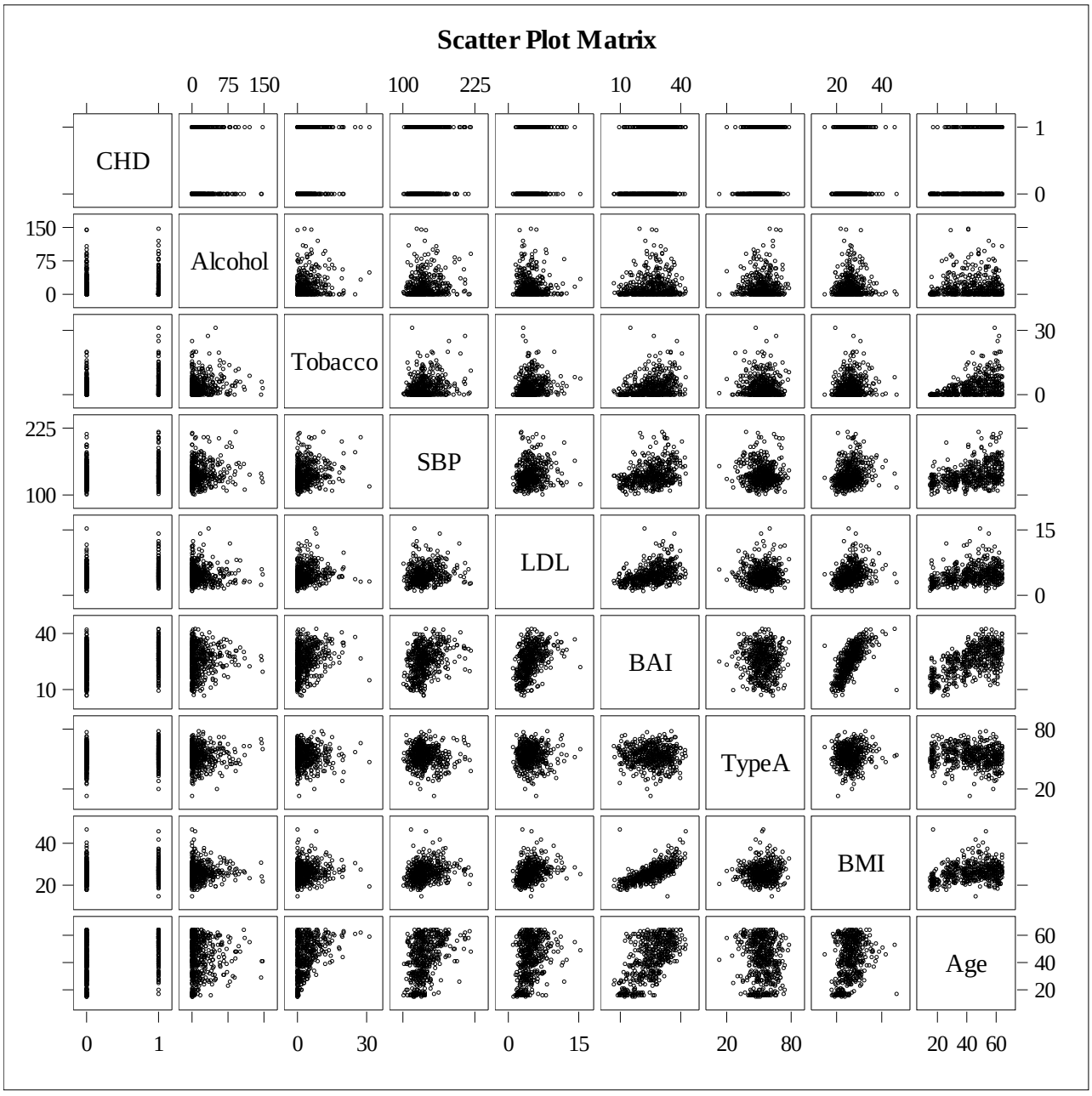
9 Variables:	CHD Alcohol Tobacco SBP LDL BAI TypeA BMI Age

Simple Statistics							
Variable	**N**	**Mean**	**Std Dev**	**Sum**	**Minimum**	**Maximum**	**Label**
CHD	462	0.34632	0.47631	160.00000	0	1.00000	Coronary heart disease
Alcohol	462	17.04439	24.48106	7875	0	147.19000	Alcohol
Tobacco	462	3.63565	4.59302	1680	0	31.20000	Tobacco
SBP	462	138.32684	20.49632	63907	101.00000	218.00000	Systolic blood pressure
LDL	462	4.74032	2.07091	2190	0.98000	15.33000	Low density lipoprotein cholesterol
BAI	462	25.40673	7.78070	11738	6.74000	42.49000	Body adiposity index
TypeA	462	53.10390	9.81753	24534	13.00000	78.00000	TypeA
BMI	462	26.04411	4.21368	12032	14.70000	46.58000	Body Mass Index
Age	462	42.81602	14.60896	19781	15.00000	64.00000	Age

Pearson Correlation Coefficients, N = 462 Prob > |r| under H0: Rho=0									
	CHD	**Alcohol**	**Tobacco**	**SBP**	**LDL**	**BAI**	**TypeA**	**BMI**	**Age**
CHD Coronary heart disease	1.00000	0.06253 0.1797	0.29972 <.0001	0.19235 <.0001	0.26305 <.0001	0.25412 <.0001	0.10316 0.0266	0.10010 0.0315	0.37297 <.0001
Alcohol Alcohol	0.06253 0.1797	1.00000	0.20081 <.0001	0.14010 0.0025	-0.03340 0.4738	0.10033 0.0311	0.03950 0.3970	0.05162 0.2682	0.10112 0.0298
Tobacco Tobacco	0.29972 <.0001	0.20081 <.0001	1.00000	0.21225 <.0001	0.15891 0.0006	0.28664 <.0001	-0.01461 0.7542	0.12453 0.0074	0.45033 <.0001
SBP Systolic blood pressure	0.19235 <.0001	0.14010 0.0025	0.21225 <.0001	1.00000	0.15830 0.0006	0.35650 <.0001	-0.05745 0.2177	0.23807 <.0001	0.38877 <.0001
LDL Low density lipoprotein cholesterol	0.26305 <.0001	-0.03340 0.4738	0.15891 0.0006	0.15830 0.0006	1.00000	0.44043 <.0001	0.04405 0.3448	0.33051 <.0001	0.31180 <.0001
BAI Body adiposity index	0.25412 <.0001	0.10033 0.0311	0.28664 <.0001	0.35650 <.0001	0.44043 <.0001	1.00000	-0.04314 0.3548	0.71656 <.0001	0.62595 <.0001
TypeA TypeA	0.10316 0.0266	0.03950 0.3970	-0.01461 0.7542	-0.05745 0.2177	0.04405 0.3448	-0.04314 0.3548	1.00000	0.07401 0.1122	-0.10261 0.0274
BMI Body Mass Index	0.10010 0.0315	0.05162 0.2682	0.12453 0.0074	0.23807 <.0001	0.33051 <.0001	0.71656 <.0001	0.07401 0.1122	1.00000	0.29178 <.0001
Age Age	0.37297 <.0001	0.10112 0.0298	0.45033 <.0001	0.38877 <.0001	0.31180 <.0001	0.62595 <.0001	-0.10261 0.0274	0.29178 <.0001	1.00000

The SAS System

E- Model building



The SAS System

The GENMOD Procedure

Model Information		
Data Set	WORK.CHD	
Distribution	Binomial	
Link Function	Logit	
Dependent Variable	CHD	Coronary heart disease

Number of Observations Read	462
Number of Observations Used	462
Number of Events	160
Number of Trials	462

Response Profile		
Ordered Value	**CHD**	**Total Frequency**
1	1	160
2	0	302

PROC GENMOD is modeling the probability that CHD='1'.

Criteria For Assessing Goodness Of Fit			
Criterion	**DF**	**Value**	**Value/DF**
Log Likelihood		-277.2847	
Full Log Likelihood		-277.2847	
AIC (smaller is better)		562.5694	
AICC (smaller is better)		562.6569	
BIC (smaller is better)		579.1116	

Algorithm converged.

The SAS System

The GENMOD Procedure

Analysis Of Maximum Likelihood Parameter Estimates							
Parameter	**DF**	**Estimate**	**Standard Error**	**Wald 95% Confidence Limits**		**Wald Chi-Square**	**Pr > ChiSq**
Intercept	1	-1.1730	0.1638	-1.4940	-0.8520	51.30	<.0001
Alcohol	1	-0.0012	0.0065	-0.0139	0.0115	0.03	0.8559
Tobacco	1	0.1398	0.0314	0.0783	0.2014	19.83	<.0001
Alcohol*Tobacco	1	0.0003	0.0010	-0.0017	0.0023	0.08	0.7834
Scale	0	1.0000	0.0000	1.0000	1.0000		

Note: The scale parameter was held fixed.

The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CHD Coronary heart disease

Number of Observations Read	462
Number of Observations Used	462

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	21.56337	2.69542	14.71	<.0001
Error	453	83.02537	0.18328		
Corrected Total	461	104.58874			

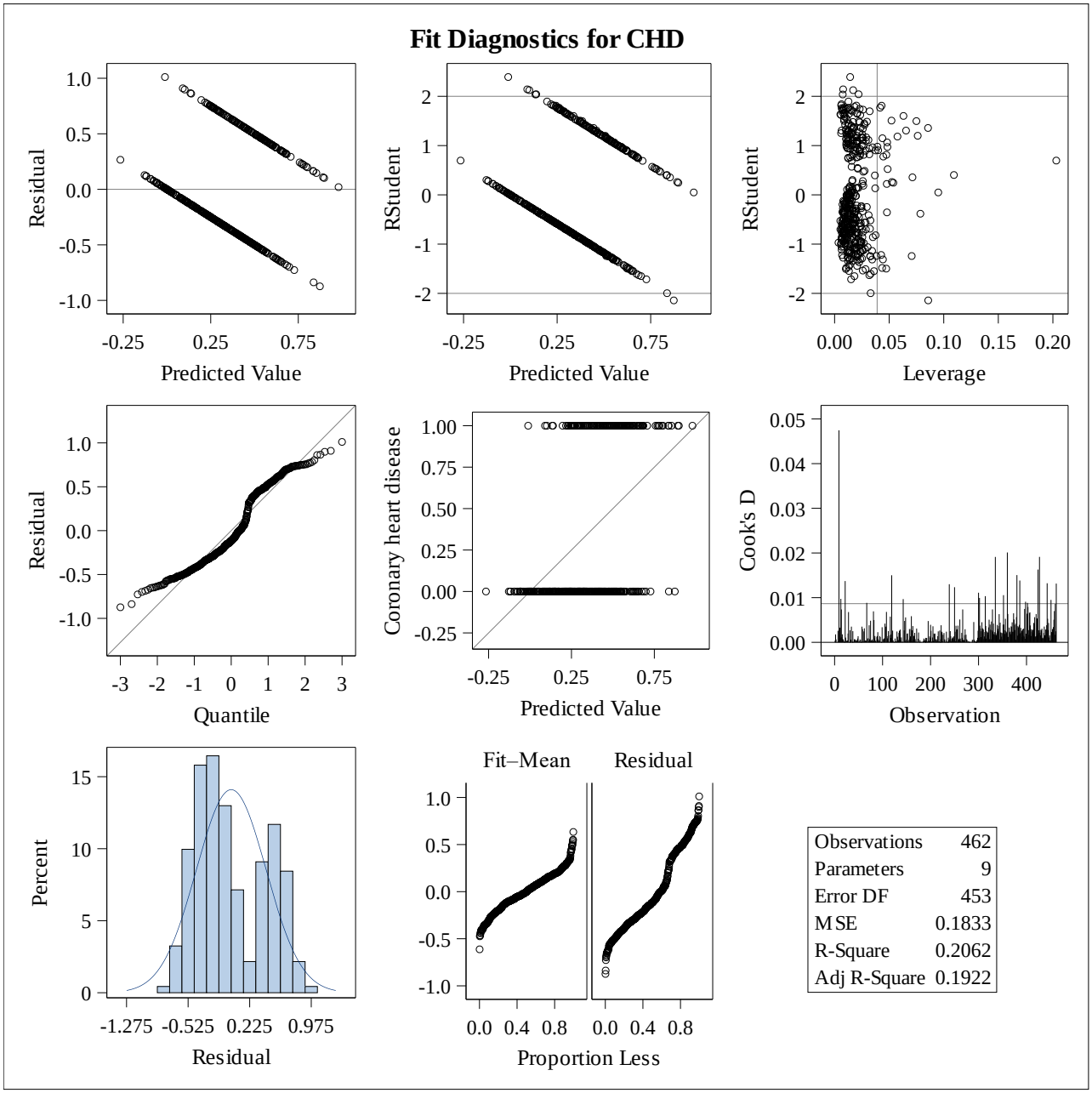
Root MSE	0.42811	**R-Square**	0.2062
Dependent Mean	0.34632	**Adj R-Sq**	0.1922
Coeff Var	123.61703		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	Intercept	1	-0.54014	0.20817	-2.59	0.0098	0
Alcohol	Alcohol	1	0.00000260	0.00084151	0.00	0.9975	1.06750
Tobacco	Tobacco	1	0.01582	0.00495	3.20	0.0015	1.29812
SBP	Systolic blood pressure	1	0.00125	0.00108	1.16	0.2453	1.22602
LDL	Low density lipoprotein cholesterol	1	0.03705	0.01083	3.42	0.0007	1.26492
BAI	Body adiposity index	1	0.00219	0.00486	0.45	0.6520	3.59132
TypeA	TypeA	1	0.00659	0.00207	3.18	0.0016	1.03924
BMI	Body Mass Index	1	-0.01065	0.00716	-1.49	0.1374	2.28851
Age	Age	1	0.00822	0.00200	4.12	<.0001	2.13735

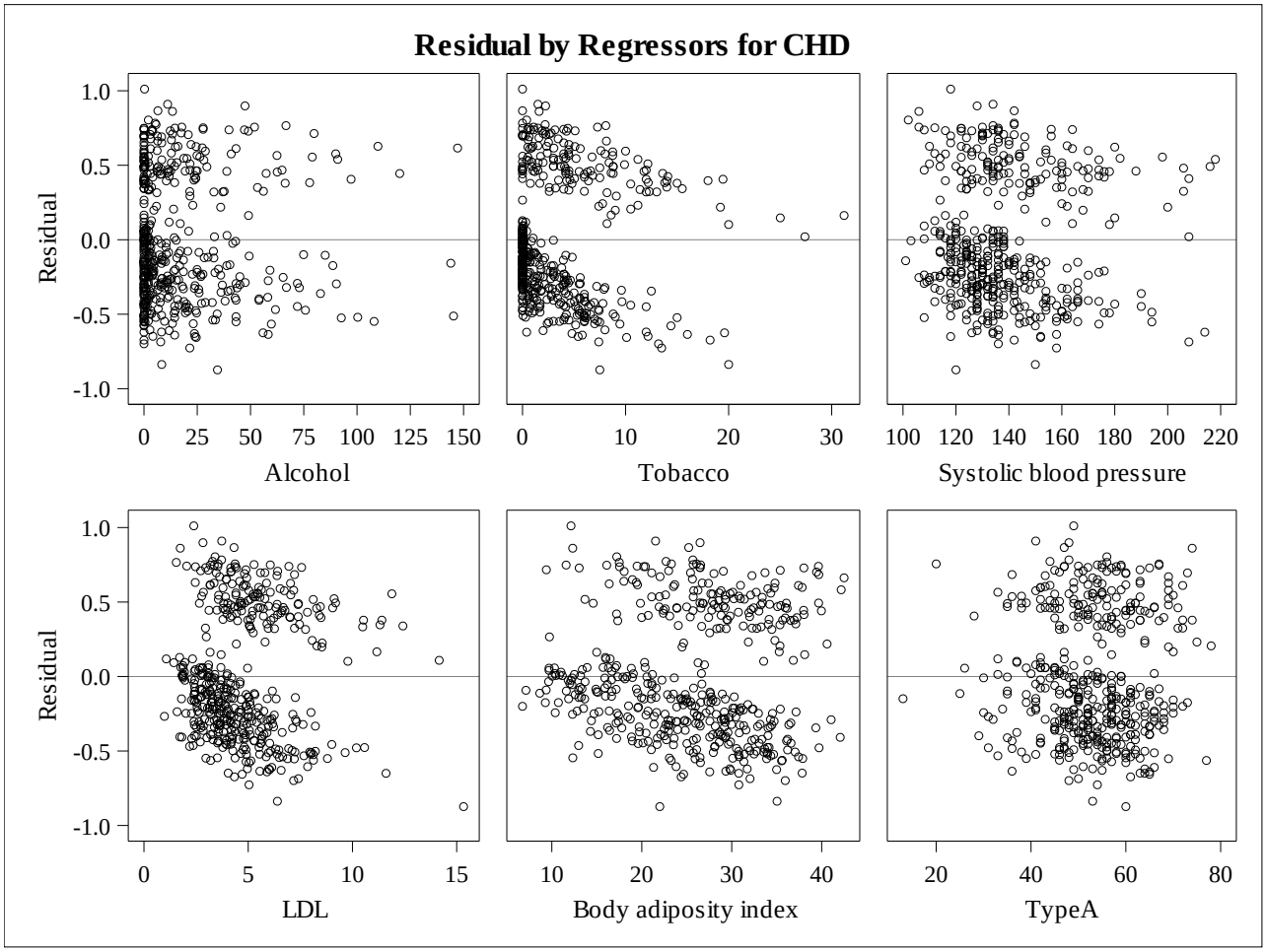
The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CHD Coronary heart disease



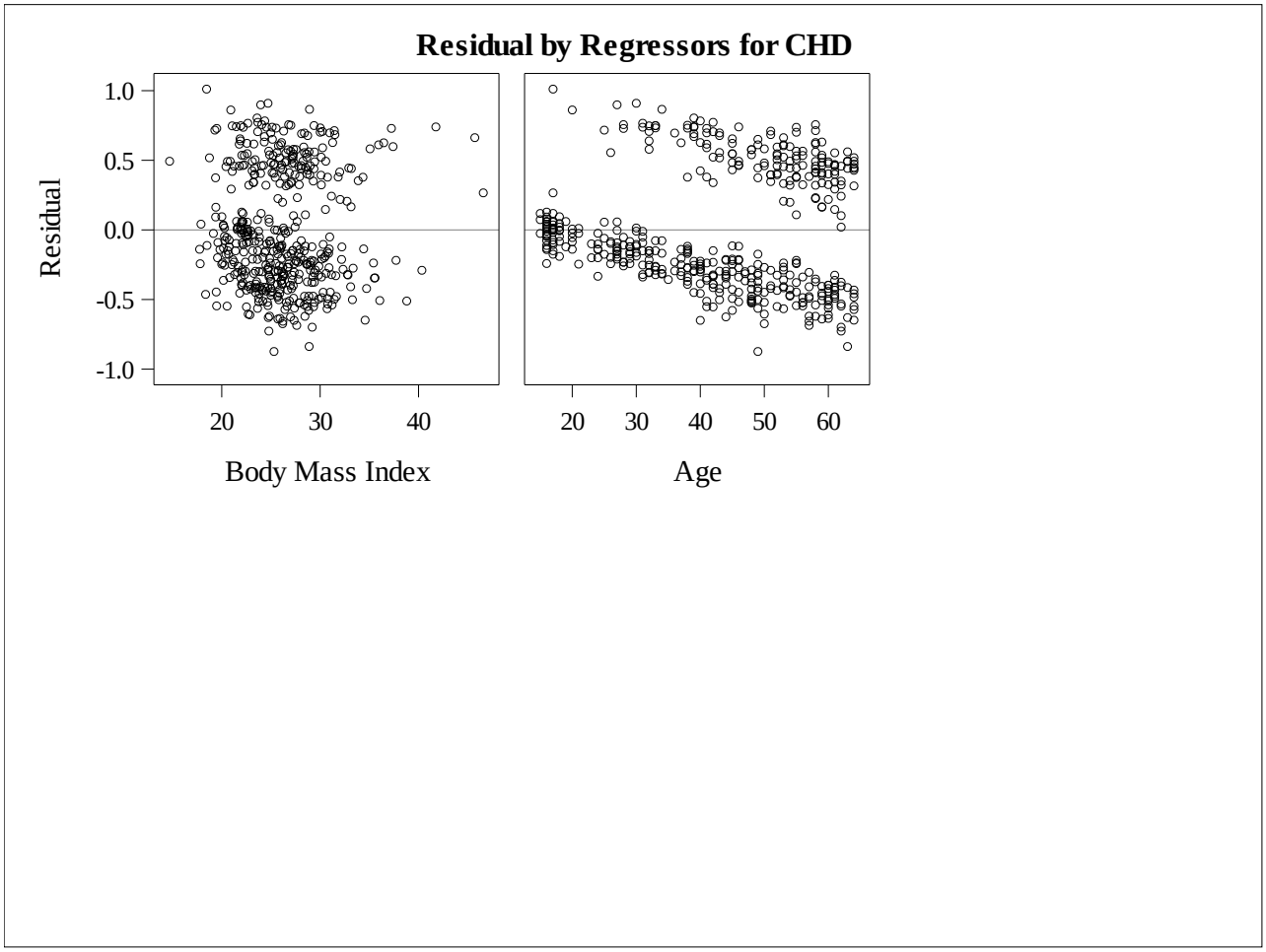
The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CHD Coronary heart disease



The SAS System

The REG Procedure
Model: MODEL1
Dependent Variable: CHD Coronary heart disease



The SAS System

The LOGISTIC Procedure

Model Information		
Data Set	WORK.CHD	
Response Variable	CHD	Coronary heart disease
Number of Response Levels	2	
Model	binary logit	
Optimization Technique	Fisher's scoring	

Number of Observations Read	462
Number of Observations Used	462

Response Profile		
Ordered Value	**CHD**	**Total Frequency**
1	1	160
2	0	302

Probability modeled is CHD='1'.

Stepwise Selection Procedure

Class Level Information		
Class	**Value**	**Design Variables**
Famhist	**Absent**	-1
	Present	1

Step 0. Intercept entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

-2 Log L	=	596.108

The SAS System

The LOGISTIC Procedure

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
110.1654	10	<.0001

Step 1. Effect Age entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	598.108	529.562
SC	602.244	537.833
-2 Log L	596.108	525.562

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	70.5461	1	<.0001
Score	64.2684	1	<.0001
Wald	56.4428	1	<.0001

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
52.2500	9	<.0001

Note: No effects for the model in Step 1 are removed.

Step 2. Effect Famhist entered:

The SAS System

The LOGISTIC Procedure

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	598.108	512.658
SC	602.244	525.065
-2 Log L	596.108	506.658

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	89.4503	2	<.0001
Score	80.6802	2	<.0001
Wald	68.0493	2	<.0001

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
34.1517	8	<.0001

Note: No effects for the model in Step 2 are removed.

Step 3. Effect Tobacco entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

The SAS System

The LOGISTIC Procedure

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	598.108	503.385
SC	602.244	519.928
-2 Log L	596.108	495.385

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	100.7230	3	<.0001
Score	91.3271	3	<.0001
Wald	74.6203	3	<.0001

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
23.7709	7	0.0012

Note: No effects for the model in Step 3 are removed.

Step 4. Effect TypeA entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	598.108	494.714
SC	602.244	515.392
-2 Log L	596.108	484.714

The SAS System

The LOGISTIC Procedure

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	111.3941	4	<.0001
Score	98.3611	4	<.0001
Wald	77.8614	4	<.0001

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
13.4494	6	0.0364

Note: No effects for the model in Step 4 are removed.

Step 5. Effect LDL entered:

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	598.108	487.686
SC	602.244	512.499
-2 Log L	596.108	475.686

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	120.4228	5	<.0001
Score	105.5848	5	<.0001
Wald	82.5120	5	<.0001

The SAS System

The LOGISTIC Procedure

Residual Chi-Square Test		
Chi-Square	**DF**	**Pr > ChiSq**
4.4226	5	0.4903

Note: No effects for the model in Step 5 are removed.

Note: No (additional) effects met the 0.05 significance level for entry into the model.

Summary of Stepwise Selection								
	Effect			Number	Score	Wald		Variable
Step	**Entered**	**Removed**	**DF**	**In**	**Chi-Square**	**Chi-Square**	**Pr > ChiSq**	**Label**
1	**Age**		1	1	64.2684		<.0001	Age
2	**Famhist**		1	2	19.0794		<.0001	Family history of heart disease(Present, Absent)
3	**Tobacco**		1	3	11.0460		0.0009	Tobacco
4	**TypeA**		1	4	10.4263		0.0012	TypeA
5	**LDL**		1	5	9.0922		0.0026	Low density lipoprotein cholesterol

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
Tobacco	1	9.6456	0.0019
LDL	1	8.6846	0.0032
Famhist	1	16.1827	<.0001
TypeA	1	9.3058	0.0023
Age	1	24.4446	<.0001

The SAS System

The LOGISTIC Procedure

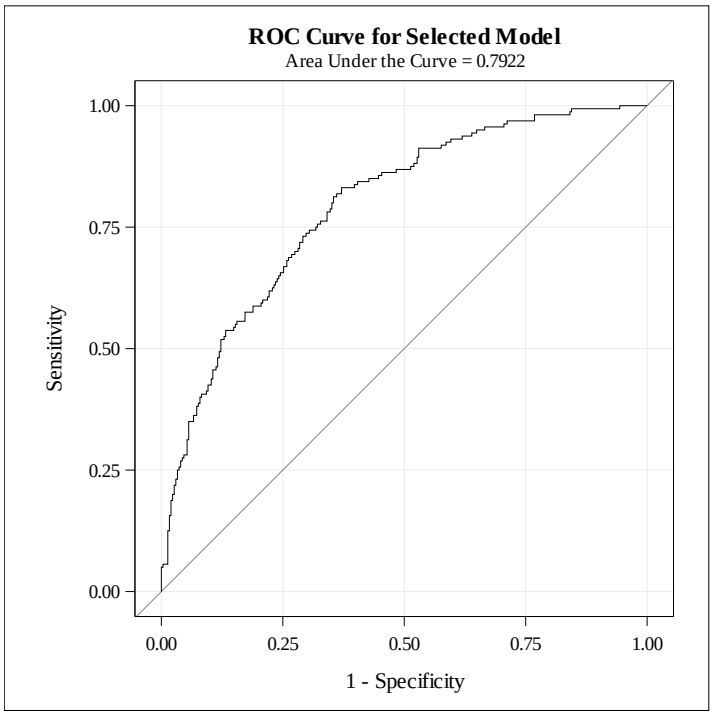
Analysis of Maximum Likelihood Estimates						
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-5.9923	0.9174	42.6626	<.0001
Tobacco		1	0.0804	0.0259	9.6456	0.0019
LDL		1	0.1620	0.0550	8.6846	0.0032
Famhist	**Present**	1	0.4541	0.1129	16.1827	<.0001
TypeA		1	0.0371	0.0122	9.3058	0.0023
Age		1	0.0505	0.0102	24.4446	<.0001

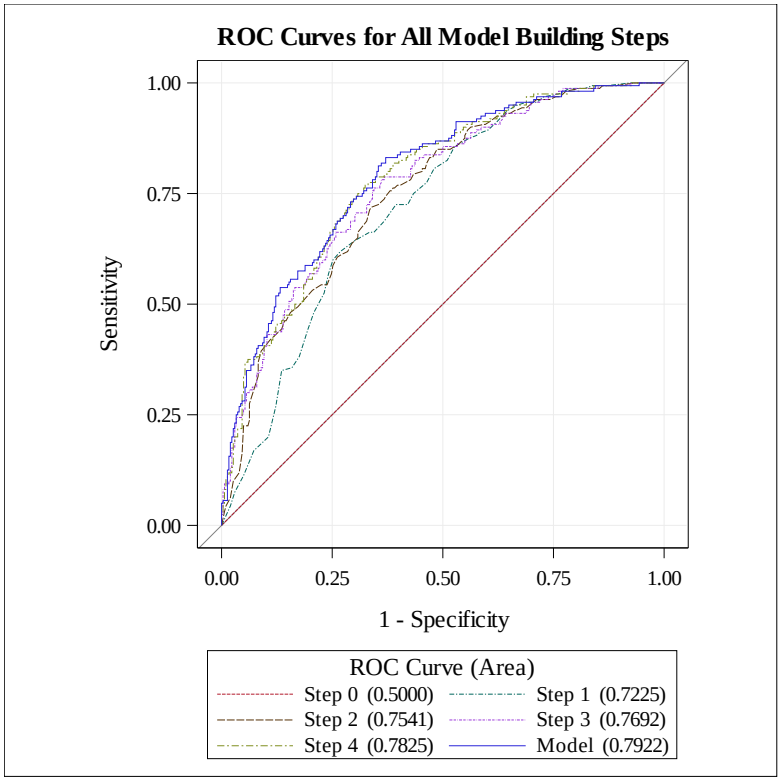
Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
Tobacco	1.084	1.030	1.140
LDL	1.176	1.056	1.310
Famhist Present vs Absent	2.480	1.593	3.860
TypeA	1.038	1.013	1.063
Age	1.052	1.031	1.073

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	79.2	**Somers' D**	0.584
Percent Discordant	20.8	**Gamma**	0.584
Percent Tied	0.0	**Tau-a**	0.265
Pairs	48320	**c**	0.792

The SAS System

The LOGISTIC Procedure



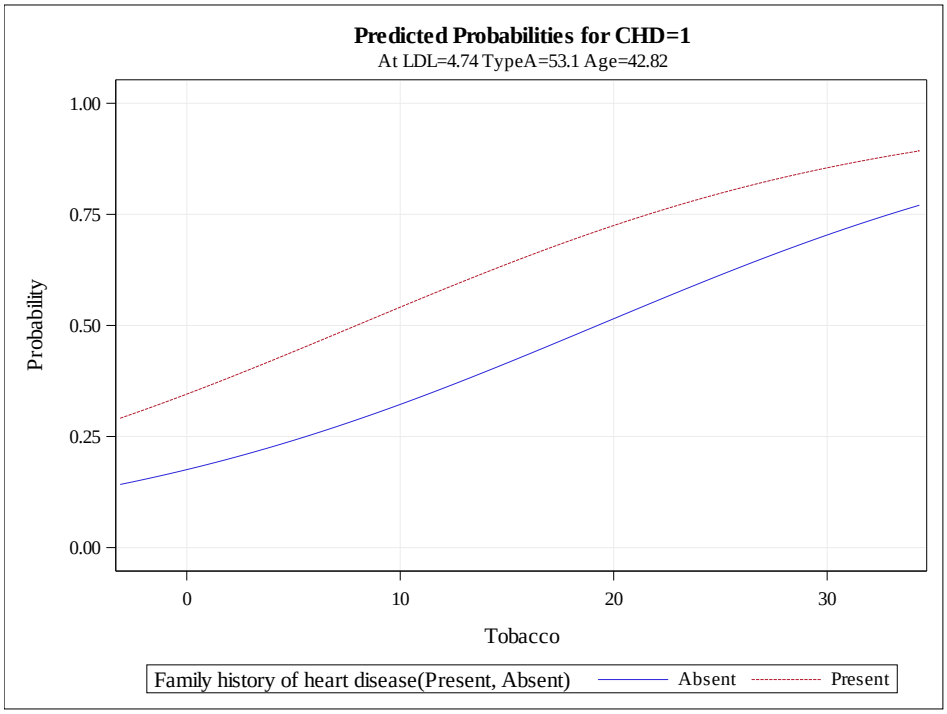


The SAS System

The LOGISTIC Procedure

Partition for the Hosmer and Lemeshow Test					
		CHD = 1		CHD = 0	
Group	Total	Observed	Expected	Observed	Expected
1	46	1	1.72	45	44.28
2	46	4	3.92	42	42.08
3	46	8	6.61	38	39.39
4	46	9	9.06	37	36.94
5	46	12	12.42	34	33.58
6	46	18	16.08	28	29.92
7	46	19	20.43	27	25.57
8	46	23	24.37	23	21.63
9	46	28	28.48	18	17.52
10	48	38	36.91	10	11.09

Hosmer and Lemeshow Goodness-of-Fit Test		
Chi-Square	DF	Pr > ChiSq
1.5312	8	0.9922



The SAS System

The LOGISTIC Procedure

Model Information		
Data Set	WORK.CHD	
Response Variable	CHD	Coronary heart disease
Number of Response Levels	2	
Model	binary logit	
Optimization Technique	Fisher's scoring	

Number of Observations Read	462
Number of Observations Used	462

Response Profile		
Ordered Value	**CHD**	**Total Frequency**
1	1	160
2	0	302

Probability modeled is CHD='1'.

Class Level Information		
Class	**Value**	**Design Variables**
Famhist	**Absent**	-1
	Present	1

Model Convergence Status
Convergence criterion (GCONV=1E-8) satisfied.

Model Fit Statistics		
Criterion	**Intercept Only**	**Intercept and Covariates**
AIC	598.108	506.724
SC	602.244	531.537
-2 Log L	596.108	494.724

The SAS System

The LOGISTIC Procedure

Testing Global Null Hypothesis: BETA=0			
Test	**Chi-Square**	**DF**	**Pr > ChiSq**
Likelihood Ratio	101.3845	5	<.0001
Score	92.1911	5	<.0001
Wald	74.9950	5	<.0001

Type 3 Analysis of Effects			
Effect	**DF**	**Wald Chi-Square**	**Pr > ChiSq**
Alcohol	1	0.3803	0.5374
Tobacco	1	4.1263	0.0422
Alcohol*Tobacco	1	0.6392	0.4240
Famhist	1	19.5725	<.0001
Age	1	27.0468	<.0001

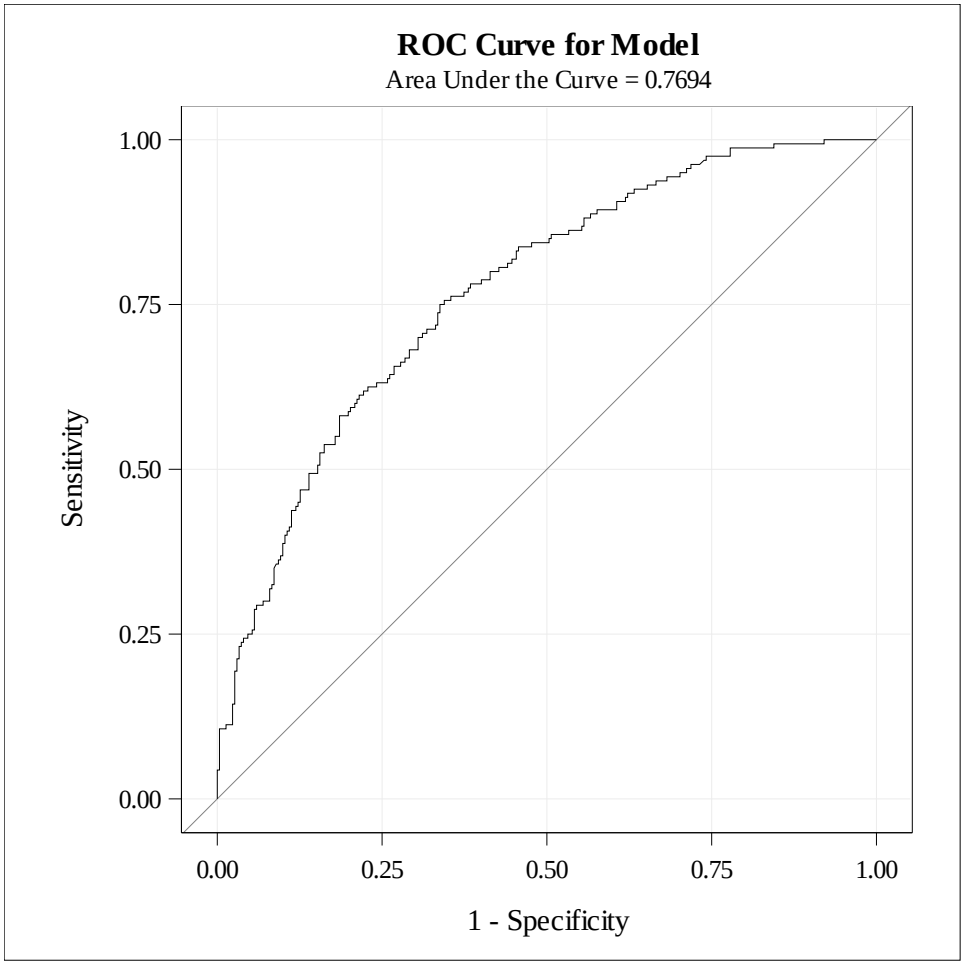
Analysis of Maximum Likelihood Estimates						
Parameter		**DF**	**Estimate**	**Standard Error**	**Wald Chi-Square**	**Pr > ChiSq**
Intercept		1	-3.0890	0.4468	47.7947	<.0001
Alcohol		1	-0.00421	0.00683	0.3803	0.5374
Tobacco		1	0.0667	0.0328	4.1263	0.0422
Alcohol*Tobacco		1	0.000833	0.00104	0.6392	0.4240
Famhist	**Present**	1	0.4877	0.1102	19.5725	<.0001
Age		1	0.0493	0.00947	27.0468	<.0001

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
Famhist Present vs Absent	2.652	1.722	4.086
Age	1.050	1.031	1.070

The SAS System

The LOGISTIC Procedure

Association of Predicted Probabilities and Observed Responses			
Percent Concordant	76.9	**Somers' D**	0.539
Percent Discordant	23.1	**Gamma**	0.539
Percent Tied	0.0	**Tau-a**	0.245
Pairs	48320	**c**	0.769



The SAS System

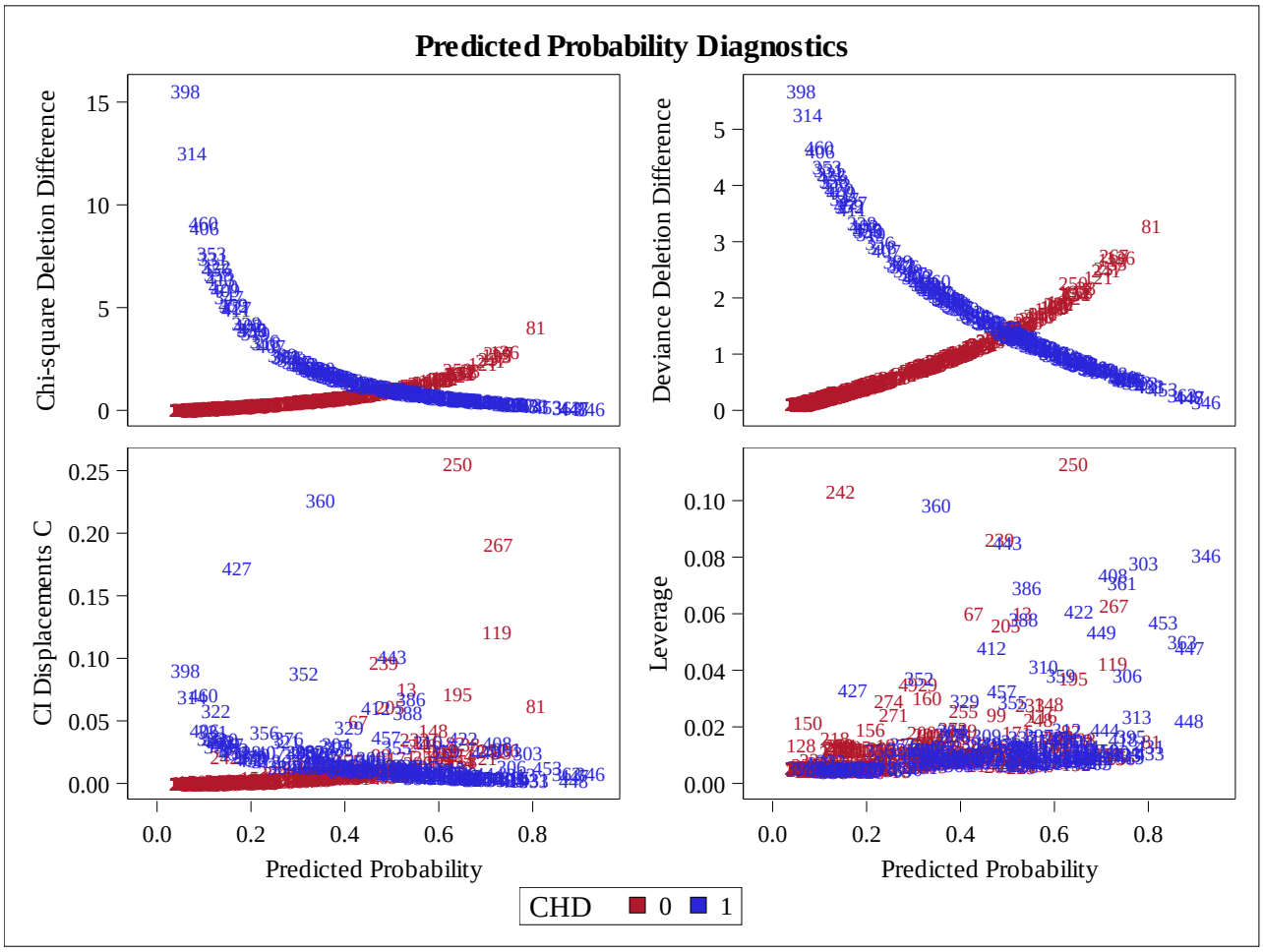
The LOGISTIC Procedure

Partition for the Hosmer and Lemeshow Test					
		CHD = 1		CHD = 0	
Group	Total	Observed	Expected	Observed	Expected
1	46	1	2.76	45	43.24
2	46	6	4.57	40	41.43
3	46	10	6.74	36	39.26
4	46	9	9.66	37	36.34
5	46	12	13.66	34	32.34
6	46	17	16.55	29	29.45
7	46	19	19.67	27	26.33
8	46	23	23.69	23	22.31
9	46	26	27.72	20	18.28
10	48	37	34.99	11	13.01

Hosmer and Lemeshow Goodness-of-Fit Test		
Chi-Square	DF	Pr > ChiSq
4.6813	8	0.7910

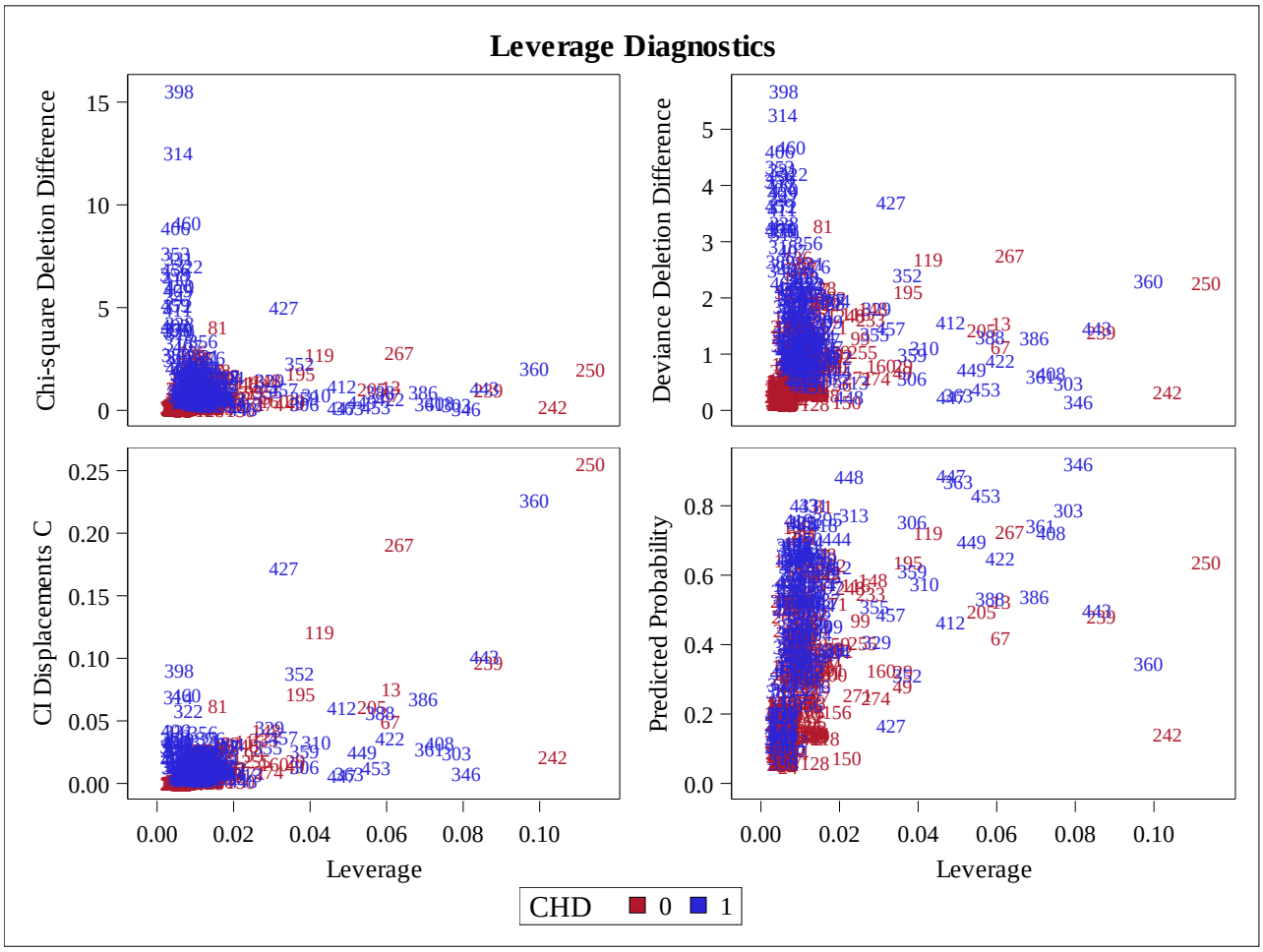
The SAS System

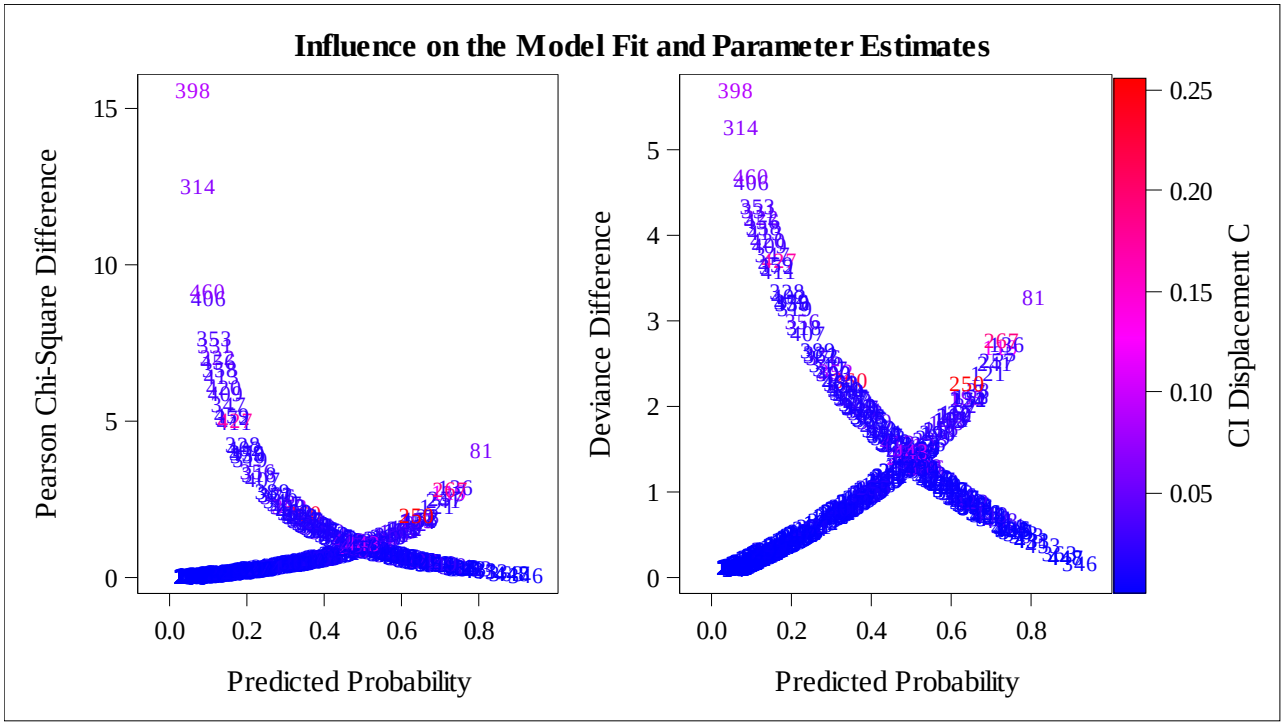
The LOGISTIC Procedure



The SAS System

The LOGISTIC Procedure





The SAS System

The LOGISTIC Procedure