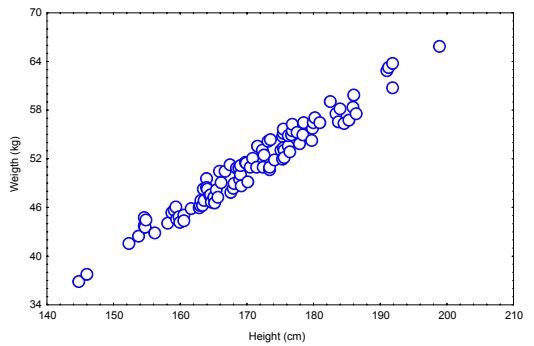
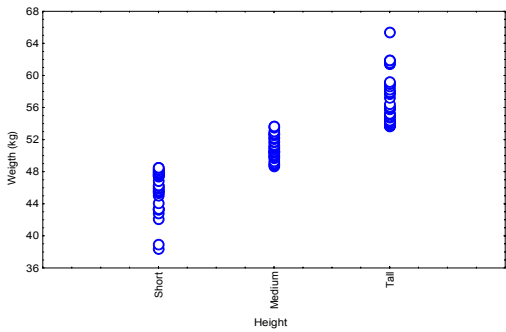
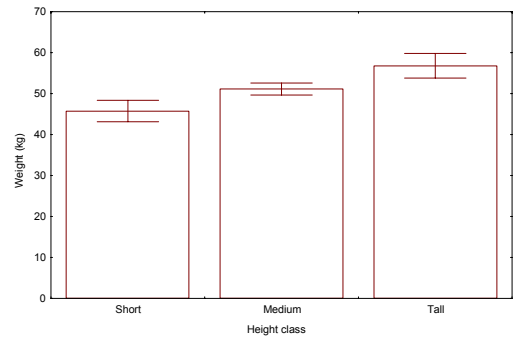


So far

--> looked at the effect of a discrete variable on a continuous variable

t-test, ANOVA, 2-way ANOVA



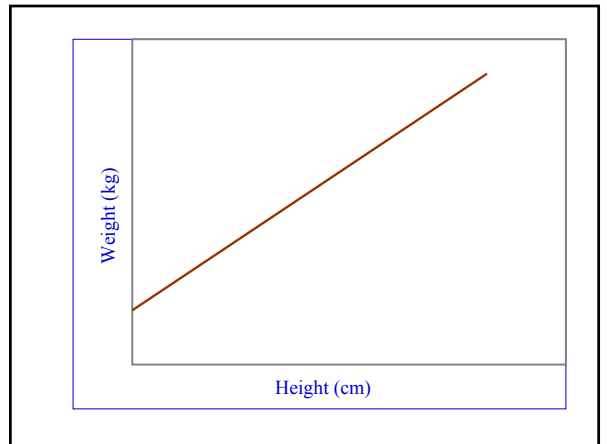
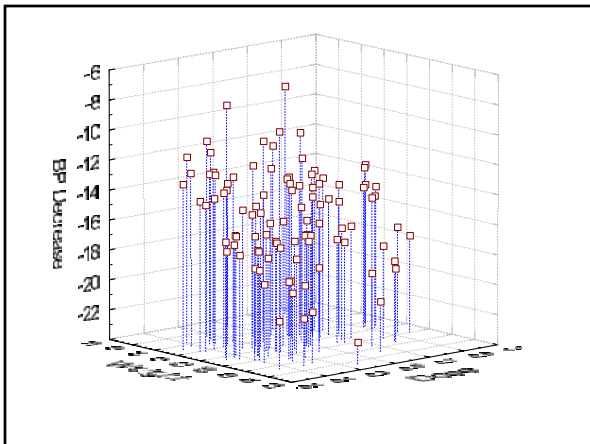
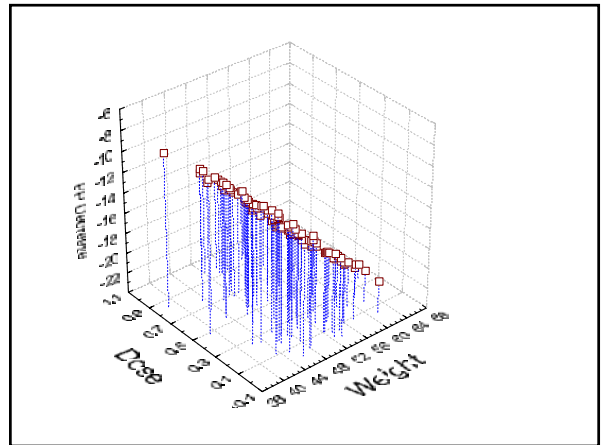
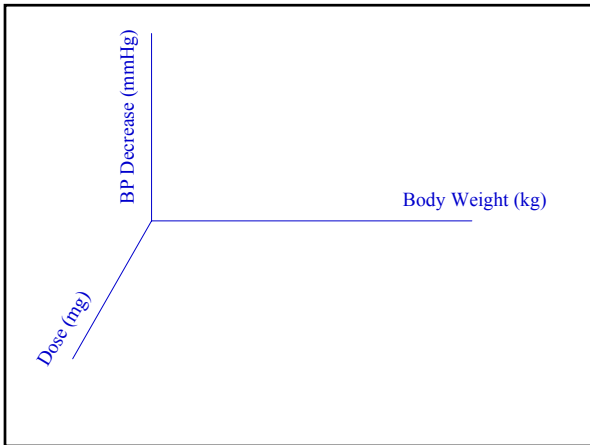
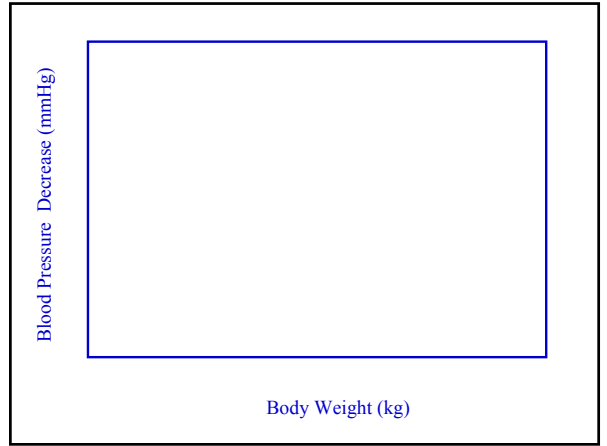
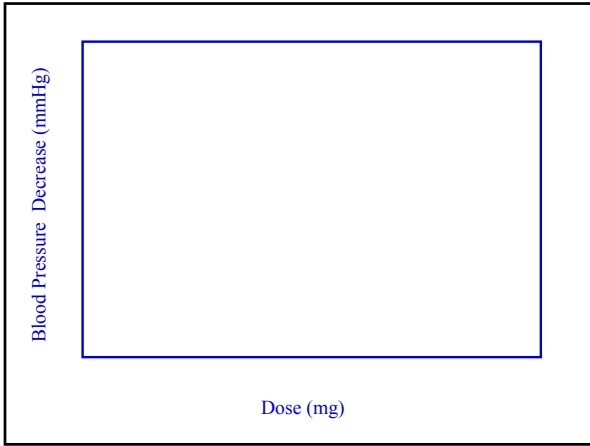
Often -

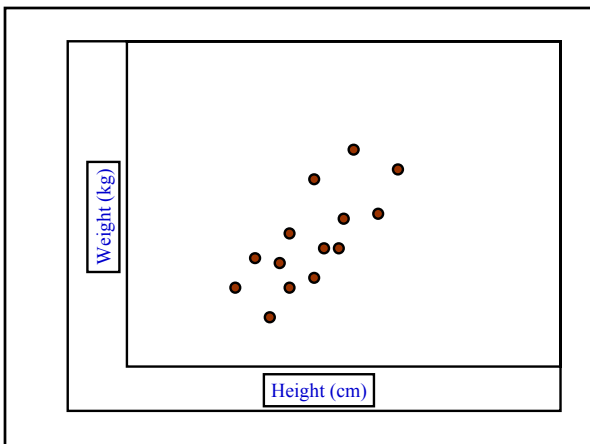
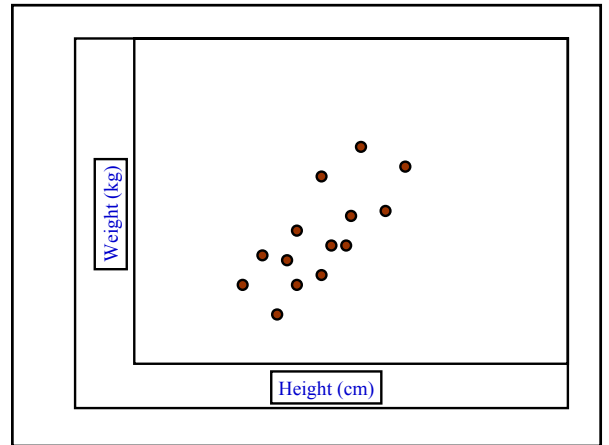
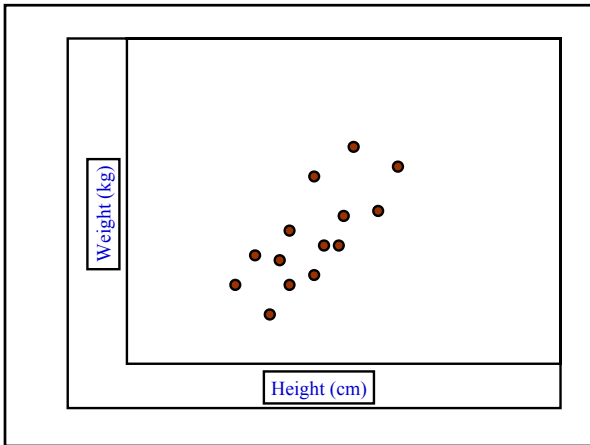
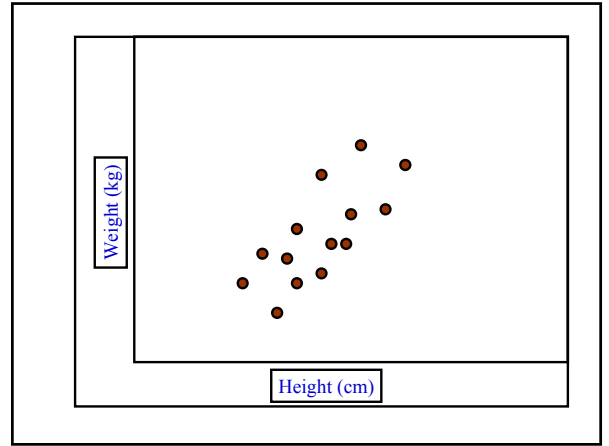
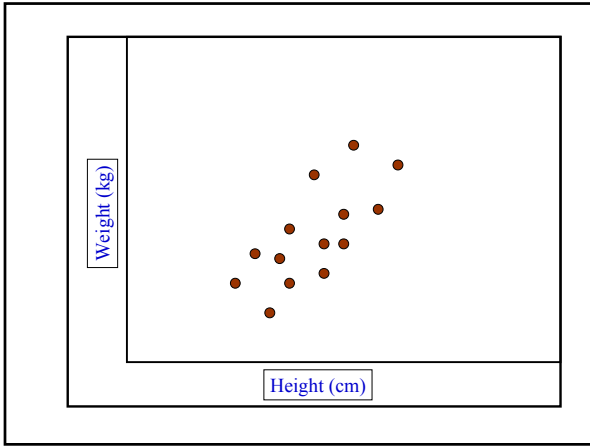
interested in the relationship between 2 or more continuous variables

## REGRESSION

Eg height and age, height and weight, dose and response

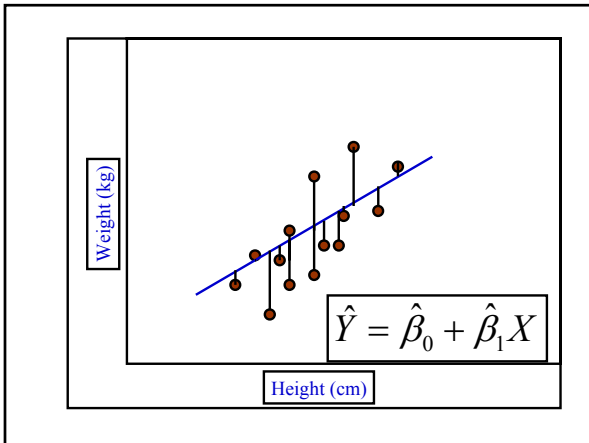
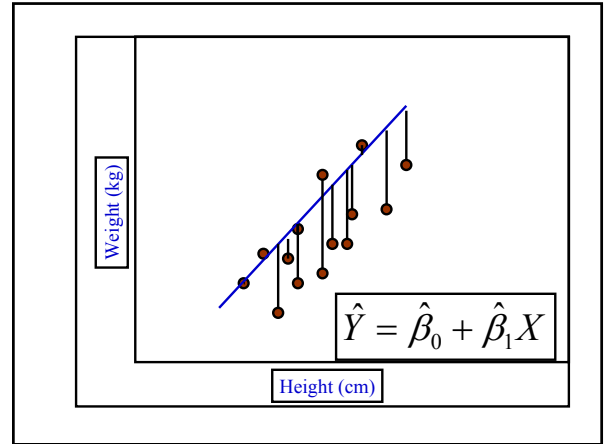
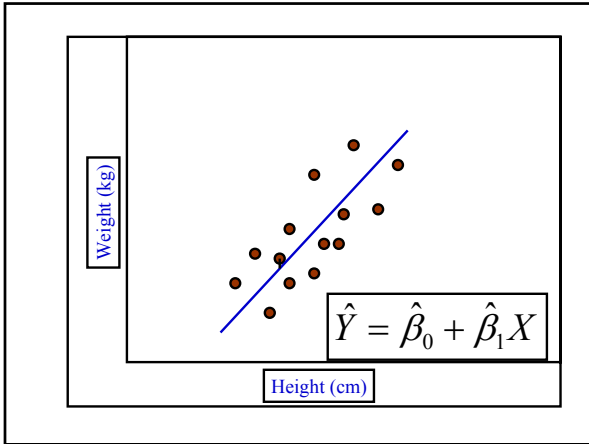
Regression allows us to ask:





Ordinary Least Squares - OLS

--> find the line that produces the



Hypothesis Tests Regarding Regression

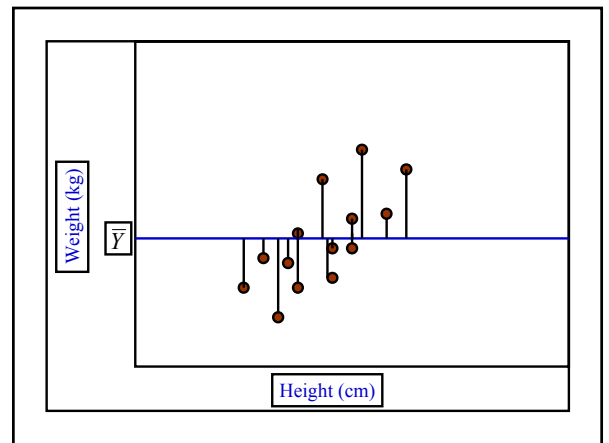
as

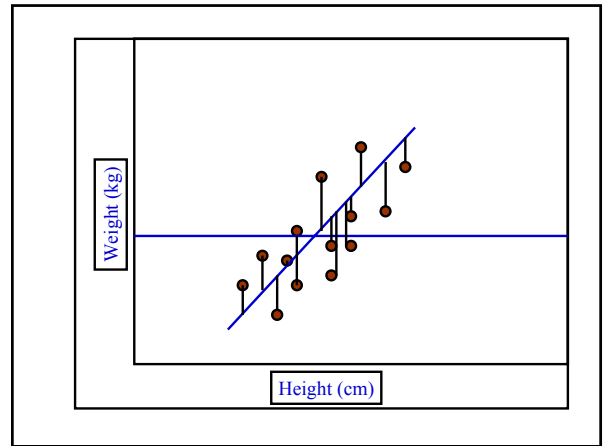
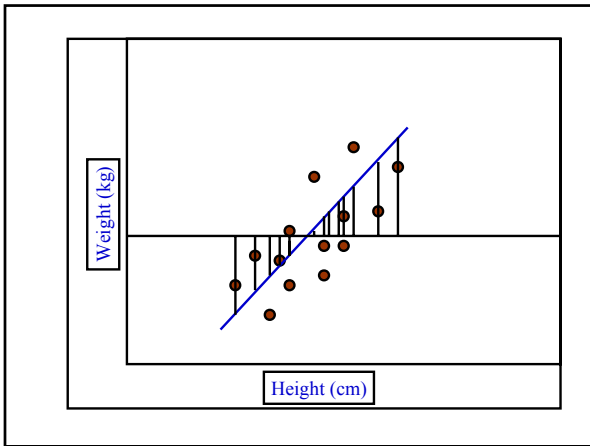
So, --> make inferences about the POPULATION based on a sample.

Hypotheses:

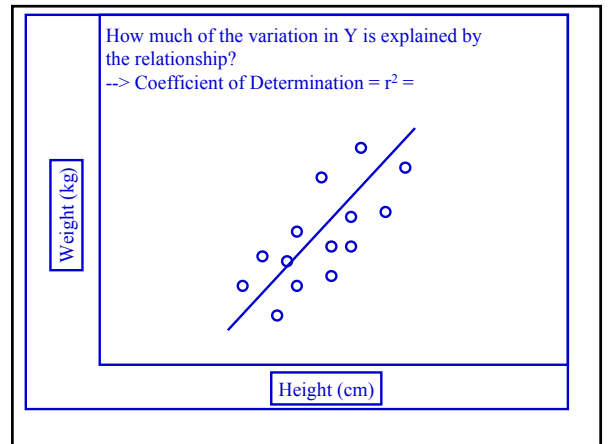
Slope  
 $H_0: \beta_1 = 0$   
 $H_A: \beta_1 \neq 0$

Intercept  
 $H_0: \beta_0 = 0$   
 $H_A: \beta_0 \neq 0$





ANOVA Table				
Source of Variation	SS	DF	MS	F
Regression	$\sum (\bar{Y}_i - \bar{Y})^2$	1		
Residual	$\sum (Y_i - \bar{Y}_i)^2$	n-2		
Total	$\sum (Y_i - \bar{Y})^2$	n-1		



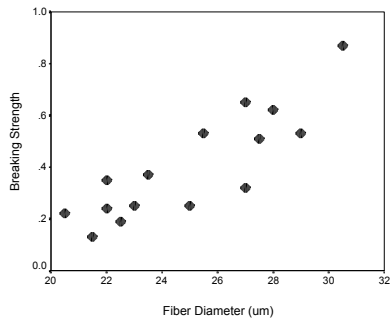
Observation	X Fiber Diameter	Y Breaking Strength
1	22.5	0.19
2	28.0	0.62
3	27.5	0.51
4	25.5	0.53
5	22.0	0.24
6	30.5	0.87
7	23.0	0.25
8	25.0	0.25
9	23.5	0.37
10	27.0	0.32
11	21.5	0.13
12	22.0	0.35
13	29.0	0.53
14	20.5	0.22
15	27.0	0.65

Hypotheses:

$H_0: \beta = 0$

$H_A: \beta \neq 0$

Scatter Plot of the Data



ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.447	1	.447	36.158	.000 <sup>a</sup>
	Residual	.161	13	1.236E-02		
	Total	.607	14			

a. Predictors: (Constant), DIAM

b. Dependent Variable: STRENGTH

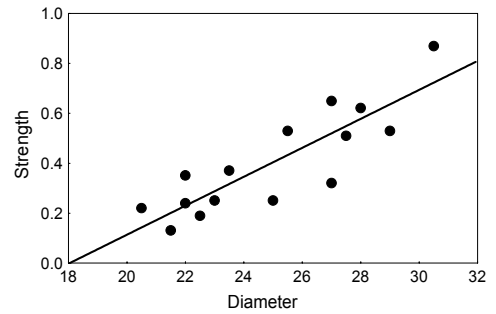
Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.047	.243		-4.314	.001
	DIAM	5.80E-02	.010	.858	6.013	.000

a. Dependent Variable: STRENGTH

Intercept

Slope



Coefficients<sup>a</sup>

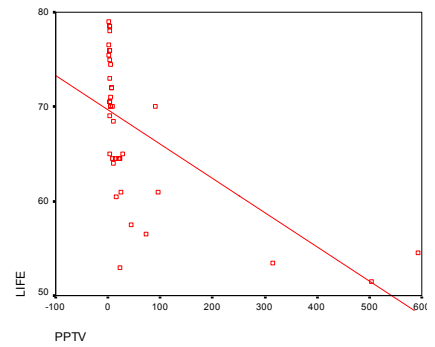
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.047	.243		-4.314	.001
	DIAM	5.80E-02	.010	.858	6.013	.000

a. Dependent Variable: STRENGTH

$$\hat{Y} = -1.047 + 0.058X$$

Observation	X Fiber Diameter	Y Breaking Strength
1	22.5	0.19
2	28.0	0.62
3	27.5	0.51
4	25.5	0.53
5	22.0	0.24
6	30.5	0.87
7	23.0	0.25
8	25.0	0.25
9	23.5	0.37
10	27.0	0.32
11	21.5	0.13
12	22.0	0.35
13	29.0	0.53
14	20.5	0.22
15	27.0	0.65

What is the predicted strength of a fiber that is 26um diameter?



**Model Summary<sup>a</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.651 <sup>b</sup>	.361	.349	6.293

a. Predictors: (Constant), PPTV  
b. Dependent Variable: LIFE

**ANOVA<sup>a</sup>**

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	826.733	1	826.733	20.877	.000 <sup>b</sup>
	Residual	1425.636	36	39.601		
	Total	2252.368	37			

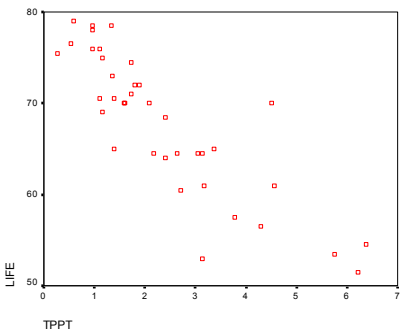
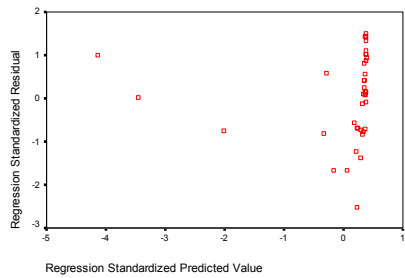
a. Predictors: (Constant), PPTV  
b. Dependent Variable: LIFE

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	69.648	1.101			63.256	.000
	PPTV	-.036	.008	-.606		-4.569	.000

a. Dependent Variable: LIFE

Scatterplot  
Dependent Variable: LIFE



**Model Summary<sup>a</sup>**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.659 <sup>b</sup>	.724	.724	4.101

a. Predictors: (Constant), TPPT  
b. Dependent Variable: LIFE

**ANOVA<sup>a</sup>**

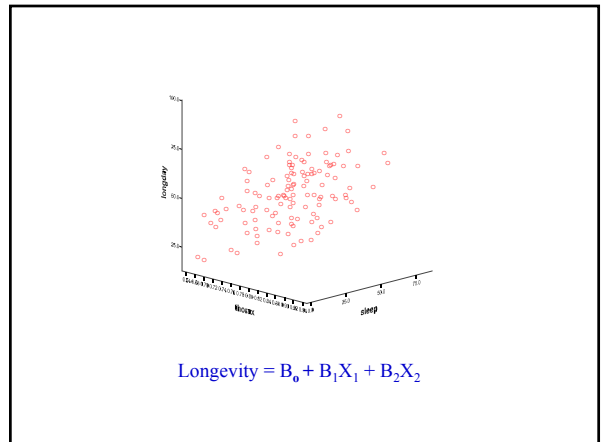
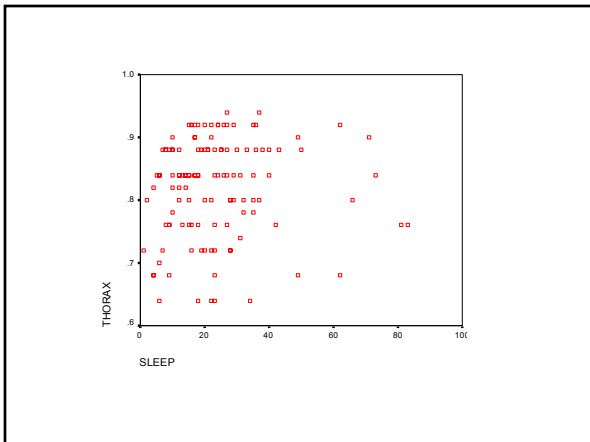
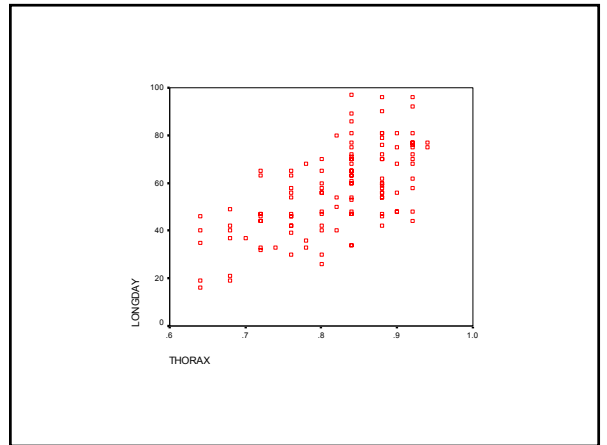
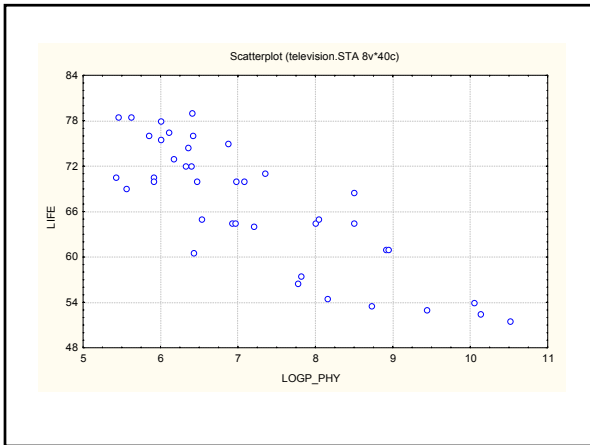
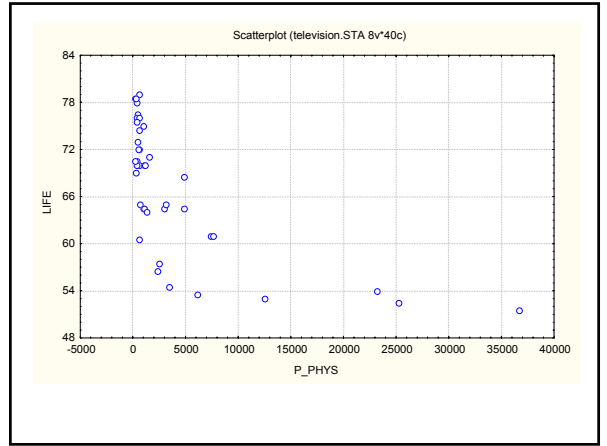
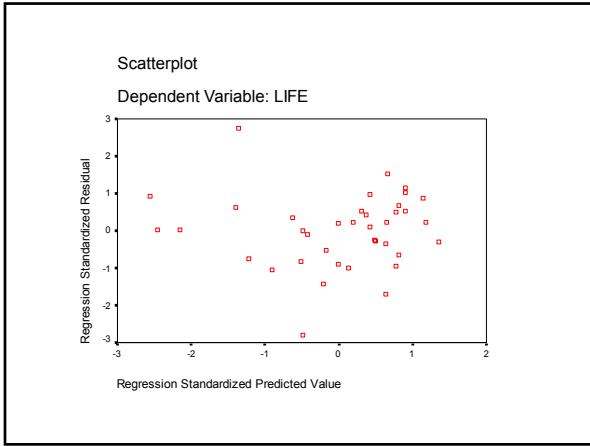
Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	1648.972	1	1648.972	97.938	.000 <sup>b</sup>
	Residual	605.396	36	16.817		
	Total	2252.368	37			

a. Predictors: (Constant), TPPT  
b. Dependent Variable: LIFE

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	77.887	1.220			63.827	.000
	TPPT	-4.292	.430	-.893		-9.896	.000

a. Dependent Variable: LIFE



Model	R	R Square	Adjusted R Square	Sig. Error of the Estimate
1	.638 <sup>a</sup>	.407	.397	13.6410

a. Predictors: (Constant), SLEEP, THORAX

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	15551.370	2	7775.685	41.787	.000 <sup>b</sup>
	Residual	22701.430	122	186.077		
	Total	38252.800	124			

a. Predictors: (Constant), SLEEP, THORAX

b. Dependent Variable: LONGDAY

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	40.533	12.876			-4.629	.000
	THORAX	144.899	15.850	.638		9.142	.000
	SLEEP	-.042	.077	-.036		-.542	.589

a. Dependent Variable: LONGDAY

Model	R	R Square	Adjusted R Square	Sig. Error of the Estimate
1	.630 <sup>a</sup>	.400	.400	13.6018

a. Predictors: (Constant), THORAX

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	15499.641	1	15499.641	83.761	.000 <sup>b</sup>
	Residual	22756.159	123	185.009		
	Total	38255.800	124			

a. Predictors: (Constant), THORAX

b. Dependent Variable: LONGDAY

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	41.622	13.004			-4.695	.000
	THORAX	144.333	15.770	.636		9.152	.000

a. Dependent Variable: LONGDAY