Summary Results

48 different veterinary doctors were each provided with a questionnaire to investigate the knowledge, attitudes, and practices on the use of Extra-corporeal shockwave therapy (ESWT).

Demographics

Variable	Levels	Frequency n (%)
Institution of qualification	In South Africa	39 (81.25)
	Outside South Africa	9 (18.75)
Age group	18 – 25	0
	26 – 35	12 (25.00)
	36 – 50	23 (47.92)
	>50	13 (27.08)
How many years in practice	<1 year	0
	2 – 5 years	6 (12.50)
	6 – 10 years	7 (14.58)
	>11 years	35 (72.92)
What type of practice	Mixed practice	15 (31.25)
	Equine only	33 (68.75)
What is your sex	Male	21 (43.75)
	Female	27 (56.25)

Knowledge descriptive statistics

Six veterinary doctors felt that they lacked adequate knowledge on the topic to continue with the questionnaire, therefore, did not answer the following questions. These are dropped from data for the further analysis.

Question	Answer options	Frequency n (%)
Original use of ESWT was used in human medicine	Strongly agree	19 (45.24)
	Agree	19 (45.24)
	I do not know	0
	Disagree	1 (2.38)
	Strongly disagree	0
	N/A	3 (7.14)
The current use of ESWT is based on understanding that it has regenerative effect	Strongly agree	5 (11.90)
	Agree	29 (69.05)
	I do not know	5 (11.90)
	Disagree	1 (2.38)
	Strongly disagree	0
	N/A	2 (4.76)
The standard protocol for ESWT on tendon and ligaments is 3 sessions, 2 weeks apart	Strongly agree	3 (7.14)
	Agree	29 (69.05)
	I do not know	5 (11.90)
	Disagree	0
	Strongly disagree	0
	N/A	5 (11.90)
The current protocol used for treatment of tendons and	Strongly agree	2 (4.76)
	Agree	15 (35.71)
	I do not know	10 (23.81)

ligaments is based on extensive scientific research	Disagree	3 (7.14)
	Strongly disagree	0
	N/A	12 (28.57)
The principle physiological effect of ESWT is a mechanical force resulting in tissue cavitation	Strongly agree	2 (4.76)
	Agree	20 (47.62)
	I do not know	7 (16.67)
	Disagree	5 (11.90)
	Strongly disagree	0
	N/A	8 (19.05)
ESWT has the most usage with treating tendons/ligaments	Strongly agree	2 (4.76)
	Agree	22 (52.38)
	I do not know	13 (30.95)
	Disagree	3 (3.14)
	Strongly disagree	0
	N/A	2 (4.76)
ESWT induces a strong analgesic effect in injured tendons	Strongly agree	4 (9.52)
	Agree	21 (50)
	I do not know	12 (28.57)
	Disagree	1 (2.38)
	Strongly disagree	0
	N/A	4 (9.52)
ESWT increases vascularization in damaged tissue on which it is applied	Strongly agree	5 (11.90)
	Agree	33 (78.57)
	I do not know	0
	Disagree	0
	Strongly disagree	0
	N/A	4 (9.52)
There is meaningful angiogenesis in tendons/ligaments of equines treated with ESWT.	Strongly agree	1 (2.38)
	Agree	28 (66.67)
	I do not know	2 (4.76)
	Disagree	0
	Strongly disagree	0
	N/A	11 (26.19)
The radial ESWT soundwave is more powerful than the focused ESWT soundwave	Strongly agree	0
	Agree	4 (9.52)
	I do not know	22 (52.38)
	Disagree	6 (14.29)
	Strongly disagree	0
	N/A	10 (23.81)
Radial waves are generated by a pneumatic force	Strongly agree	5 (11.90)
	Agree	25 (59.52)
	I do not know	1 (2.38)
	Disagree	0
	Strongly disagree	0
	N/A	11 (26.19)
Focused waves are generated by an electric	Strongly agree	5 (11.90)
	Agree	20 (47.62)
	I do not know	2 (4.76)
	Disagree	0
	Strongly disagree	0
	N/A	15 (35.71)
Radial ESWT, when compared to Focused	Strongly agree	6 (14.29)
	Agree	22 (52.38)

	I do not know	2 (4.76)
ESWT is a less specific/accurate targeted wave.	Disagree	0
	Strongly disagree	0
	N/A	12 (28.57)
Use of the focussed ESWT machine on tendons/ligaments must be be done in conjunction with ultrasound analysis.	Strongly agree	12 (28.57)
	Agree	21 (50)
	I do not know	5 (11.90)
	Disagree	0
	Strongly disagree	0
	N/A	4 (9.52)
Overuse of waves from the Focussed ESWT cannot cause injury to healthy tissue	Strongly agree	1 (2.38)
	Agree	7 (16.67)
	I do not know	19 (45.24)
	Disagree	6 (14.29)
	Strongly disagree	0
	N/A	9 (21.43)
Through overuse, waves from the Radial ESWT can cause injury to healthy tissue	Strongly agree	5 (11.90)
	Agree	15 (35.71)
	I do not know	7 (16.67)
	Disagree	1 (2.38)
	Strongly disagree	0
	N/A	14 (33.33)
The bar pressure for the focussed ESWT waves are 10-100 times greater than radial waves	Strongly agree	2 (4.76)
	Agree	15 (35.71)
	I do not know	2 (4.76)
	Disagree	0
	Strongly disagree	0
	N/A	23 (54.76)
The Fédération Éxquestre Internationale (FEI) and the Jockey Club's ruling of banning ESWT prior to sporting events is based on specific scientific research.	Strongly agree	4 (9.52)
	Agree	20 (47.62)
	I do not know	8 (19.05)
	Disagree	1 (2.38)
	Strongly disagree	0
	N/A	9 (21.43)

Attitude descriptive statistics

Questions	Answer Options	Frequency n (%)
I have no problem recommending ESWT is for the treatment of equine tendons/ligaments.	Strongly agree	17 (40.48)
	Agree	19 (45.24)
	I do not know	2 (4.76)
	Disagree	2 (4.76)
	Strongly disagree	0
	N/A	2 (4.76)
ESWT is effective in treating equine Kissing spine	Strongly agree	9 (21.43)
	Agree	22 (52.38)
	I do not know	7 (16.67)
	Disagree	2 (4.76)
	Strongly disagree	1 (2.38)
	N/A	1 (2.38)
ESWT is effective in treating equine navicular disease	Strongly agree	1 (2.38)
	Agree	11 (26.19)

	I do not know	16 (38.10)
	Disagree	11 (26.19)
	Strongly disagree	1 (2.38)
	N/A	2 (4.76)
ESWT can be used as an adjunct in the treatment protocol of degenerative joint disease.	Strongly agree	2 (4.76)
	Agree	24 (57.14)
	I do not know	10 (23.81)
	Disagree	4 (9.52)
	Strongly disagree	2 (4.76)
	N/A	0
Between the Radial ESWT and the Focussed ESWT, the Radial ESWT is the preferred of the two.	Strongly agree	2 (4.76)
	Agree	8 (19.05)
	I do not know	10 (23.81)
	Disagree	14 (33.33)
	Strongly disagree	4 (9.52)
	N/A	4 (9.52)
It is important to keep up to date with the current scientific research on equine ESWT.	Strongly agree	16 (38.10)
	Agree	23 (54.76)
	I do not know	1 (2.38)
	Disagree	0
	Strongly disagree	0
	N/A	2 (4.76)
There is no difference between the Radial and focused ESWT treatments and as a result, they can be used on the same types of injuries.	Strongly agree	0
	Agree	2 (4.76)
	I do not know	5 (11.90)
	Disagree	22 (52.38)
	Strongly disagree	13 (30.95)
	N/A	0
Most equine practises should have access to ESWT as part of the treatment protocol for treating injured horses.	Strongly agree	9 (21.43)
	Agree	23 (54.76)
	I do not know	5 (11.90)
	Disagree	3 (7.14)
	Strongly disagree	0
	N/A	2 (4.76)
The ESWT machine can be used to treat chronic tendon and ligament injuries	Strongly agree	6 (14.29)
	Agree	29 (69.05)
	I do not know	6 (14.29)
	Disagree	1 (2.38)
	Strongly disagree	0
	N/A	0

Practices descriptive statistics

Questions	Answer Options	Frequency n (%)
Our practice owns a shockwave machine	Strongly agree	10 (23.81)
	Agree	31 (73.81)
	I do not know	0
	Disagree	0
	Strongly disagree	0
	N/A	1 (2.38)
I prefer referring cases that require treatment with	Strongly agree	11 (26.19)
	Agree	20 (47.62)

ESWT than handle them myself.	I do not know	0
	Disagree	4 (9.52)
	Strongly disagree	3 (7.14)
	N/A	4 (9.52)
Cases presented with tendon injuries to our practices are always/often treated using ESWT.	Strongly agree	5 (11.90)
	Agree	20 (47.62)
	I do not know	2 (4.76)
	Disagree	9 (21.43)
	Strongly disagree	3 (7.14)
	N/A	3 (7.14)
Cases presented to our practice with Kissing Spine injuries are usually treated with ESWT	Strongly agree	5 (11.90)
	Agree	14 (33.33)
	I do not know	4 (9.52)
	Disagree	14 (33.33)
	Strongly disagree	2 (4.76)
	N/A	3 (7.14)
I take advantage of analgesic effects of ESWT when treating relevant injuries	Strongly agree	1 (2.38)
	Agree	23 (54.76)
	I do not know	3 (7.14)
	Disagree	7 (16.67)
	Strongly disagree	2 (4.76)
	N/A	6 (14.29)
There is a standard protocol for treatment of all tendon/ligament injuries using the ESWT.	Strongly agree	2 (4.76)
	Agree	16 (38.10)
	I do not know	8 (19.05)
	Disagree	11 (26.19)
	Strongly disagree	3 (7.14)
	N/A	2 (4.76)
My recommendation for treatment of equine injuries using radial and focused ESWT varies depending on the injury and/or issue	Strongly agree	6 (14.29)
	Agree	27 (64.29)
	I do not know	2 (4.76)
	Disagree	2 (4.76)
	Strongly disagree	0
	N/A	5 (11.90)
In our practice we generally follow the recommended protocol of 3 sessions 2 weeks apart.	Strongly agree	7 (16.67)
	Agree	19 (45.24)
	I do not know	3 (7.14)
	Disagree	6 (14.29)
	Strongly disagree	1 (2.38)
	N/A	6 (14.29)

Knowledge Cronbach alpha coefficient

We used a Cronbach alpha coefficient to assess the reliability of each section of questions in the questionnaire. Cronbach's alpha evaluates whether the questions within a test are consistent in measuring the same thing, i.e., knowledge and attitude. It ranges from 0 to 1, with higher values indicating greater internal consistency. Alpha coefficient 0.6 and greater indicated that generally, all items in the section assess the same construct.

The scoring for each question is given by,

Levels	Scale measurement
Strongly disagree	0
Disagree	1
Agree	2
Strongly agree	3
Don't know / Not applicable	-

As observed in the tabulated screenshot below, the following 12 questions out of 18 from Section B are consistent (alpha = 0.6012) in measuring knowledge among the veterinary doctors. These 12 questions are used to calculate the mean knowledge score for everyone.

```
                                                    Average
                              Item-test   Item-rest  interitem
Item            Obs   Sign   correlation  correlation covariance    alpha

SB7             39     -       0.6105      0.4707    .0310665      0.4989
SB8             40     -       0.4164      0.2238    .036632       0.5395
SB9             37     -       0.3184      0.2097    .0448706      0.5850
SB11            34     -       0.1892     -0.0315    .0448542      0.6188
SB16            32     +       0.2405      0.0927    .0498577      0.6218
SB17            31     -       0.4244      0.3145    .043692       0.5776
SB18            27     -       0.5454      0.4230    .0385234      0.5486
SB19            30     -       0.4298      0.2988    .0402342      0.5598
SB21            33     +       0.4478      0.2141    .0411575      0.5835
SB22            28     +       0.4929      0.2739    .0456531      0.6129
SB23            19     -       0.3593      0.2282    .0438561      0.5849
SB24            33     +       0.3478      0.0625    .045374       0.6061

Test scale                                          .0421834      0.6012
```

The average knowledge score among the respondents is calculated using the questions above is 1.8832, which is approximately 62.77% (1.8832 / 3)

Attitude Cronbach alpha coefficient

As observed in the table below, the following 8 questions out of 9 from Section C are consistent (alpha = 0.6117) in measuring attitudes of veterinary doctors towards EWST. These 8 questions are used to calculate the average attitude scores.

```
                                              Average
                         Item-test   Item-rest   interitem
Item          Obs  Sign  correlation correlation covariance      alpha

SC25           38    -      0.5614      0.3153    .0516442       0.5660
SC26           34    -      0.7218      0.5286    .0398263       0.5004
SC27           24    -      0.5880      0.3423    .046096        0.5386
SC28           32    -      0.3288      0.0237    .0604076       0.6184
SC30           39    -      0.4143      0.1276    .0604673       0.5970
SC31           37    +      0.5695      0.3590    .0546856       0.5788
SC32           35    -      0.6293      0.4070    .0508655       0.5573
SC33           36    -      0.1474     -0.0289    .0742505       0.6491

Test scale                                       .0546699       0.6117
```

The mean attitude score among the respondents is calculated using the questions above is 2.1476. Therefore, the average attitude score is approximately 71.59% (2.1476 / 3).

Practices Cronbach alpha coefficient

As observed in the table below, the following 4 questions out of 8 from Section D are consistent (alpha = 0.6002) in measuring practices of veterinary doctors towards EWST. These 4 questions are used to calculate the average practice scores.

```
                                              Average
                         Item-test   Item-rest   interitem
Item          Obs  Sign  correlation correlation covariance      alpha

SD36           37    -      0.8213      0.6017    .0726321       0.3560
SD37           35    -      0.8048      0.5450    .1020819       0.4552
SD40           35    -      0.6024      0.3768    .1738031       0.5433
SD41           33    -      0.5746      0.1570    .2098944       0.6775

Test scale                                       .1404245       0.6002
```

The mean practice score among the respondents is calculated using the questions above is 1.8435. Therefore, the average practice score is approximately 61.45% (1.8435 / 3).

Association analysis

Two sample T-test and ANOVA tests are used to test for the difference in mean scores (knowledge, attitude, and practices) between different demographic groups.

Knowledge scores t-test

Ho: There is no difference in the means of the two groups. ($\mu_A = \mu_B$)

Ha: The means of the two groups differ. ($\mu_A \neq \mu_B$)

Variable		Knowledge mean scores	P-value
Institution	Inside South Africa	1.8976	0.5120
	Outside South Africa	1.8110	
Practice Type	Mixed practice	1.9590	0.3569

	Equine only practice	1.8562	
Sex	Male	1.8420	0.4903
	Female	1.9111	

Veterinary doctors who studied inside South Africa on average are more knowledgeable in ESWT than those who studied outside South Africa. Doctors with mixed practices on average are more knowledgeable than doctors with equine only practices. Furthermore, female doctors on average are more knowledgeable than male doctors.

All p-values > 0.05. There is insufficient statistical evidence to reject the null hypothesis. Therefore, the mean knowledge scores differences are not statistically significant between groups.

Knowledge scores ANOVA

Ho: There are no differences in the means of the groups. In other words, all the groups have the same population mean.

Ha: At least one of the groups means differs significantly from the others.

	Variable	Knowledge mean scores	P-value
Age	26 – 35	1.8437	0.5661
	36 – 50	1.8631	
	>50	1.9826	
Practice years	2-5 years	1.7586	0.5877
	6-10 years	1.9035	
	>11 years	1.9040	

Older veterinary doctors on average are more knowledgeable on ESWT compared to younger doctors. Doctors with more years of experience on average are also more knowledgeable compared to doctors with fewer years of experience.

P-values >0.05. There is insufficient statistical evidence to reject the null hypothesis. Therefore, these observed differences in knowledge are not statistically significant.

Note: Considering a multiple linear regression model, none of the demographic variables are significant in the model and therefore not reported.

Attitude score t-test

	Variable	Attitude mean scores	P-value
Institution	Inside South Africa	2.1398	0.1621
	Outside South Africa	2.3206	
Practice Type	Mixed practice	2.2464	0.3802
	Equine only practice	2.1462	
Sex	Male	2.0412	0.0222
	Female	2.2624	

Veterinary doctors who studied outside South Africa on average have a better attitude towards ESWT than those who studied inside South Africa. Doctors with mixed practices on average have a better attitude towards ESWT than doctors with equine only practices. Furthermore, female doctors on average have a better attitude than male doctors.

P-value from the sex t-test < 0.05. There is sufficient evidence to reject the null hypothesis. Therefore, the attitude mean scores statistically differs between male (2.0412) and females (2.2624).

Attitude score ANOVA.

	Variable	Attitude mean scores	P-value
Age	26 – 35	2.2798	0.3287
	36 – 50	2.1414	
	>50	2.0903	
Practice years	2-5 years	2.0179	0.4299
	6-10 years	2.2153	
	>11 years	2.1931	

Younger veterinary doctors on average have a better attitude towards ESWT compared to older doctors. Doctors with 6-10 years of experience on average have a better attitude towards ESWT as compared to doctors with 2-5 and >11 years of experience.

P-values >0.05. There is insufficient statistical evidence to reject the null hypothesis. Therefore, these observed differences in attitude are not statistically significant.

Practice score t-test (Or Mann Whitney test)

	Variable	Attitude mean scores	P-value
Institution	Inside South Africa	1.8429	0.9861
	Outside South Africa	1.8472	
Practice Type	Mixed practice	1.875 (Median score)	0.9386 (Mann Whitney test)
	Equine only practice	1.75 (Median score)	
Sex	Male	1.7206	0.2393
	Female	1.9305	

Veterinary doctors who studied outside South Africa on average have the same ESWT practice score compared to those who studied inside South Africa. Female doctors on average have a higher practice score than male doctors.

The t-test assumption i.e., equal variances between the two groups, is not met for the comparison between veterinary doctors with a mixed practice and those with equine only practice. Therefore, we use a non-parametric, Mann Whiteny test. Doctors with mixed practices have a higher ESWT median practice score compared to doctors with equine only practices.

P-values >0.05. There is insufficient statistical evidence to reject the null hypothesis. Therefore, these observed differences in practice are not statistically significant.

Practice score ANOVA.

	Variable	Attitude mean scores	P-value
Age	26 – 35	2	0.4551
	36 – 50	1.7421	
	>50	1.8889	
Practice years	2-5 years	1.875	0.6215
	6-10 years	2.0417	
	>11 years	1.7960	

Younger veterinary doctors on average have a better ESWT practices compared to older doctors. Doctors with 6-10 years of experience on average have a better ESWT practices as compared to doctors with 2-5 and >11 years of experience.

P-values >0.05. There is insufficient statistical evidence to reject the null hypothesis. Therefore, these observed differences in attitude are not statistically significant.

Regression Analysis

Multiple Linear regression for attitude scores.

Variable	Categories	Coefficient	P-value	95% Conf Int	
Institution	In SA	**Ref**			
	Outside SA	0.2435	0.029	0.0265	0.4605
Age	26 – 35	**Ref**			
	36 – 50	-0.5607	0.000	-0.8229	-0.2985
	>50	-0.5586	0.001	-0.8693	-0.2479
Practice years	2-5 years	**Ref**			
	6-10 years	0.4686	0.003	0.1749	0.7622
	>11 years	0.7653	0.000	0.4477	1.0829
Sex	Male	**Ref**			
	Female	0.2249	0.004	0.0749	0.3748

Interpretation

- Veterinary doctors who studied outside South Africa on average have higher attitude scores by 0.243 units compared to veterinary doctors who studied inside South Africa adjusting for age, practice years and sex. The p-value < 0.05 therefore, institution is significant in the model.

- Older veterinary doctors (36-50 & >50) on average have lower attitude scores (by 0.5607 and 0.5586 respectively) compared to younger doctors (26-35 years) adjusting for institution, practice years and sex. From a Wald test for significance, p-value = 0.0005 and therefore age is significant in the model.

- An increase in practice years corresponds to an increase in average attitude scores towards ESWT. Veterinary doctors who have practiced for 6-10 years and >11 years have higher average attitude scores by 0.4686 and 0.7653 units respectively compared to doctors with 2-5 practice years, adjusting for institution, age, and sex. From a Wald test for significance, p-value = 0.0001 and therefore practice years is significant in the model.

- Female veterinary doctors on average have higher attitude scores by 0.2249 units compares to male veterinary doctors adjusting for institution, age, and practice years. P-value < 0.05 therefore, sex is significant in the model.

Post estimation tests.

The linear regression model assumes:

- Constant variance of residuals
- Normality of residuals

Test for constant variance assumption.


Scatter plot of residuals against predicted values
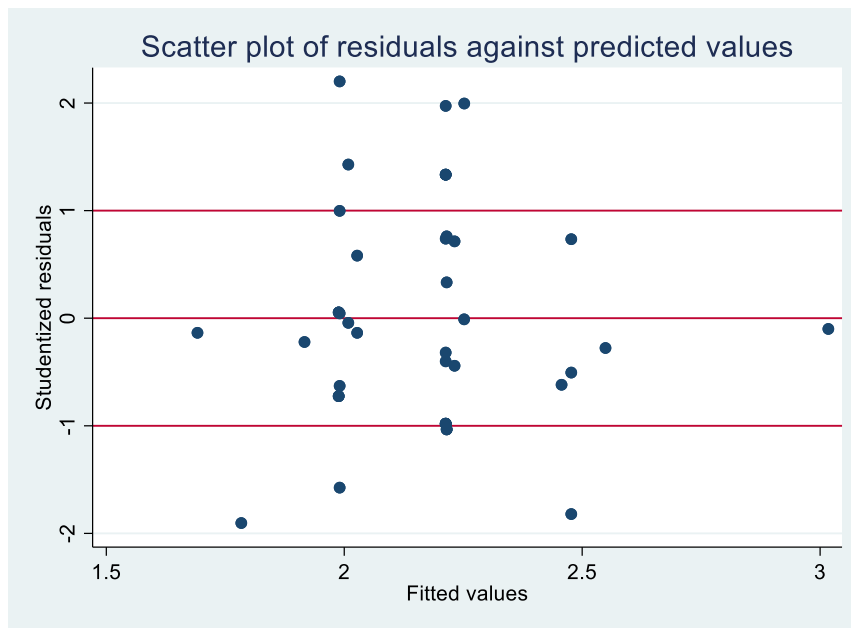
From the scatter plot above, the points are randomly scattered without a sort of pattern and therefore we can conclude heteroskedasticity of residuals (constant variance).

Cook-Weisberg test.
Also, using a Cook-Weisberg test for heteroskedasticity, **p-value = 0.6571**. There is insufficient evidence to reject the null hypothesis of constant variance. Therefore, from the scatter plot and the Cook-Weisberg test we can conclude that the residuals constant variance assumption is met.

Test for normality of residuals.

Q-Q plot for studentized residuals
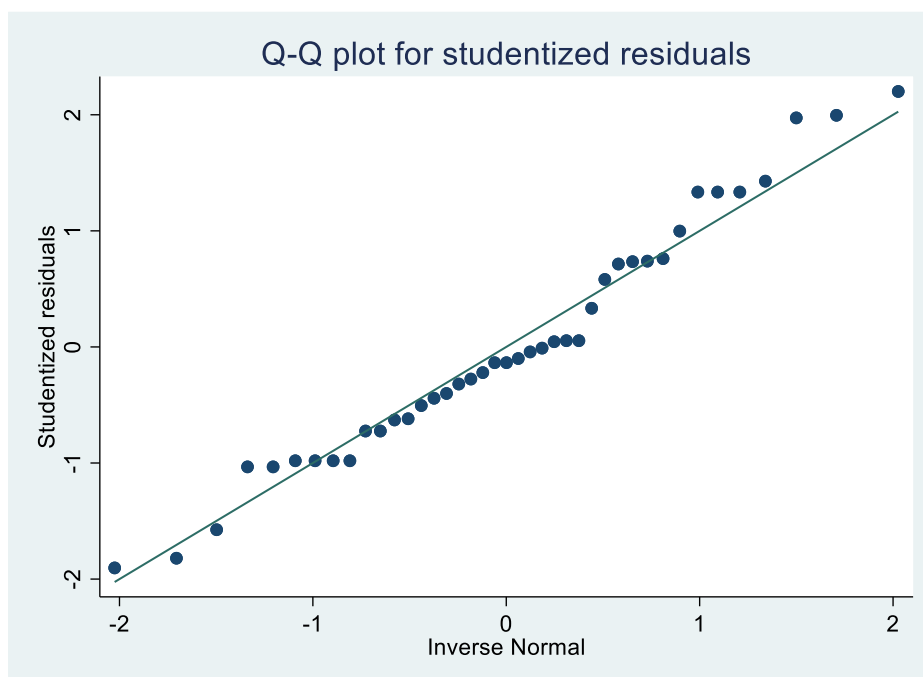
From the Q-Q plot for residuals above, we can assume that the residuals are approximately normally distributed.