# Multivariate analysis of pharmacy factors

One pharmacy owner only answered the initial online survey (not the subsequent survey), therefore data for opening hours, number of professional services, pharmacy size in m2, financial turnover in 2007/08, banner group membership, catering for an aged care facility and whether they have had a pre-registration pharmacist in the last 2 years was missing. A different pharmacy did not receive a site visit, therefore data for collecting prescription details/payments and number of dispensing terminals was missing.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | N | Mean | Std. Deviation | Missing | | No. of Extremesa | |
| Count | Percent | Low | High |
| LogCIRate | 185 | -0.667 | 0.434 | 0 | 0.0 | 3 | 0 |
| Actual Prescription Volume | 185 | 12953.790 | 7210.841 | 0 | 0.0 | 0 | 4 |
| Average Pharmacist Workload Per Week | 184 | 479.458 | 196.098 | 1 | 0.5 | 0 | 5 |
| Pharmacy Opening Hours per Week | 184 | 59.220 | 12.496 | 1 | 0.5 | 0 | 4 |
| Total Number of Professional Services Offered | 184 | 6.902 | 2.262 | 1 | 0.5 | 0 | 0 |
| % of time pharmacist collects prescription details from patient | 184 | 25.840 | 25.580 | 1 | 0.5 | 0 | 10 |
| % of time pharmacist collects payment from patient | 184 | 18.510 | 24.029 | 1 | 0.5 | 0 | 10 |
| Location | 185 |  |  | 0 | 0.0 |  |  |
| Pharmacy Size in m2 | 184 |  |  | 1 | 0.5 |  |  |
| Pharmacy $ Turnover in 2007/08 | 184 |  |  | 1 | 0.5 |  |  |
| Member of a Banner Group | 184 |  |  | 1 | 0.5 |  |  |
| Cater for aged care facility | 184 |  |  | 1 | 0.5 |  |  |
| Pharmacy has had a pre-registration pharmacist within the last 2 years | 184 |  |  | 1 | 0.5 |  |  |
| Number of Dispensing Terminals | 184 |  |  | 1 | 0.5 |  |  |
| a. Number of cases outside the range (Q1 - 1.5\*IQR, Q3 + 1.5\*IQR). | | | | | | | |

Table 1: Missing value analysis

# Proving assumptions

For dichotomous variables (including dummy coded variables), a split of less than 90/10 was desirable, otherwise the influence of the values in the smaller group can be influential. Binary variables all appeared to be acceptable. The following factors had equal to or less than 90/10 split, therefore could be used as grounds for exclusion at a later date.

* Medical centre (17; 9.2%) vs other (168; 92.8%)
* Participates in additional pharmacy trials (170; 92.4%) vs non-participants (14; 7.6%)
* Provides 3 or more professional services (162; 88.0%) vs 0-2 professional services (22; 12.0%)

Several continuous variables also had non-normal distribution.

1. Actual prescription volume - *Kolmogorov-Smirnov D*(185) = 0.145, *p* < 0.001; *Shapiro-Wilk F*(185) = 0.919, *p* < 0.001; improved with a log transformation (*Kolmogorov-Smirnov D*(185) = 0.052, *p* =0.020; *Shapiro-Wilk F*(185) = 0.990, *p* = 0.020). However, the decision was made to separate this variable into a categorical variable to improve its performance within the model.
2. Average pharmacist workload - *Kolmogorov-Smirnov D*(184) = 0.059, *p* = 0.020; *Shapiro-Wilk F*(184) = 0.959, *p* < 0.001; not greatly improved with a log transformation (*Kolmogorov-Smirnov D*(184) = 0.064, *p* = 0.063; *Shapiro-Wilk F*(184) = 0.979, *p* = 0.007), therefore the variable was converted to a categorical variable.
3. Pharmacy opening hours per week - *Kolmogorov-Smirnov D*(184) = 0.141, *p* < 0.001; *Shapiro-Wilk F*(184) = 0.903, *p* < 0.001; not improved with a log transformation (*Kolmogorov-Smirnov D*(184) = 0.107, *p* < 0.001; *Shapiro-Wilk F*(184) = 0.948, *p* < 0.001), therefore the variable was converted to a binary variable – ‘conventional’ vs ‘extended trade’.
4. Total number of professional services offered - *Kolmogorov-Smirnov D*(184) = 0.126, *p* < 0.001; *Shapiro-WilkF*(184) = 0.973, *p* < 0.001, however the histogram appeared normal. Not greatly improved with a log transformation (*Kolmogorov-Smirnov D*(184) = 0.064, *p* = 0.063; *Shapiro-Wilk F*(184) = 0.979, *p* = 0.007), therefore the variable was converted to a binary variable – ‘0-2 services’ vs ‘3 or more services’.
5. Percentage of time the pharmacist collects prescription details and collects payment - *Kolmogorov-Smirnov D*(184) = 0.200, *p*< 0.001 and *Shapiro-Wilk F*(184) = 0.845, *p* < 0.001; *Kolmogorov-Smirnov D*(184) = 0.274, *p*< 0.001; *Shapiro-Wilk F*(184) = 0.763, *p* < 0.001 respectively, however there were a large number of zeros within the variable (for example, many pharmacists collected prescription details and payment 0% of the time), therefore transformation was not attempted. Variable was converted to a binary variable – ‘high’ vs ‘low’ patient contact time.

# Model 1 (tables)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Summaryg** | | | | | | | | | | |
| **Model** | **R** | **R Square** | **Adjusted R Square** | **Std. Error of the Estimate** | **Change Statistics** | | | | | **Durbin-Watson** |
| **R2 Change** | **F Change** | **df1** | **df2** | **Sig. F Change** |
| **1** | .208a | 0.043 | 0.038 | 0.415436 | 0.043 | 8.157 | 1 | 181 | 0.005 |  |
| **2** | .269b | 0.072 | 0.062 | 0.410204 | 0.029 | 5.646 | 1 | 180 | 0.019 |  |
| **3** | .307c | 0.094 | 0.079 | 0.406417 | 0.022 | 4.37 | 1 | 179 | 0.038 |  |
| **4** | .330d | 0.109 | 0.089 | 0.404325 | 0.014 | 2.857 | 1 | 178 | 0.093 |  |
| **5** | .361e | 0.13 | 0.106 | 0.400497 | 0.022 | 4.419 | 1 | 177 | 0.037 |  |
| **6** | .381f | 0.145 | 0.116 | 0.39821 | 0.015 | 3.039 | 1 | 176 | 0.083 | 1.799 |
| a. Predictors: (Constant), Caters for aged care | | | | | | | | | | |
| b. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2 | | | | | | | | | | |
| c. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload | | | | | | | | | | |
| d. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload, Pharmacy$Turnover 1.5to2.5M | | | | | | | | | | |
| e. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload, Pharmacy$Turnover 1.5to2.5M, Pharmacy$Turnover 2.5to4.0M | | | | | | | | | | |
| f. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload, Pharmacy$Turnover 1.5to2.5M, Pharmacy$Turnover 2.5to4.0M, Participates in pharmacy trials | | | | | | | | | | |
| g. Dependent Variable: Log CI Rate | | | | | | | | | | |

Table 2: Stepwise regression model for all variables

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **ANOVAg** | | | | | | |  |
| **Model** | | **Sum of Squares** | **df** | **Mean Square** | **F** | **Sig.** |
| **1** | **Regression** | 1.408 | 1 | 1.408 | 8.157 | .005a |
| **Residual** | 31.238 | 181 | 0.173 |  |  |
| **Total** | 32.646 | 182 |  |  |  |
| **2** | **Regression** | 2.358 | 2 | 1.179 | 7.006 | .001b |
| **Residual** | 30.288 | 180 | 0.168 |  |  |
| **Total** | 32.646 | 182 |  |  |  |
| **3** | **Regression** | 3.08 | 3 | 1.027 | 6.215 | .000c |
| **Residual** | 29.566 | 179 | 0.165 |  |  |
| **Total** | 32.646 | 182 |  |  |  |
| **4** | **Regression** | 3.547 | 4 | 0.887 | 5.424 | .000d |
| **Residual** | 29.099 | 178 | 0.163 |  |  |
| **Total** | 32.646 | 182 |  |  |  |
| **5** | **Regression** | 4.256 | 5 | 0.851 | 5.306 | .000e |
| **Residual** | 28.39 | 177 | 0.16 |  |  |
| **Total** | 32.646 | 182 |  |  |  |
| **6** | **Regression** | 4.737 | 6 | 0.79 | 4.979 | .000f |
| **Residual** | 27.908 | 176 | 0.159 |  |  |
| **Total** | 32.646 | 182 |  |  |  |
| a. Predictors: (Constant), Caters for aged care | | | | | | | |
| b. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2 | | | | | | | |
| c. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload | | | | | | | |
| d. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload, Pharmacy$Turnover 1.5to2.5M | | | | | | | |
| e. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload, Pharmacy$Turnover 1.5to2.5M, Pharmacy$Turnover 2.5to4.0M | | | | | | | |
| f. Predictors: (Constant), Caters for aged care, Pharmacy area 150 to 250m2, High Pharmacist Workload, Pharmacy$Turnover 1.5to2.5M, Pharmacy$Turnover 2.5to4.0M, Participates in pharmacy trials | | | | | | | |
| g. Dependent Variable: Log CI Rate | | | | | | | |

Table 3: ANOVAs for stepwise regression model for all variables

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model** | | **Unstandardised Coefficients** | | **Standardised Coefficients** | **t** | **Sig.** | **95.0% Confidence Interval for B** | | **Correlations** | | | **Collinearity Statistics** | |
| **B** | **Std. Error** | **Beta** | **Lower Bound** | **Upper Bound** | **Zero-order** | **Partial** | **Part** | **Tolerance** | **VIF** |
| **1** | **(Constant)** | -0.595 | 0.038 |  | -15.748 | 0.000 | -0.669 | -0.520 |  |  |  |  |  |
| **Caters for aged care** | -0.185 | 0.065 | -0.208 | -2.856 | 0.005 | -0.313 | -0.057 | -0.208 | -0.208 | -0.208 | 1.000 | 1.000 |
| **2** | **(Constant)** | -0.567 | 0.039 |  | -14.539 | 0.000 | -0.644 | -0.490 |  |  |  |  |  |
| **Caters for aged care** | -0.159 | 0.065 | -0.178 | -2.451 | 0.015 | -0.288 | -0.031 | -0.208 | -0.18 | -0.176 | 0.972 | 1.029 |
| **Pharmacy area 150 to 250 m2** | -0.184 | 0.077 | -0.173 | -2.376 | 0.019 | -0.337 | -0.031 | -0.203 | -0.174 | -0.171 | 0.972 | 1.029 |
| **3** | **(Constant)** | -0.529 | 0.043 |  | -12.366 | 0.000 | -0.614 | -0.445 |  |  |  |  |  |
| **Caters for aged care** | -0.136 | 0.065 | -0.152 | -2.081 | 0.039 | -0.265 | -0.007 | -0.208 | -0.154 | -0.148 | 0.943 | 1.060 |
| **Pharmacy area 150 to 250 m2** | -0.192 | 0.077 | -0.181 | -2.505 | 0.013 | -0.344 | -0.041 | -0.203 | -0.184 | -0.178 | 0.969 | 1.032 |
| **High Pharmacist Workload** | -0.136 | 0.065 | -0.151 | -2.090 | 0.038 | -0.264 | -0.008 | -0.172 | -0.154 | -0.149 | 0.970 | 1.031 |
| **4** | **(Constant)** | -0.500 | 0.046 |  | -10.874 | 0.000 | -0.591 | -0.409 |  |  |  |  |  |
| **Caters for aged care** | -0.139 | 0.065 | -0.156 | -2.143 | 0.033 | -0.268 | -0.011 | -0.208 | -0.159 | -0.152 | 0.942 | 1.061 |
| **Pharmacy area 150 to 250 m2** | -0.164 | 0.078 | -0.154 | -2.097 | 0.037 | -0.318 | -0.010 | -0.203 | -0.155 | -0.148 | 0.924 | 1.082 |
| **High Pharmacist Workload** | -0.128 | 0.065 | -0.143 | -1.981 | 0.049 | -0.256 | 0.000 | -0.172 | -0.147 | -0.14 | 0.966 | 1.035 |
| **Pharmacy$Turnover 1.5 to 2.5M** | -0.110 | 0.065 | -0.123 | -1.690 | 0.093 | -0.239 | 0.018 | -0.166 | -0.126 | -0.12 | 0.951 | 1.052 |
| **5** | **(Constant)** | -0.456 | 0.050 |  | -9.089 | 0.000 | -0.555 | -0.357 |  |  |  |  |  |
| **Caters for aged care** | -0.123 | 0.065 | -0.138 | -1.892 | 0.060 | -0.251 | 0.005 | -0.208 | -0.141 | -0.133 | 0.929 | 1.077 |
| **Pharmacy area 150 to 250 m2** | -0.133 | 0.079 | -0.126 | -1.692 | 0.092 | -0.289 | 0.022 | -0.203 | -0.126 | -0.119 | 0.893 | 1.120 |
| **High Pharmacist Workload** | -0.130 | 0.064 | -0.145 | -2.031 | 0.044 | -0.257 | -0.004 | -0.172 | -0.151 | -0.142 | 0.966 | 1.036 |
| **Pharmacy$Turnover 1.5 to 2.5M** | -0.169 | 0.070 | -0.188 | -2.401 | 0.017 | -0.308 | -0.030 | -0.166 | -0.178 | -0.168 | 0.801 | 1.249 |
| **Pharmacy$Turnover 2.5 to 4.0M** | -0.168 | 0.080 | -0.163 | -2.102 | 0.037 | -0.326 | -0.010 | -0.124 | -0.156 | -0.147 | 0.818 | 1.222 |
| **6** | **(Constant)** | -0.277 | 0.114 |  | -2.423 | 0.016 | -0.502 | -0.051 |  |  |  |  |  |
| **Caters for aged care** | -0.118 | 0.065 | -0.133 | -1.830 | 0.069 | -0.246 | 0.009 | -0.208 | -0.137 | -0.128 | 0.927 | 1.079 |
| **Pharmacy area 150 to 250 m2** | -0.118 | 0.079 | -0.111 | -1.491 | 0.138 | -0.273 | 0.038 | -0.203 | -0.112 | -0.104 | 0.881 | 1.135 |
| **High Pharmacist Workload** | -0.117 | 0.064 | -0.130 | -1.824 | 0.07 | -0.244 | 0.010 | -0.172 | -0.136 | -0.127 | 0.952 | 1.050 |
| **Pharmacy$Turnover 1.5 to 2.5M** | -0.185 | 0.071 | -0.206 | -2.624 | 0.009 | -0.325 | -0.046 | -0.166 | -0.194 | -0.183 | 0.787 | 1.271 |
| **Pharmacy$Turnover 2.5 to 4.0M** | -0.171 | 0.079 | -0.165 | -2.146 | 0.033 | -0.327 | -0.014 | -0.124 | -0.16 | -0.15 | 0.818 | 1.222 |
| **Participates in pharmacy trials** | -0.197 | 0.113 | -0.124 | -1.743 | 0.083 | -0.420 | 0.026 | -0.145 | -0.13 | -0.122 | 0.958 | 1.043 |
| a. Dependent Variable: Log CI Rate | | | | | | | | | | | | | |

Table 4: Coefficients for stepwise regression model for all variables

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Casewise Diagnosticsa** | | | | |
| **Case Number** | **Std. Residual** | **LogCIRate** | **Predicted Value** | **Residual** |
| **185** | -3.071 | -2.000 | -0.777 | -1.223 |
| a. Dependent Variable: Log CI Rate | | | | |

Table 5: Outlying case for model 1

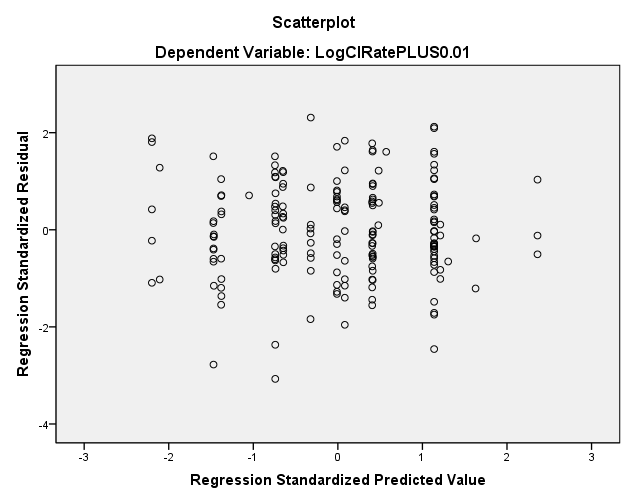


Figure 1: Residual plot for model 1 (the clumps of data are likely due to all the included variables being of a binary nature)

# Model 2 (tables)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Summaryf** | | | | | | | | | | |
| **Model** | **R** | **R Square** | **Adjusted R Square** | **Std. Error of the Estimate** | **Change Statistics** | | | | | **Durbin-Watson** |
| **R2 Change** | **F Change** | **df1** | **df2** | **Sig. F Change** |
| **1** | .258a | 0.067 | 0.061 | 0.410296 | 0.067 | 12.925 | 1 | 181 | 0 |  |
| **2** | .313b | 0.098 | 0.088 | 0.404516 | 0.031 | 6.21 | 1 | 180 | 0.014 |  |
| **3** | .345c | 0.119 | 0.104 | 0.400788 | 0.021 | 4.365 | 1 | 179 | 0.038 |  |
| **4** | .368d | 0.136 | 0.116 | 0.39812 | 0.017 | 3.407 | 1 | 178 | 0.067 |  |
| **5** | .386e | 0.149 | 0.125 | 0.396173 | 0.013 | 2.754 | 1 | 177 | 0.099 | 1.811 |
| a. Predictors: (Constant), Pharmacy$Turnover 1.5to4.0M | | | | | | | | | | |
| b. Predictors: (Constant), Pharmacy$Turnover 1.5to4.0M, Caters for aged care | | | | | | | | | | |
| c. Predictors: (Constant), Pharmacy$Turnover 1.5to4.0M, Caters for aged care, Participates in pharmacy trials | | | | | | | | | | |
| d. Predictors: (Constant), Pharmacy$Turnover 1.5to4.0M, Caters for aged care, Participates in pharmacy trials, Location in a medical centre | | | | | | | | | | |
| e. Predictors: (Constant), Pharmacy$Turnover 1.5to4.0M, Caters for aged care, Participates in pharmacy trials, Location in a medical centre, High Pharmacist Workload | | | | | | | | | | |
| f. Dependent Variable: Log CI Rate | | | | | | | | | | |

Table 6: Stepwise regression model 2

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | | | | | | | | |
| **Model** | | **Unstandardized Coefficients** | | **Standardized Coefficients** | **t** | **Sig.** | **95.0% Confidence Interval for B** | | **Correlations** | | | **Collinearity Statistics** | |
| **B** | **Std. Error** | **Beta** | **Lower Bound** | **Upper Bound** | **Zero-order** | **Partial** | **Part** | **Tolerance** | **VIF** |
| **1** | **(Constant)** | -0.539 | 0.045 |  | -12.044 | 0.000 | -0.628 | -0.451 |  |  |  |  |  |
| **Pharmacy$Turnover 1.5 to 4.0M** | -0.219 | 0.061 | -0.258 | -3.595 | 0.000 | -0.339 | -0.099 | -0.258 | -0.258 | -0.258 | 1.000 | 1.000 |
| **2** | **(Constant)** | -0.496 | 0.047 |  | -10.446 | 0.000 | -0.589 | -0.402 |  |  |  |  |  |
| **Pharmacy$Turnover 1.5 to 4.0M** | -0.200 | 0.060 | -0.236 | -3.302 | 0.001 | -0.319 | -0.080 | -0.258 | -0.239 | -0.234 | 0.984 | 1.016 |
| **Caters for aged care** | -0.159 | 0.064 | -0.178 | -2.492 | 0.014 | -0.284 | -0.033 | -0.208 | -0.183 | -0.176 | 0.984 | 1.016 |
| **3** | **(Constant)** | -0.279 | 0.114 |  | -2.442 | 0.016 | -0.504 | -0.054 |  |  |  |  |  |
| **Pharmacy$Turnover 1.5 to 4.0M** | -0.208 | 0.060 | -0.246 | -3.469 | 0.001 | -0.327 | -0.090 | -0.258 | -0.251 | -0.243 | 0.979 | 1.021 |
| **Caters for aged care** | -0.148 | 0.063 | -0.165 | -2.331 | 0.021 | -0.273 | -0.023 | -0.208 | -0.172 | -0.163 | 0.977 | 1.023 |
| **Participates in other pharmacy trials** | -0.234 | 0.112 | -0.147 | -2.089 | 0.038 | -0.455 | -0.013 | -0.145 | -0.154 | -0.147 | 0.990 | 1.011 |
| **4** | **(Constant)** | -0.294 | 0.114 |  | -2.590 | 0.010 | -0.518 | -0.070 |  |  |  |  |  |
| **Pharmacy$Turnover 1.5 to 4.0M** | -0.209 | 0.060 | -0.247 | -3.508 | 0.001 | -0.327 | -0.092 | -0.258 | -0.254 | -0.244 | 0.979 | 1.021 |
| **Caters for aged care** | -0.135 | 0.063 | -0.151 | -2.125 | 0.035 | -0.259 | -0.010 | -0.208 | -0.157 | -0.148 | 0.965 | 1.036 |
| **Participates in other pharmacy trials** | -0.240 | 0.111 | -0.151 | -2.158 | 0.032 | -0.460 | -0.021 | -0.145 | -0.160 | -0.150 | 0.989 | 1.012 |
| **Location in/near a medical centre** | 0.188 | 0.102 | 0.129 | 1.846 | 0.067 | -0.013 | 0.390 | 0.145 | 0.137 | 0.129 | 0.987 | 1.013 |
| **5** | **(Constant)** | -0.283 | 0.113 |  | -2.502 | 0.013 | -0.507 | -0.060 |  |  |  |  |  |
| **Pharmacy$Turnover 1.5 to 4.0M** | -0.207 | 0.059 | -0.244 | -3.486 | 0.001 | -0.324 | -0.090 | -0.258 | -0.253 | -0.242 | 0.979 | 1.022 |
| **Caters for aged care** | -0.119 | 0.064 | -0.133 | -1.869 | 0.063 | -0.245 | 0.007 | -0.208 | -0.139 | -0.130 | 0.944 | 1.059 |
| **Participates in other pharmacy trials** | -0.221 | 0.111 | -0.139 | -1.982 | 0.049 | -0.441 | -0.001 | -0.145 | -0.147 | -0.137 | 0.978 | 1.023 |
| **Location in/near a medical centre** | 0.180 | 0.102 | 0.124 | 1.770 | 0.078 | -0.021 | 0.381 | 0.145 | 0.132 | 0.123 | 0.985 | 1.016 |
| **High Pharmacist Workload** | -0.106 | 0.064 | -0.117 | -1.659 | 0.099 | -0.231 | 0.020 | -0.172 | -0.124 | -0.115 | 0.960 | 1.042 |
| a. Dependent Variable: Log CI Rate | | | | | | | | | | | | | |

Table 7: Coefficients for regression model 2

# Model 3 (tables)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Casewise Diagnosticsa** | | | | | |
| **Case Number** | **Std. Residual** | **Log CI Rate** | **Predicted Value** | **Residual** | **Cook’s Distance** |
| 185 | -3.336 | -2.000 | -0.661 | -1.339 | 0.045 |
| a. Dependent Variable: Log CI Rate | | | | |  |

Table 8: Outlying case for model 3

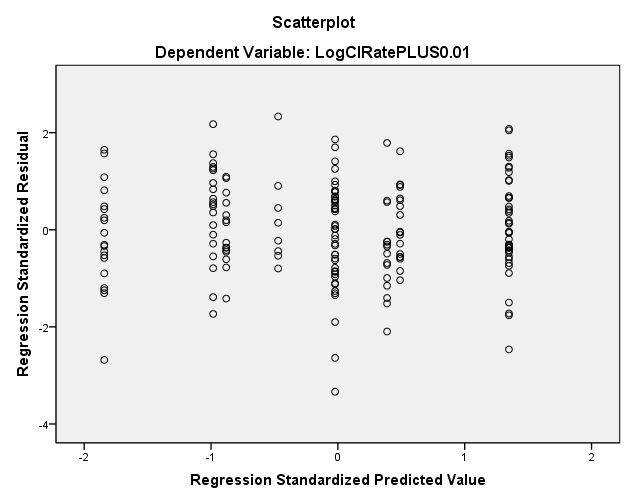


Figure 2: Residuals plot for model 3



Figure 3: Residuals plot for prescription volume model