

Chapter 4

Statistical Modelling

Logistics regression was used to assess the effects of the determinants on the outcomes using treatment contrast. There are two models of this study including the unrest involved victims and the unrest severity involved greater than or equal to 75 percent.

4.1 Logistic regression model

Unrest involved victims

The result after fitting a logistic regression model with all determinants to the outcome are shown in Table 4.1. The reference groups were the first category of the unrest factor.

Table 4.1 Full model of unrest victims

	Estimate	Std. Error	z-value	p-value
Constant	3.032	0.154	19.698	< 0.001
Years				
2004*	0	-	-	-
2005	-0.554	0.107	-5.201	< 0.001
2006	-1.040	0.108	-9.627	< 0.001
2007	-1.267	0.098	-12.953	< 0.001
2008	-0.935	0.115	-8.138	< 0.001
2009	-0.908	0.116	-7.814	< 0.001
2010	-0.813	0.122	-6.661	< 0.001
2011	-0.916	0.126	-7.278	< 0.001
2012	-0.687	0.130	-5.286	< 0.001
2013	-1.117	0.118	-9.453	< 0.001
2014	-0.940	0.133	-7.047	< 0.001
2015	-0.779	0.147	-5.287	< 0.001

	Estimate	Std. Error	z-value	p-value
2016	-0.794	0.159	-4.980	< 0.001
2017	-1.528	0.186	-8.212	< 0.001
Months				
January*	0	-	-	-
February	0.110	-0.527	0.598	0.110
March	0.107	-3.175	0.001	0.107
April	0.104	-3.644	< 0.001	0.104
May	0.106	-4.895	< 0.001	0.106
June	0.105	-5.268	< 0.001	0.105
July	0.112	-0.837	0.403	0.112
August	0.104	-5.286	< 0.001	0.104
September	0.118	-0.447	0.655	0.118
October	0.109	1.692	0.091	0.109
November	0.112	-0.719	0.472	0.112
December	0.114	-2.470	0.014	0.114
Days				
Sunday*	0	-	-	-
Monday	0.098	0.082	1.202	0.229
Tuesday	0.237	0.082	2.876	0.004
Wednesday	0.188	0.080	2.345	0.019
Thursday	0.022	0.080	0.275	0.783
Friday	0.183	0.083	2.198	0.028
Saturday	0.359	0.088	4.073	< 0.001
Times				
18.01-21.00*	0	-	-	-
21.01-00.00	0.446	0.079	5.632	< 0.001
00.01-03.00	-0.003	0.096	-0.029	0.977
03.01-06.00	-0.440	0.092	-4.799	< 0.001
06.01-09.00	0.539	0.068	7.949	< 0.001
09.01-12.00	0.550	0.076	7.253	< 0.001
12.01-15.00	0.524	0.082	6.388	< 0.001
15.01-18.00	0.820	0.082	9.961	< 0.001
Provinces				
Pattani*	0	-	-	-
Yala	-0.252	0.056	-4.467	< 0.001
Narathiwat	-0.309	0.052	-5.909	< 0.001
Songkhla	0.218	0.110	1.985	0.047
Zones				
Road*	0	-	-	-

	Estimate	Std. Error	z-value	p-value
Resident	0.930	0.069	13.501	< 0.001
Business	0.281	0.084	3.364	0.001
Public Place	-0.626	0.094	-6.641	< 0.001
Check point	-2.108	0.121	-17.455	< 0.001
Others	0.614	0.061	9.996	< 0.001
Areas				
Urban*	0	-	-	-
Rural	-0.072	0.060	-1.203	0.229
Type of unrest				
Shooting*	0	-	-	-
Bombing	-1.856	0.059	-31.447	< 0.001
Aggravate	-4.322	0.068	-63.585	< 0.001
Arson	-3.507	0.077	-45.336	< 0.001
Others	-3.199	0.099	-32.269	< 0.001

Note: * represents the reference group

Table 4.1 represents the initial model of the unrest involved victims. The model found that the only areas were not significantly associated with the unrest involved victims. This model represents the residual deviance of 14,491 on 17,673 degrees of freedom. The final model after omitting the determinants with a p-value greater than 0.05 using a backward eliminating method is shown in Table 4.2.

Table 4.2 Final logistic regression model of the unrest involved victims

	Estimate	Std. Error	z-value	p-value	OR (95% CI)
Constant	2.971	0.145	20.455	< 0.001	-
Years					
2004*	0	-	-	-	1
2005	-0.558	0.107	-5.237	< 0.001	0.57 (0.46, 0.71)
2006	-1.042	0.108	-9.649	< 0.001	0.35 (0.29, 0.44)
2007	-1.266	0.098	-12.944	< 0.001	0.28 (0.23, 0.34)
2008	-0.937	0.115	-8.152	< 0.001	0.39 (0.31, 0.49)
2009	-0.910	0.116	-7.826	< 0.001	0.40 (0.32, 0.51)
2010	-0.817	0.122	-6.695	< 0.001	0.44 (0.35, 0.56)
2011	-0.918	0.126	-7.290	< 0.001	0.40 (0.31, 0.51)

	Estimate	Std. Error	z-value	p-value	OR (95% CI)
2012	-0.689	0.130	-5.298	< 0.001	0.50 (0.39, 0.65)
2013	-1.118	0.118	-9.469	< 0.001	0.33 (0.26, 0.41)
2014	-0.944	0.133	-7.078	< 0.001	0.39 (0.30, 0.51)
2015	-0.780	0.147	-5.295	< 0.001	0.46 (0.34, 0.61)
2016	-0.800	0.159	-5.017	< 0.001	0.45 (0.33, 0.61)
2017	-1.536	0.186	-8.264	< 0.001	0.22 (0.15, 0.31)
Months					
January*	0	-	-	-	1
February	-0.058	0.110	-0.529	0.597	0.94 (0.76, 1.17)
March	-0.340	0.107	-3.193	0.001	0.71 (0.58, 0.88)
April	-0.382	0.104	-3.663	< 0.001	0.68 (0.56, 0.84)
May	-0.521	0.106	-4.893	< 0.001	0.59 (0.48, 0.73)
June	-0.557	0.105	-5.305	< 0.001	0.57 (0.47, 0.70)
July	-0.095	0.112	-0.849	0.396	0.91 (0.73, 1.13)
August	-0.550	0.104	-5.301	< 0.001	0.58 (0.47, 0.71)
September	-0.055	0.118	-0.464	0.643	0.95 (0.75, 1.19)
October	0.182	0.109	1.672	0.095	1.20 (0.97, 1.49)
November	-0.080	0.112	-0.719	0.472	0.92 (0.74, 1.15)
December	-0.285	0.114	-2.493	0.013	0.75 (0.60, 0.94)
Days					
Sunday*	0	-	-	-	1
Monday	0.098	0.081	1.197	0.231	1.10 (0.94, 1.29)
Tuesday	0.236	0.082	2.861	0.004	1.27 (1.08, 1.49)
Wednesday	0.188	0.080	2.352	0.019	1.21 (1.03, 1.41)
Thursday	0.023	0.080	0.282	0.778	1.02 (0.87, 1.20)
Friday	0.182	0.083	2.195	0.028	1.20 (1.02, 1.41)
Saturday	0.361	0.088	4.095	< 0.001	1.44 (1.21, 1.71)
Times					
18.01-21.00*	0	-	-	-	1
21.01-00.00	0.449	0.079	5.668	< 0.001	1.57 (1.34, 1.83)
00.01-03.00	-0.002	0.096	-0.017	0.987	1.00 (0.83, 1.20)
03.01-06.00	-0.440	0.092	-4.794	< 0.001	0.64 (0.54, 0.77)
06.01-09.00	0.537	0.068	7.924	< 0.001	1.71 (1.50, 1.95)
09.01-12.00	0.547	0.076	7.221	< 0.001	1.73 (1.49, 2.01)
12.01-15.00	0.520	0.082	6.346	< 0.001	1.68 (1.43, 1.97)
15.01-18.00	0.816	0.082	9.924	< 0.001	2.26 (1.92, 2.66)
Provinces					
Pattani*	0	-	-	-	1
Yala	-0.240	0.055	-4.323	< 0.001	0.79 (0.71, 0.88)

	Estimate	Std. Error	z-value	p-value	OR (95% CI)
Narathiwat	-0.315	0.052	-6.048	< 0.001	0.73 (0.66, 0.81)
Songkhla	0.207	0.110	1.891	0.059	1.23 (0.99, 1.53)
Zones					
Road*	0	-	-	-	1
Resident	0.930	0.069	13.497	< 0.001	2.53 (2.21, 2.90)
Business	0.298	0.082	3.619	< 0.001	1.35 (1.15, 1.58)
Public Place	-0.621	0.094	-6.595	< 0.001	0.54 (0.45, 0.65)
Check point	-2.111	0.121	-17.482	< 0.001	0.12 (0.10, 0.15)
Others	0.614	0.061	9.999	< 0.001	1.85 (1.64, 2.08)
Type of unrest					
Shooting*	0	-	-	-	1
Bombing	-1.848	0.059	-31.523	< 0.001	0.16 (0.14, 0.18)
Aggravate	-4.320	0.068	-63.586	< 0.001	0.01 (0.01, 0.02)
Arson	-3.507	0.077	-45.341	< 0.001	0.03 (0.03, 0.03)
Others	-3.198	0.099	-32.264	< 0.001	0.04 (0.03, 0.05)

Note: * represents the reference group

The result represents that years, months, days, times, provinces, zones of happened unrest, and type of occurred unrest were associated with the unrest involved victims.

The result expressed that all seven determinants were statistically significant. The model was fitted and gave residual deviance of 14,493 with 17,674 degrees of freedom. The comparison of the residual deviance value of the initial model from Table 4.1 and the final model from Table 4.2 found that the difference between the deviances was two, the number of omitted parameters was one, with 0.157 of the corresponding p-value. The reduced model is adequate and all variables were statistically significant.

The 95% confidence interval of odds ratio represented the association between the unrest involved victims and each factor from the logistic regression model. Figure 4.1, the baseline odds ratio is implied by the red horizontal line. The green dots indicate the crude odds ratio while the black dots represent the adjusted crude odds

ratio with the upper and lower bounds based on the 95% confidence interval. The 95% CI that not involved one indicated that there is an association between unrest involved victims and its factor.

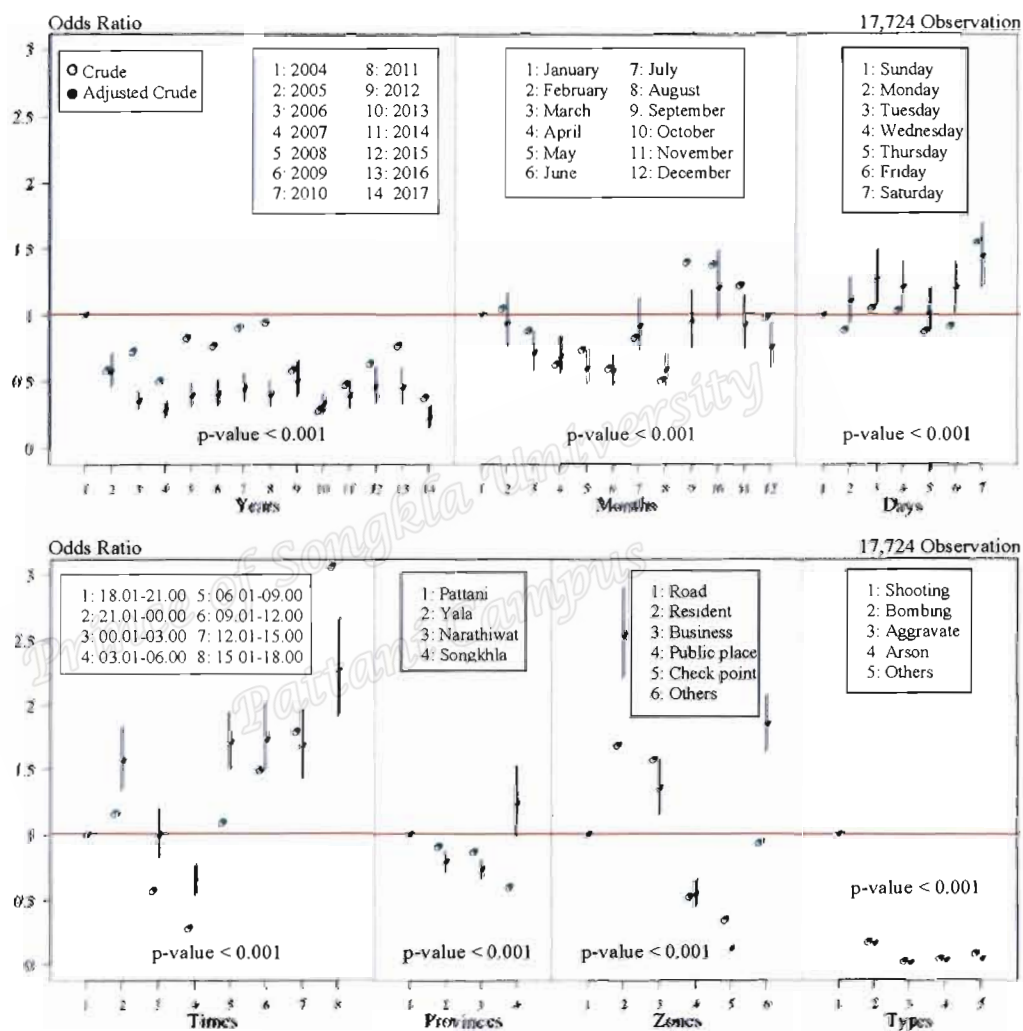


Figure 4.1 95% CI of the unrest involved victims and its factor

Figure 4.1, the odds of unrest involved victims from the year 2005 to 2017 were lower than the year 2004. The odds of unrest involved victims of February, July, September, and November were not different from January while other months were lower. Monday to Saturday expressed that the odds of occurring unrest involved

victims were not different from Sunday. Time at 03.01 am to 06.00 am was lower risk to have unrest involved victims compared to the time at 06.01 pm to 09.00 pm. The odds of Yala and Narathiwat province were the lower risk to occur unrest involved victims than Pattani province. Public places and checking point were lower risks to have unrest involved victims compared to on the road. Bombing, aggravate, arson and others were lower risks to arise the unrest involved victims than shooting.

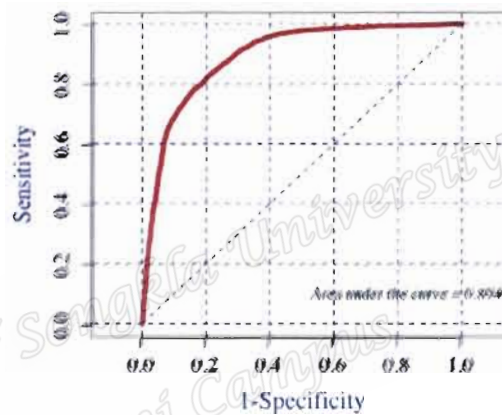


Figure 4.2 ROC curve of the unrest involved victims

Figure 4.2 displays the ROC curves of the model of the unrest involved victims. The AUC was 0.89, which is showing a fair classification of the unrest involved victims' categories.

Severity of unrest

The result after fitting a logistic regression model with all determinants to the outcome are shown in Table 4.3. The reference groups were the first category of the unrest severity factors.

Table 4.3 Full logistic regression model of unrest severity

	Estimate	Std. Error	z-value	p-value
Constant	-0.293	0.162	-1.805	0.071
Years				
2004*	0	-	-	-
2005	-0.268	0.117	-2.301	0.021
2006	-0.214	0.113	-1.899	0.058
2007	-0.178	0.105	-1.691	0.091
2008	-0.200	0.118	-1.701	0.089
2009	-0.042	0.121	-0.348	0.728
2010	-0.107	0.126	-0.847	0.397
2011	-0.046	0.132	-0.347	0.729
2012	0.139	0.138	1.004	0.315
2013	0.150	0.144	1.041	0.298
2014	-0.031	0.157	-0.201	0.841
2015	-0.239	0.185	-1.288	0.198
2016	-0.475	0.204	-2.327	0.020
2017	0.287	0.270	1.065	0.287
Months				
January*	0	-	-	-
February	0.013	0.119	0.109	0.913
March	-0.146	0.119	-1.220	0.223
April	-0.073	0.122	-0.599	0.549
May	-0.002	0.121	-0.019	0.985
June	0.035	0.121	0.288	0.773
July	0.002	0.119	0.017	0.986
August	0.122	0.119	1.023	0.306
September	0.061	0.119	0.510	0.610
October	-0.115	0.115	-1.004	0.316
November	-0.072	0.118	-0.612	0.540
December	-0.068	0.124	-0.548	0.584
Days				
Sunday*	0	-	-	-
Monday	-0.020	0.091	-0.222	0.824
Tuesday	0.134	0.091	1.472	0.141
Wednesday	0.061	0.090	0.680	0.497
Thursday	-0.072	0.092	-0.781	0.435
Friday	0.050	0.094	0.527	0.598
Saturday	0.047	0.093	0.509	0.611

	Estimate	Std. Error	z-value	p-value
Times				
18.01-21.00*	0	-	-	-
21.01-00.00	-0.022	0.096	-0.225	0.822
00.01-03.00	-0.173	0.139	-1.251	0.211
03.01-06.00	0.183	0.133	1.373	0.170
06.01-09.00	0.380	0.079	4.797	< 0.001
09.01-12.00	0.233	0.084	2.768	0.006
12.01-15.00	0.216	0.087	2.484	0.013
15.01-18.00	0.212	0.078	2.725	0.006
Provinces				
Pattani*	0	-	-	-
Yala	0.068	0.062	1.090	0.276
Narathiwat	-0.025	0.059	-0.422	0.673
Songkhla	-0.221	0.147	-1.504	0.132
Zones				
Road*	0	-	-	-
Resident	0.076	0.069	1.104	0.270
Business	-0.091	0.101	-0.901	0.368
Public Place	0.182	0.129	1.404	0.160
Check point	-1.620	0.292	-5.552	< 0.001
Others	0.128	0.075	1.701	0.089
Areas				
Urban*	0	-	-	-
Rural	0.040	0.071	0.562	0.574
Type of unrest				
Shooting*	0	-	-	-
Bombing	-3.344	0.134	-24.929	< 0.001
Aggravate	-1.601	0.132	-12.173	< 0.001
Arson	-4.307	0.453	-9.517	< 0.001
Others	-0.438	0.138	-3.184	0.001

Note: * represents the reference group

Table 4.3, the initial model of the severity of unrest that greater than or equal to 75 percent found that the months, days, provinces, and areas of happened unrest were not statistically associated with the severity of unrest that greater than or equal to 75 percent. The model shows the residual deviance of 10,081 on 9,650 degrees of

freedom. The final model after omitting the determinants with a p-value greater than 0.05 using a backward eliminating method is shown in Table 4.4.

Table 4.4 Final logistic regression model of unrest severity

	Estimate	Std. Error	z-value	p-value	OR (95% CI)
Constant	-0.262	0.104	-2.526	0.012	-
Years					
2004*	0	-	-	-	1
2005	-0.247	0.116	-2.133	0.033	0.78 (0.62, 0.98)
2006	-0.209	0.112	-1.866	0.062	0.81 (0.65, 1.01)
2007	-0.162	0.104	-1.554	0.120	0.85 (0.69, 1.04)
2008	-0.173	0.117	-1.485	0.137	0.84 (0.67, 1.06)
2009	-0.020	0.120	-0.166	0.868	0.98 (0.78, 1.24)
2010	-0.087	0.125	-0.693	0.488	0.92 (0.72, 1.17)
2011	-0.028	0.131	-0.210	0.834	0.97 (0.75, 1.26)
2012	0.159	0.138	1.155	0.248	1.17 (0.90, 1.54)
2013	0.172	0.143	1.205	0.228	1.19 (0.90, 1.57)
2014	-0.020	0.156	-0.127	0.899	0.98 (0.72, 1.33)
2015	-0.216	0.184	-1.172	0.241	0.81 (0.56, 1.16)
2016	-0.485	0.204	-2.382	0.017	0.62 (0.41, 0.92)
2017	0.280	0.268	1.044	0.297	1.32 (0.78, 2.24)
Times					
18.01-21.00*	0	-	-	-	1
21.01-00.00	-0.032	0.095	-0.337	0.736	0.97 (0.80, 1.17)
00.01-03.00	-0.169	0.138	-1.227	0.220	0.84 (0.64, 1.11)
03.01-06.00	0.181	0.133	1.363	0.173	1.20 (0.92, 1.55)
06.01-09.00	0.376	0.079	4.769	< 0.001	1.46 (1.25, 1.70)
09.01-12.00	0.223	0.084	2.666	0.008	1.25 (1.06, 1.47)
12.01-15.00	0.218	0.086	2.523	0.012	1.24 (1.05, 1.47)
15.01-18.00	0.212	0.077	2.736	0.006	1.24 (1.06, 1.44)
Zones					
Road*	0	-	-	-	1
Resident	0.077	0.069	1.118	0.264	1.08 (0.94, 1.23)
Business	-0.089	0.101	-0.887	0.375	0.91 (0.75, 1.11)
Public Place	0.184	0.129	1.428	0.153	1.20 (0.93, 1.55)
Check point	-1.619	0.291	-5.564	< 0.001	0.20 (0.11, 0.35)
Others	0.134	0.074	1.795	0.073	1.14 (0.99, 1.32)
Type of unrest					
Shooting*	0	-	-	-	1

	Estimate	Std. Error	z-value	p-value	OR (95% CI)
Bombing	-3.333	0.134	-24.965	< 0.001	0.04 (0.03, 0.05)
Aggravate	-1.626	0.130	-12.462	< 0.001	0.20 (0.15, 0.25)
Arson	-4.323	0.452	-9.556	< 0.001	0.01 (0.01, 0.03)
Others	-0.435	0.137	-3.169	0.002	0.65 (0.49, 0.85)

Note: * represents the reference group

The result shows that the years, times, zones of happened unrest and type of occurred unrest were associated with the severity of unrest that greater than or equal to 75 percent. As a fitted model, the four factors were giving residual deviance of 10,102 with 9,671 degrees of freedom. The comparison of the residual deviance value of the initial model from Table 4.3 and the final model from Table 4.4 found that the difference between the residual deviance was 21. The number of omitted parameters was four, with the corresponding to 0.459 of the p-value. The final model is adequate and the variables were statistically significant.

Figure 4.3, a 95% CI plot was displayed from the odds ratio values of the logistic regression model of the unrest severity that greater than or equal to 75 percent and its factors.

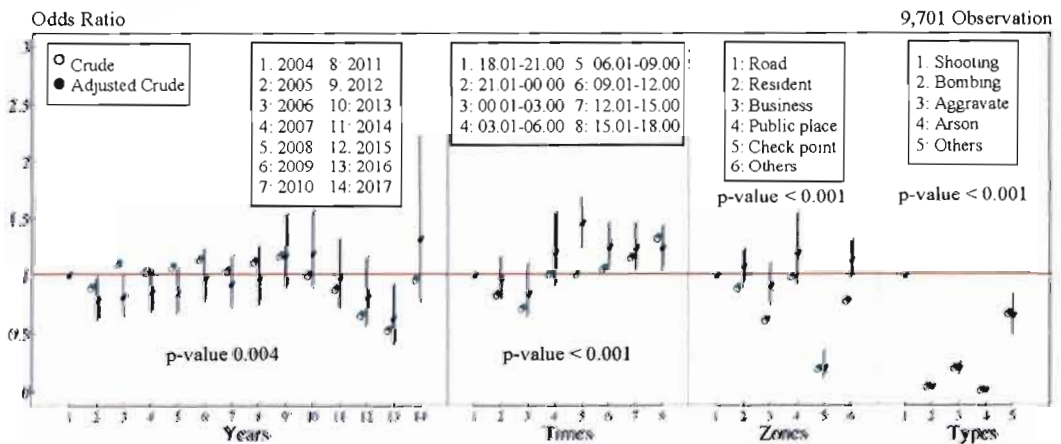


Figure 4.3 95% CI of the unrest severity that greater than or equal to 75 percent and its factor

Figure 4.3 illustrates that the year 2016 was lower odds of having unrest severity that greater than or equal to 75 percent compared to the year 2004. All times of having unrest severity that greater than or equal to 75 percent were not different from the baseline of time at 06.01 pm to 09.00 pm. Checking point was lower risk to have unrest severity that greater than or equal to 75 percent than on the road. Type of occurred unrest including bombing, aggravate, arson, and others were lower risks to arise the unrest severity that greater than or equal to 75 percent than shooting.



Figure 4.4 ROC curve of the unrest severity that greater than or equal to 75 percent

Figure 4.4 presents the ROC curves of the model of the unrest severity that greater than or equal to 75 percent. The AUC was 0.74 was observed for the unrest severity that greater than or equal to 75 percent and expressed a fair classification of its categories.