



Development a Predictive Score for Severe Coronavirus Disease 2019 (COVID-19) from High Risk Factor of Patient Described by Thai Government Policy



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Background:

Thai government had a policy defined population groups that are at risk of severe COVID-19 infection. It is called "608 group" consisting of age more than 60 years old, obesity, diabetes mellitus, cancer, cerebrovascular disease, respiratory disease, chronic kidney disease, HIV infection, and pregnancy. But no study has evaluated performance of this policy. We aimed to develop parameter risk-based scoring system from Thai policy for diagnosis of severe COVID-19 infection.

Method:

A study was carried out in 11,677 patients with confirmed COVID-19 infection were admitted to Hatyai hospital, Songkhla, Thailand from 1 April 2021 to 31 December 2021. Patients were categorized to severe COVID-19 infection if their oxygen saturation less than 94% or need oxygen supplement. Multivariable logistic regression was used to explore for predictors. The logistic coefficients were transformed to risk-based scoring system.

Results:

A total of 11,677 patients were included in analysis and predictive model development, 1036 (8.88%) patients were severe COVID-19 infection, and 10,631 (91.12%) patients were non-severe COVID-19 infection. Age more than 60 years old, obesity, diabetes, cancer, cerebrovascular disease, respiratory disease, chronic kidney disease, HIV infection, and pregnancy were used for derivation of the scoring system. The score-based model showed area under ROC of 0.81 (95%CI 0.79 – 0.82). The scoring system ranged from 0 to 40 was classified into 3 subcategories for clinical practicability. The sensitivity and specificity for predictive of severe COVID-19 were 81.18% and 69.83% for low risk patient, 70.56% and 80.79% in moderate risk patient, and 54.92% and 89.81% in high risk patient.

Conclusion:

This simplified risk-based scoring system for prediction severe COVID-19 disease could aid general physicians or internist in evaluation and triage of patients who present with COVID-19 infection and help physicians in management and prioritization of patients in outbreak situation.

Table1. Baseline characteristics, laboratory, treatment, and outcome of patients with severe COVID-19 infection compare with patients with non-severe COVID-19 infection

Clinical characteristic	Patient with severe COVID-19 infection (n=1,036 (8.88%))		Patient non-severe COVID-19 infection (n=10,631 (91.12%))		p-value*
	No.	(%)	No.	(%)	
- Age (mean) (±SD)	58.39	(±17.57)	39.64	(±16.12)	<0.001
- Gender (male)	428	41.31	4,256	40.03	0.426
Risk factor "608 group"***					
1 Obesity (BMI≥30)	222	21.43	1,336	12.57	<0.001
2 Diabetes mellitus	361	34.85	592	5.57	<0.001
3 Cancer	32	3.09	107	1.01	<0.001
4 Cerebrovascular disease	86	8.30	130	1.22	<0.001
5 Respiratory disease	110	10.62	225	2.12	<0.001
6 Chronic kidney disease	120	11.58	109	1.03	<0.001
7 HIV infection	15	1.45	91	0.86	0.060
8 Pregnancy	28	2.70	237	2.23	0.325
Laboratory*** (mean, ±SD)					
- Absolute lymphocyte (cell/mm ³)	1280.41	(±790.89)	1,799.69	(±881.82)	<0.001
- Platelet (cell/mm ³)	262.92	(±118.81)	258.37	(±108.30)	0.492
- Creatinine (mg/dL)	1.42	(±1.96)	1.03	(±1.98)	<0.001
- AST (U/L)	58.58	(±149.94)	34.40	(±27.00)	<0.001
- ALT (U/L)	51.93	(±107.08)	32.57	(±49.16)	<0.001
- CRP (mg/dL)	71.80	(±57.58)	25.91	(±37.16)	<0.001
Treatment					
- Favipiravir	835	80.60	7,487	70.43	<0.001
- Remdesivir	339	32.72	78	0.73	<0.001
- Dexamethasone	876	84.36	1,626	15.29	<0.001
- IL-6inhibitor	24	2.32	0	0	<0.001
- LMWH	448	43.24	62	0.58	<0.001
Outcome					
- ICU admission	378	36.49	136	1.28	<0.001
- Shock	228	22.05	44	0.41	<0.001
- HFNC	379	36.62	9	0.008	<0.001
- Mechanical ventilator	253	24.42	1	0.01	<0.001
- Dead	232	22.39	6	0.06	<0.001

HIV; human immunodeficiency virus, AST; aspartate aminotransferase, ALT; alanine transaminase, CRP; c-reactive protein, IL-6; interleukin 6, LMWH; low molecular weight heparin, ICU; intensive care unit, HFNC; high flow nasal cannula

*The chi-square test or Fisher's exact test were used for the categorical data

**608 group is Thai government policy defined high risk for severe COVID-19 infection consisting of age ≥ 60 years, obesity, diabetes mellitus, cancer, cerebrovascular disease, respiratory disease, chronic kidney disease, HIV infection, and pregnancy

***Only patients who hospitalized in medical center

Table2. Predictor for severe COVID-19 infection assigned item score

Predictors	aORs*	95%CI	p-value	Coefficient*	Score
Age≥60years	3.40	2.90 – 3.99	<0.001	1.22	5
Obesity	1.63	1.36 – 1.96	<0.001	0.49	2
Cardiovascular disease	4.75	3.69 – 6.11	<0.001	1.55	6
Diabetes mellitus	3.99	3.33 – 4.78	<0.001	1.38	6
Cancer	1.68	1.05 – 2.68	0.028	0.52	2
Cerebrovascular disease	1.27	0.89 – 1.83	0.184	0.24	1
Respiratory disease	3.10	2.34 – 4.10	<0.001	1.13	5
Chronic kidney disease	2.95	2.14 – 4.07	<0.001	1.08	4
HIV infection	3.03	1.69 – 5.45	<0.001	1.11	5
Pregnancy	2.42	1.61 – 3.66	<0.001	0.88	4

aOR; adjusted odd ratios, CI; confident interval, HIV; human immunodeficiency virus

*Adjusted odd ratios and coefficients from multivariable logistic regression, adjusted with age≥60years, obesity, cardiovascular disease, diabetes mellitus, cancer, cerebrovascular disease, respiratory disease, chronic kidney disease, HIV infection, pregnancy

Table3. Different level of risk categories (Low risk, moderate risk, and high risk), sensitivity, specificity positive likelihood ratio and negative likelihood ratio

Categories	Score	Sensitivity	Specificity	Positive likelihood ratio	Negative likelihood ratio
Low	≤2	81.18%	69.83%	2.6910	0.2695
Moderate	3-5	70.56%	80.79%	3.6735	0.3644
High	≥6	54.92%	89.81%	5.3914	0.5019

Figure. Performance of the clinical risk score. Receiver operating characteristic (ROC) curves of clinical score for prediction of severe COVID-19 infection

