

THE POSSIBLE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE OUTCOME OF VENTILATED PATIENTS IN COVID-19 PANDEMIC

Chin-Ming Chen ^{1, 2}

**Department of Intensive Care Medicine¹, Center for Quality Management ²,
Chi-Mei Medical Center, Tainan, Taiwan**

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INTRODUCTION

Patients with mechanical ventilator (MV) could cause ventilator-associated events during intensive care unit (ICU) stays, especially during the COVID-19 pandemic. An intervention of artificial intelligence (AI) might improve the outcome of these patients with MV.

AIM

We surveyed the effect of all adult patients with MV admitted to a 10-bed COVID-19 ICU of a medical center in Southern Taiwan. We used previous big data and AI/machine learning technologies to establish new predictive models of the optimal timing to successfully weaning from the MV (no further intubation within 48 hours).

METHOD

An interdisciplinary team initiated the MV weaning protocol with the integration of AI. Two steps of weaning process (try weaning and weaning) were conducted with prediction models established for multiple periods of time based on clinical needs separately (Figure 1 & 2). We wanted to explore the short outcomes between phase 1 (before AI, Sep 1 to Oct 31, 2022) and phase 2 (after AI, Nov 1 to Dec 31, 2022)..

RESULTS

There were 45 (phase 1) and 52 (phase 2) patients admitted to our ICU, with 18 and 33 MV patients separately. Both groups (phase 1 vs. 2) had similar disease severity as mean age (68.9 vs. 72.6), APACHE II (20.8 vs. 23.8), SOFA scores (8.9 vs. 7.8) and TISS (30.9 vs. 31.6) at initial admission (Figure 3). After the introduction of AI, patients in phase 2 had a higher successful weaning (not re-intubation within 48 hours) as 86.4 vs. 72.7%, lower mean MV use (7.6 vs. 22.3 days), ICU stays (10.5 vs. 18.5 days) and hospital stays (20.0 vs. 41.3 days) (Figure 4).

Figure 3. The baseline background between each group

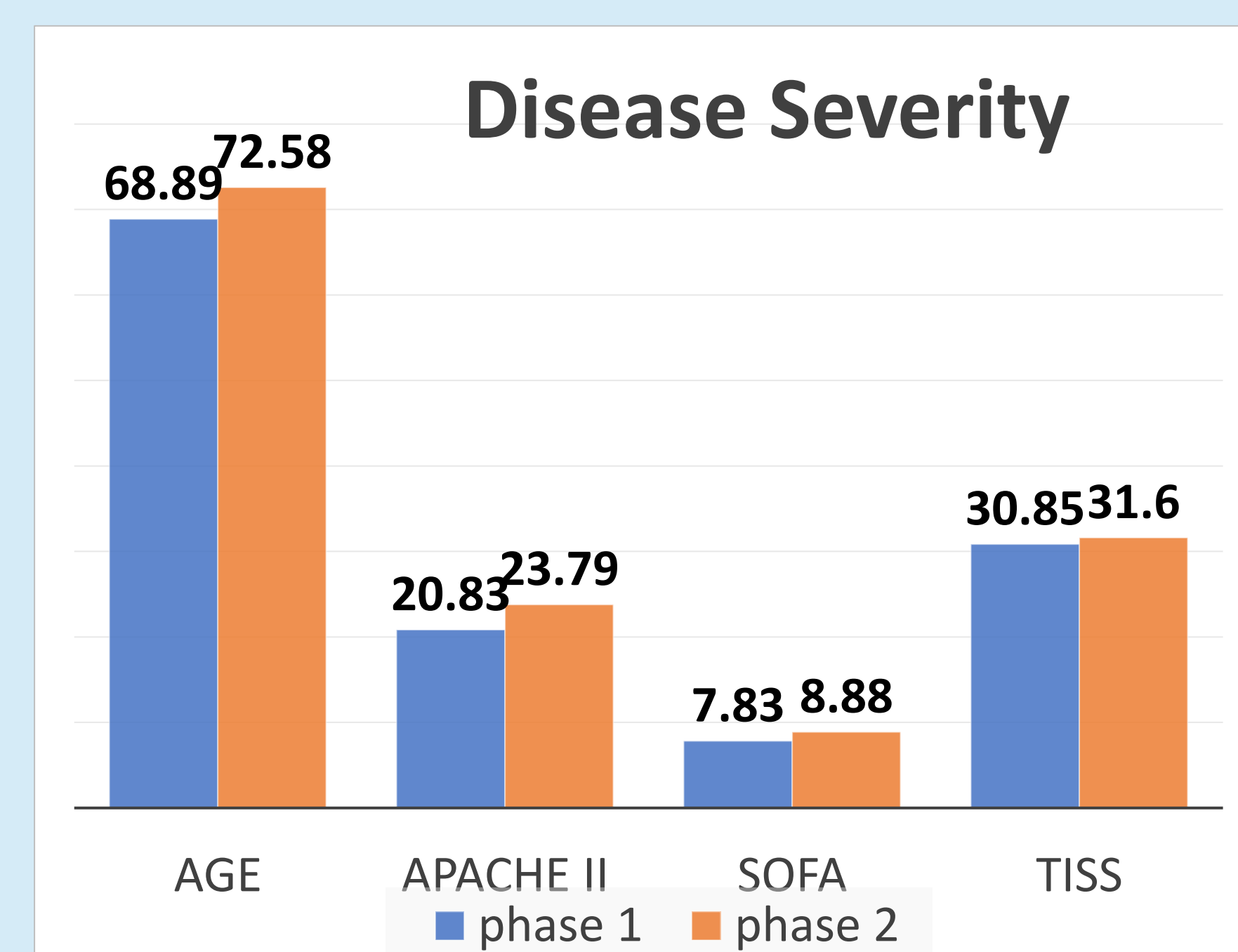
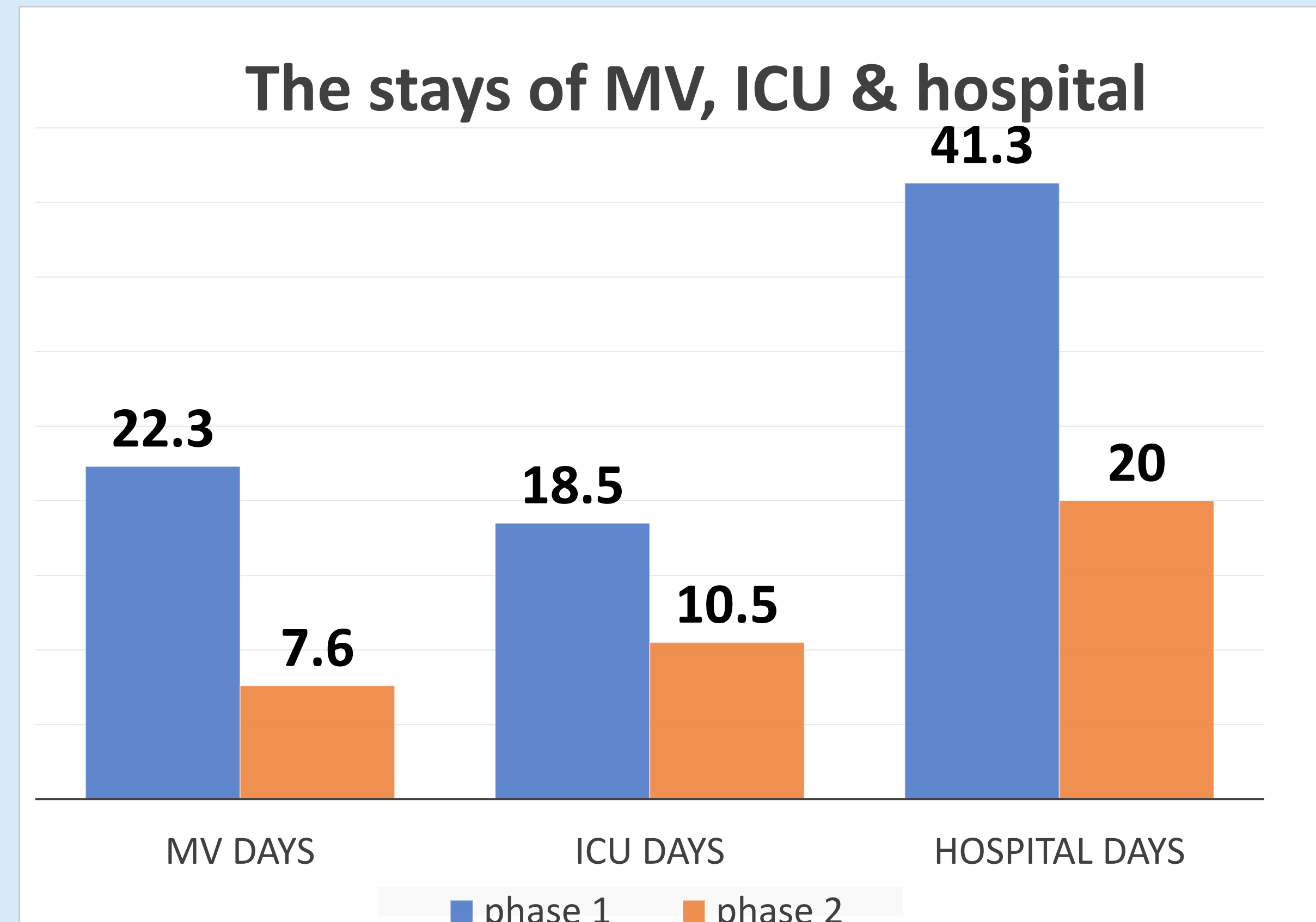
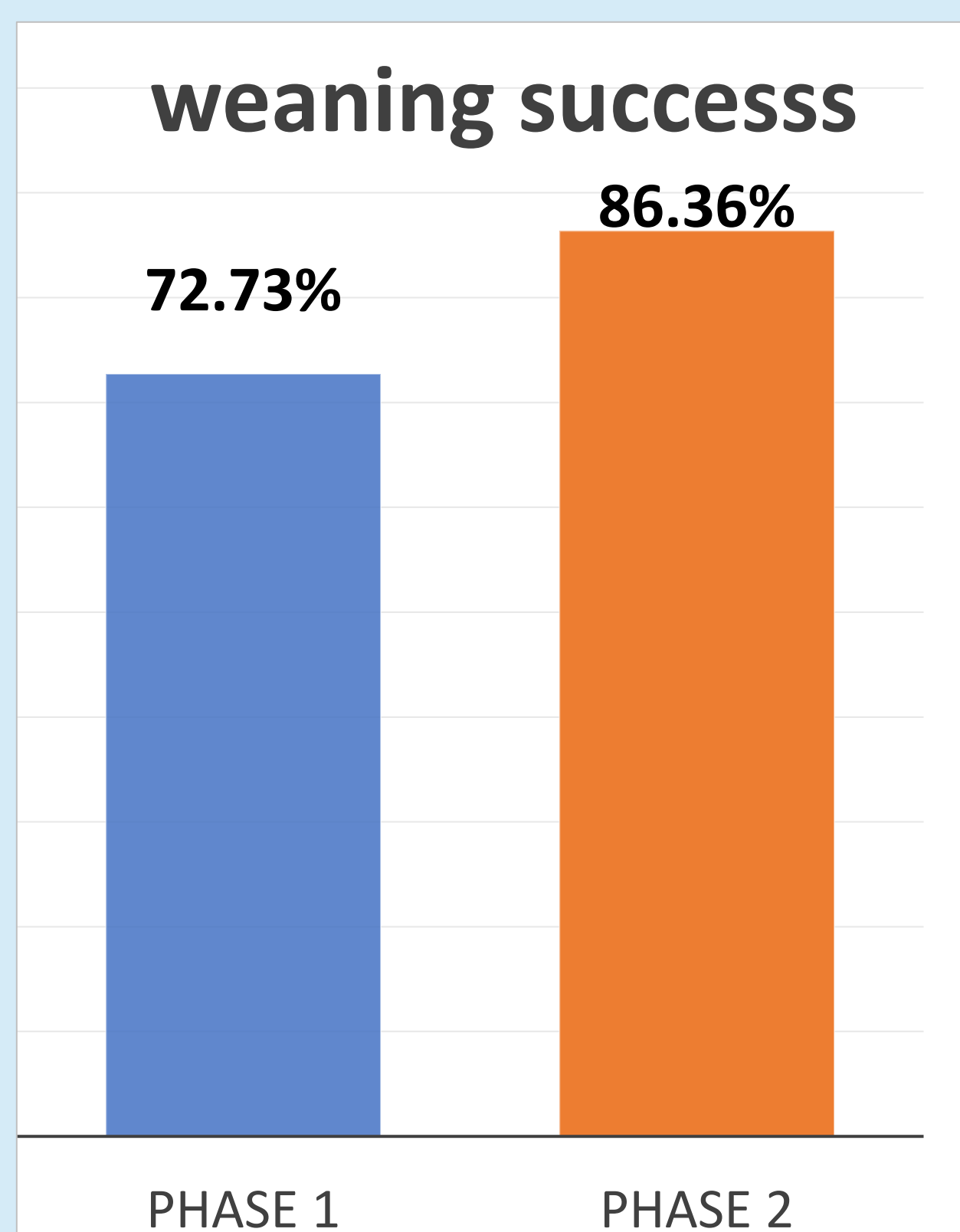


Figure 4. The outcome comparison between each group



CONCLUSIONS

The major limitation was the recruited numbers of patients. But the pilot study showed that the integration of AI with weaning protocol could improve the quality and outcome of patients with MV, even during the outbreak of COVID-19. We would apply the successful experiences to other ICUs at neighboring hospital, and might serve as a benchmarking for other hospitals in Taiwan.

Key words

artificial intelligence, intensive care unit, mechanical ventilation, weaning, outcome

Figure 1. The predicting model of two-steps ventilator weaning

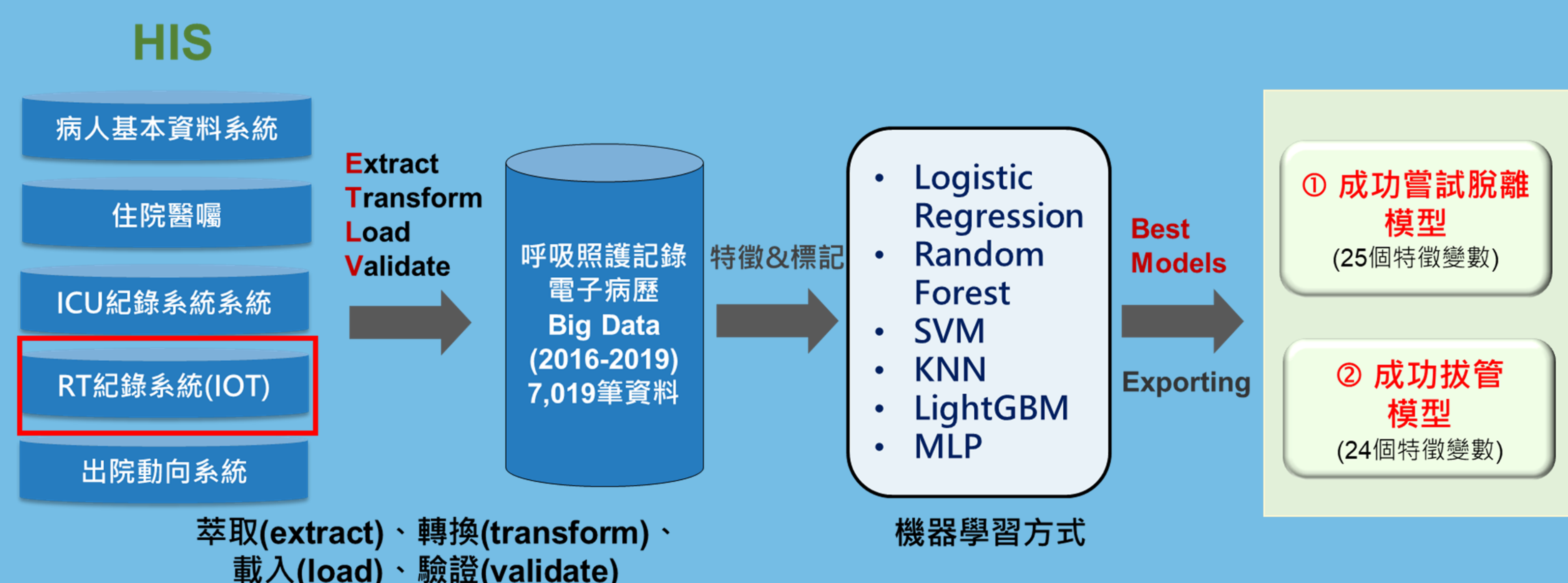


Figure 2. The predicting possibility of ventilator weaning

脫離呼吸器時機預估																
try weaning																
護理站	床號	病歷號	姓名	開始時間	目前時數	8hr	12hr	24hr	36hr	48hr	60hr	72hr	84hr	96hr	108hr	120hr
3BI	3BI20			2020-10-12 22:00	59	59.93%	28.8%	58.2%	72.53%	76.6%	79.67%					
3BI	3BI26			2020-10-12 21:30	59			21.67%	42%	64.4%	61.07%					
4BI	4BI18			2020-10-13 18:25	38			42.2%	38.13%	39%						
4BI	4BI19			2020-10-14 02:10	31			47.13%	58.6%							
4BI	4BI20			2020-10-12 12:50	68		40.13%	60.73%	65.2%	72.13%	78.33%	79.4%				

脫離呼吸器時機預估																
weaning MV																
護理站	床號	病歷號	姓名	開始時間	目前時數	1 Day	2 Days	3 Days	4 Days	5 Days	6 Days	7 Days	8 Days	9 Days	10 Days	11 Day
3B1	3B108		男	2020-12-07 10:30	30	42.78%	52.57%									
3B1	3B111		示	2020-11-30 10:40	198	14.21%	24.41%	44.76%	24%	29.91%	33.3%	35.96%	42.01%	25.33%		
3B1	3B116		楊	2020-12-08 09:25	7	22.98%										
3B1	3B117		江	2020-12-01 09:15	175	87.76%	81.92%	87.89%	88.18%	91.41%	93.16%	97.3%	96.53%			
3B1	3B118		軒	2020-12-02 11:10	149	40.79%	46.39%	39.19%	45.85%	74.66%	64.93%	70.12%				
3B1	3B123		哥	2020-12-04 14:30	96	47.87%	51.77%	42.82%	87.85%	91.69%						

呼吸器脫離預測2 (Weaning MV)



脫離呼吸器

病人特徵值	原始標值	調整標值
FIO2set	25	25
PEEPPEPAP	5	5
RRHzZetActual	17	17
MMsleActual	7	7
Ppeak	13	13
mPaw	8	8
SpO2	98	98
PSL	8	8
Vte	499	499
HR	67	67
SBP	153	153
DBP	75	75